BOOK OF ABSTRACTS

Ways to (proto)language conference series

Roma Tre University

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Mental Prerequisites for Language
Michael Corballis
University of Auckland

A critical feature of language is displacement, the capacity to refer to events at times and places other than the present. Mental time travel itself probably has ancient evolutionary origins. Studies of the hippocampal-entorhinal circuit in rats show that place cells in the hippocampus not only represent present locations, but can also replay past trajectories in space and even preplay possible future ones. Through interactions with entorhinal grid cells, place cells can be rapidly remapped to correspond to different environments, adjust for different orientations and spatial perspectives (“zooming”) and tag locations with sensory associations. These properties underlie the generative, recursive nature of language as it later emerged to allow us to share mental time travels with others, thereby enhancing social bonding and cooperation. Communication itself may have evolved through the co-opting of intentional action systems, at first through pantomime and transparent gestures, such as pointing. Through conventionalization and pressure toward more economical production, the iconic aspect was gradually curtailed, and for the most part lost.

Language Doesn't Evolve in a Void: Culture, Biology and Physical Environment
Dan Dediu
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Language originated, evolved and exists in a complex and highly dynamic context with which it interacts in many, often subtle and surprising, ways. Here I will argue that we must seriously consider this rich context and interactions, and that recent advances in several disciplines provide not only new data and quantitative methods but also generate a profound change in our mindset, promising to give new answers to old questions and, more importantly, to ask new and unexpected questions. Larger and richer linguistic databases covering more and more languages at multiple levels, coupled with advanced statistical methods (some imported from evolutionary biology) and increased computer power, suggest that the physical environment the speakers inhabit seemingly influence structural properties of the languages they speak. Even if these proposals are controversial, they point the way towards a systematic, quantitative and multidisciplinary research program linking properties of language to properties of its physical environment. Incontestably, also the biology of the speakers influences language in non-trivial ways, ranging from properties of our cognitive system to features of our vocal tract and hearing organs, but I will argue in this talk that biology affects not only the universal aspects of language and speech but is also a factor in explaining linguistic diversity. This type of biological biases can be different in different human populations, differentially influencing the trajectory of language change and resulting in structural differences between languages. I will discuss some proposals in this vein and the data and methods required to test them, focusing on the structure of the vocal tract and its potential impact on phonetics and phonology. However, language is primarily a cultural system and, to be effective, these extra-linguistic factors must interact with the process of linguistic cultural evolution. This process was, for most of our evolution, immediate, face-to-face and embedded in a rich multi-modal communicative social context, and it is in such contexts that language use and acquisition take place and where such biases must act. On the other hand, language itself creates new opportunities and pressures on the biological, cognitive and physical systems supporting it, resulting in a closed feedback loop whereby language is shaped and in turn shapes these systems. Such an enclosing view, treating language in its complex dynamic environment and part of multiple feedback loops, effectively constructing its own niche, allows us to better understand the evolution of language and of the systems subtending it, as well as the present-day patterning of linguistic diversity and universal tendencies.
Invited Speakers

Cultural Exaptation, a Key Mechanism for Understanding the Emergence of Complex Cultural Transmission

Francesco D'Errico
1University of Bordeaux

Fifteen years ago, the saga of Neanderthal extinction and colonization of Europe by modern humans served to scholars from different disciplines as a narrative to explain the path that our species followed to attain ‘modern’ behavior and language. This path was thought to be short, abrupt, exclusively associated with anatomically modern humans, and best reflected in the cultural traits associated with the ‘Aurignacian’, seen at the time as an indissoluble package of fully modern cultural traits. An updated review of evidence on the emergence of key cultural innovations in our lineage challenges the idea of a strict link between biological and behavioral change, and suggests that modern cognition and language are results of a gradual, complex and non-linear process to whose advancement different human populations have contributed. This pattern may appear patchy to those who seek single cause models for the emergence of human societies comparable to ours. It is less so for those who consider "modernity" and symbolic behavior as the outcome of cultural trajectories that need to be understood and traced at a regional scale. We argue that innovations in symbolic practices can be seen as exaptations of cultural traits that played symbolic or non-symbolic functions in antecedent cultural systems. This implies that relationship between changes in cultural adaptation and evolution of cognition in our genus must be seen as dialectic, progressive in nature, and more dependent on brain plasticity and adaptability than on isolation and speciation events.

From Experience to Imagination: The Origin and Evolution of Language as a Communication Technology

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In this talk, I will present a new general hypothesis concerning the entire process of the origin and further evolutionary development of human language and its speakers. The hypothesis is based on the theory of language I develop in Dor (2015), and I will begin my talk with a quick exposition of the essential claim: language should be properly understood as a social communication technology of a very particular type, collectively constructed for the very specific function of the instruction of imagination. All the other systems of intentional communication, used by humans and other species, work with what I call the experiential strategy: they provide materials for the interlocutors to experience with their senses and thus allow for the actual sharing of experience. Crucially, the experiential strategy is inherently limited: only what can be directly presented to the interlocutor’s senses can be communicated. Language is the only system that goes beyond the sharing of experience. It allows speakers to intentionally and systematically instruct their interlocutors in the process of imagining the intended experience - instead of directly experiencing it. The speaker provides the receiver with a code, a skeletal list of the basic co-ordinates of the experience - which the receiver is then expected to use as a scaffold for experiential imagination. The essence of the instructive strategy, and its implementation, lies in the fact that it requires a huge amount of collective effort to make it work, prior to actual communication - the effort of experiential mutual identification: the never-ending process of the careful mapping and marking of those points in experience, and those ways of communicating, which the different speakers within the community, with their variable private experiences, may count on, more or less reliably, as shared foundations for communication. In general terms, then, the evolutionary hypothesis I will present runs as follows:

1. The pre-history of language: ancient hominins (most probably homo Erectus) invented and stabilized the collective capacity for experiential mutual-identification, which they still used only for experiential communication. It was exactly what allowed them to make their enormous advances at all the relevant material, cultural and social levels. 2. With mutual-identification, however, Erectus communities also brought experiential communication to the limits of its functional envelope. As survival came to depend more and more on the collective capacity for communication, the
need to go beyond experiential communication became a necessity. 3. The moment of origin consisted of no more than exploratory attempts to use the collective capacity of experiential mutual-identification for a new communicative function - the instruction of imagination. 4. When the new function began to show its potential, a developmental process was launched that was directly driven throughout by the constant pressure to raise the levels of collective success in instructive communication. I will present a detailed hypothetical narration of the process, in which language gradually develops from within its experiential-mimetic background into an autonomous technology, with its own functional and structural properties. 5. Throughout the process, individuals were selected for their ability to meet the challenges of the emerging technology, and the required capacities were (partially and variably) genetically accommodated. Homo Sapiens, an imaginative species adapted for fast speech, and maybe our sisters species too, eventually emerged from the collectively-driven process with unique adaptations to language. 6. The evolutionary hypothesis thus shows exceptionally high levels of developmental determinism: if we agree to position the instruction of imagination at the center of the story, we find that much of the way languages are today, and much of the way we are today, was already there, as functional potential, at the moment of origin.

References


An Evolutionary Context for the Acquisition of Modern Human Cognition and Language

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Modern human beings process information symbolically, rearranging mental symbols according to rules to envision multiple potential realities. They also express the ideas thus formed using structured articulate language. No other living creature does either of these things, reflecting a qualitative cognitive gulf between modern Homo sapiens and all the other species – including not only their own closest living relatives, but their closest extinct ones – that compose the Great Tree of Life. Yet it is evident that we are descended from a nonsymbolic and nonlinguistic ancestor. How did this astonishing transformation occur? Scrutiny of the fossil and archaeological records reveals that the transition to symbolic reasoning happened very late in hominid history – indeed, within the tenure of anatomically recognizable Homo sapiens. It was evidently not simply a passive result of the increase in brain size that typified multiple lineages of the genus Homo over the Pleistocene. I propose that a brain exaptively capable of complex symbolic manipulation and language acquisition was acquired as a byproduct of the major developmental reorganization that gave rise to the anatomically distinctive species Homo sapiens at about 200,000 years ago, and that this new capacity was recruited later, through the action of a cultural stimulus. In evolutionary terms this would have been a rather routine happening: after all, any structure must necessarily be in place before it can be used for a new purpose. Given the intimate interdependence of modern cognition and language – both are intrinsically symbolic activities – the most plausible cultural trigger for symbolic thought processes was the spontaneous invention of language in an African isolate of Homo sapiens at (very approximately) 100,000 years ago. Language has several advantages in this role relative to other putative stimuli such as theory of mind.

Stone Tool Use in Nonhuman Primates. A Comparison between FBV Bearded Capuchins and Tai Chimpanzees

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Stone tool use occurs in a few nonhuman primates (namely chimpanzees, capuchin monkeys and crab eating macaques). This behaviour holds special interest for scientists concerned with human origins. Stone tool use in wild bearded capuchin monkeys has been discovered 12 years ago and since then thoroughly investigated by the participants of the EthoCebus Project. The last common ancestors of living tool-using non-human primate species and Homo lived 7-8 mya for Pan and Homo and 35 mya for capuchins and Homo. The phylogenetic distance among these taxa makes the argument that also their common ancestor used tools unlikely; instead, it suggests that stone tool use has emerged independently in more than one species. However, phylogenetic distance predicts higher complexity is stone tool use in chimpanzees than in capuchins. By examining the ecological settings in which this behaviour occurs in and by focusing on the aspects of nut-cracking that have important cognitive implications (namely, namely selection of tools, tool transport, tool modification, and modulation of actions to reach the goal of cracking the nut), I will discuss whether the observed differences reflect ecological, morphological, social and/or cognitive factors
Holistic Approach onto Minds in Our Closest Relatives: What Do They Tell about Evolutionary Origins of Human Cognition?

Tetsuro Matsuzawa

Primate Research Institute of Kyoto University, President of The International Primatological Society

How might our cognitive abilities have been formed in current style? Human cognitive abilities are products of evolution as much as the body and social structure. In consequence, to answer the question, it is critical to study whether and to what extent such abilities are shared with other species. Especially chimpanzees (Pan troglodytes) and bonobos (Pan paniscus) are closest relatives to humans and thus are very important species to be examined. In order to explore and to understand their cognitive abilities as a whole, the collective efforts of researchers employing a variety of observational / experimental methods both in the lab and in the field are necessary. While the well-controlled studies in the lab would provide detailed understandings of targeted cognitive abilities, fieldworks would give great implications how these cognitive abilities may fit into their environments and thus evolved. These two approaches, therefore, compensate each other. From this perspective, in this symposium, we have three speakers. The first speaker, Dr. Ikuma Adachi, provides his recent studies from the lab on the cross-modal correspondences in chimpanzees and discusses his findings in a context of the language evolution. The second speaker, Dr. Misato Hayashi, talks about action grammar in tool-using behaviors in chimpanzees. She invented a unique method to code their tool-using behaviors to address the question. The third speaker, Dr. Shinya Yamamoto, reports his works on cooperative behaviors both in chimpanzees and bonobos. He conducts studies both in the lab and in the field and discusses the evolutionary origin of cooperation. Throughout these three talks, this symposium aims to encourage audience to perceive minds of chimpanzees and bonobos in a holistic manner and to facilitate discussion how our cognitive abilities and their cognitive abilities might evolve in response to the social and physical environment to Homo and Pan.

Primate Origins of Conceptual Metaphors- Comparative Cognitive Approach to Cross-Modal Correspondences

Ikuma Adachi

Primate Research Institute, Kyoto University

“High” vs “low status”, “top of the heap”, “bottom of the barrel”: Similar expressions are widely observed across cultures and languages. The cross-modal correspondence between the visuospatial domain (e.g. high or low) and an abstract domain (e.g. rank) has been described as a conceptual metaphor, a linguistic construction, and therefore uniquely in human. A conceptual metaphor takes one concept and connects that to another concept to better understand that concept. The way we think and act is largely influenced by conceptual metaphors, even without being aware of them. The question remains if conceptual metaphorical mapping is indeed uniquely human or if it appears in other primates and thus describes a conceptual metaphorical mapping that predates language. To address this question, we examined if non-human primates have conceptual metaphors as we humans do. In this talk, I will present the latest findings and discuss primate origins of cross-modal correspondences.
Studying Cognitive Development in Wild Chimpanzees by Focusing on Action Grammar in Tool-Using Behavior
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Cognitive development in primates including humans can be assessed through the analysis on object manipulation. Tool use is a form of object manipulation, thus, it enables us to assess cognitive development in wild chimpanzees. Nut-cracking behavior has the most complicated structure in terms of the combination among objects and only reported from some communities of wild chimpanzees in West Africa. Infant chimpanzees in Bossou, Guinea, begin to crack open nuts by appropriately combining multiple objects and actions from around 3.5 years of age. The precise analysis on the sequential patterns of each action from action-grammar perspective revealed that nut-cracking efficiency gradually increased after the first success. It took years for the juvenile chimpanzee to acquire the efficient skill of nut-cracking and reach to the level of proficient adults.

Evolutionary Origin of Cooperation: Comparative Cognitive Study with Chimpanzees and Bonobos in the Wild and Captivities
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One of the hottest questions within the social and biological sciences revolves around the evolution of cooperation. However, we still know little of its proximate cognitive mechanisms. Here I introduce our recent studies on chimpanzees’ and bonobos’ prosocial behaviour both in the wild and in the laboratory. The experimental evidences suggest the importance of direct communicative interaction in the occurrence of chimpanzees’ helping. Chimpanzees understand what a partner needs; however, they rarely help others proactively without the partner’s request. Starting with this “helping upon request”, I’ll discuss the evolution of cooperation from the viewpoint of comparative cognitive science with our closest living relatives. Chimpanzees and bonobos are considered to have diverged very recently, around 1 million years ago, but show considerably different characteristics in their social behaviors. Investigation of these differences, in association with their societies and environments, will deepen our understanding of evolution in Pan and Homo.

Language Origin Society (Los) Special Session
Bernard H. Bichakjian
1Radboud University, Nijmegen

* Speakers *

Was There a Proto-Language of Thought?
Andrew Feeney
1University of Northumbria
Either humans think in the languages they speak or in another, unarticulated system. The former of these hypotheses leads inexorably to the notion of linguistic relativity, associated with Whorf (1956), and in particular the stronger version of linguistic determinism, wherein it is believed that the manner in which someone perceives the world is conditioned by the language they speak. This position has long been discredited. If there is an orthodox position now, it is that thought exists prior to its external expression, as Penn et al. note ‘the adaptive advantages of being able to rea-son in a relational fash-ion have a certain primacy over the communicative function of language’ (2008: 123).

Moreover, as Schoenemann maintains ‘[symbols] for things must logically be applied to things that in some sense already exist in our own cognitive world. From an evolutionary per-spective, there would be no point to communication (and therefore language would not have evolved) if such cognitive categories did not already exist’ (1999: 319). The most coherent theory commensurate with this position is that advanced by Fodor (1975, 2008), that we think in a Lan-guage of Thought (LoT) or ‘mentalese’. The evolution of hominins stretches back some 7.5 million years to our last common ancestor with chimpanzees, our closest extant relatives in the animal kingdom (Sun et al, 2012). Scrutiny of the data indicates that there were two periods of rapid evolutionary change, corresponding to stages of punctuated equilibrium (Gould and Eldredge, 1993). The first of these occurred approximately two million years ago with the speciation event of Homo, saw a doubling in the size, alongside some reorganisation, of hominin brains, and resulted in the first irrefutable evidence of cognitive behaviour that distinguishes the species from all others. Based on the premise that ‘there is a fun-damental duality in human reasoning’ (Frankish, 2009: 105) and the evolutionary rationale that owning two processing systems minimizes the effect that the brain has as an extremely expensive organ, I adopt the approach of dual processing theory in which modern humans are understood to possess two mental systems (Eagleman, 2011; Evans, 2010). System One is primitive, uncon-scious, fast and automatic; System Two evolutionarily more recent, conscious, slow and reflec-tive. The first period of significant evolutionary change in hominins resulted in a development of their cognitive capacity accompanied by a gestural, and subsequently vocal, protolanguage. The important question is whether this cognitive development involved the emergence of System Two processing and a proto-LoT. For reasons I will outline, I argue that early Homo, in particular H. erectus, while clearly the most intelligent animal to have inhabited the earth at the time, was still essentially characterised by the type of cognition evident in modern chimpanzees: System One

The Place of Gesture in Language Origins Theories: A Critical Evaluation
Adam Kendon
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In the eighteenth century, when the natural origin of language first came to be widely discussed, the idea that it might have begun as gesture was found attractive by a number of prominent thinkers. This idea continued to attract attention in the nineteenth century and after the revival of language origins discussions in the 1970s it again attracted strong support from prominent scholars. Arguments in favour of the idea have developed quite persuasively, drawing as they do upon studies of gesture in apes and their apparent language capacities in this modality, in language development in babies, work on emerging sign languages, and neurophysiology, including work on mirror neurones. However, no matter these diverse kinds of support, “gesture first” theories remain unable to explain the specialisation of humans as speaking animals. On the other hand, theories that take vocalisation as their starting point, which now can draw upon recent work that suggest that speech and monkey and ape vocalisations are less different from human speech than previously supposed, rarely take work on gesture into consideration, and do not offer any account of why it is integrated with speaking. In this paper we review the main evidence and arguments for the “gesture first” position, but conclude that a different model is needed. It must be recognised that “language” as it is today, is a complex marriage of several different capacities with different evolutionary histories. This marriage came about in stages over a very long period of time. “Language”, when it is conceived of purely in its spoken (even written) form (as it so often is in language origins discussions), is to be understood as the outcome of processes of specialisation and
differentiation. Accounts of language origins need to be recast to become accounts of these processes of specialisation and diversification, accounts which show how these emerged and how these emerging systems are shaped through processes that involve social interaction as much as biology.

**What Language Evolution Tells Us about the Evolution of Our Potential for Language**

Bernard H. Bichakjian¹

¹Radboud University, Nijmegen

The study of the evolution of the human potential for language has been vitiated by the assumption that humans are endowed with a Universal Grammar, i.e. a steady state set of instructions coded in our genome that with the proper environmental stimulation will produce the expression of natural grammars such as English, Swahili, or Quechua. When it is so conceived, language becomes a “package deal,” and the evolution of the potential for language becomes the single event whereby that “package” was allegedly acquired (cf. e.g., the hypotheses claiming that language was acquired as the larynx was lowered, or, from a different angle, as the computational mechanism of recursion had been mastered). But there are no steady state grammars – the Universal Grammar is a myth. Languages are instruments of thought and communication and as such and especially as instruments of communication, they have evolved to become ever more efficient conveyers of information. Their evolution is like an iceberg – we only see the small emerging part, but the line of development is clear. Incipient speakers first cobbled a system based on their ancestral simply mammalian (?) – perception and tabulation of objects and actions in the outside world. In the subsequent phase, the improvised features were gradually replaced with alternatives especially conceived to serve linguistic purposes and do so with ever greater efficiency. This process permeates the entire body of languages, but the most illustrative change is perhaps the shift from ergative/absolutive to nominative/accusative syntax, where the former pivotal elements are based on the perceptual notion of agency, the latter on the mental construct of grammatical subject. The course is clear and understandable. Incipient speakers could only bring to the task of building a language their ancestral competence, but the acquisition of language in turn stimulated mental processes which, when applied to language, contributed to its evolution. We know that that evolution, which is still ongoing, has been gradual. There is no reason to assume that the building of the original grammar, whereby incipient utterances achieved dual patterning and by so doing brought language to criterion, was other than gradual.

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**Ontogeny and Language Evolution**

Andy Lock¹, Chris Sinha²

¹Massey University - New Zealand
²Hunan University - China

The motivation for this session is the growing recognition that ontogenetic development, as was proposed by many classical theorists of human development, was crucial for human evolution, including human symbolic evolution and the evolution of language. We will invite four participants with known expertise in this area to discuss ontogeny and language evolution, requiring them to orient their presentations to one or more fundamental questions.

Questions to be considered by the speakers:
1. What, if anything, can child prelinguistic and language development tell us about language evolution?
2. What, if anything, can the comparative developmental study of gestural communication and social interaction in extant non-human primates tell us about language evolution?
3. What, if any, effect did the evolution of the human life course have upon cognition, symbol use and language?

4. If ontogenetic development can be considered a niche, does it make sense to speak of niche-niche co-evolution as well as organism-niche co-evolution?

* Speakers *

**The Ubiquity of Gestural Comprehension**
Heidi Lyn
University of Southern Mississippi

It has been argued that the ability to comprehend gestures (most specifically pointing gestures) may be one of the revolutionary moments in the development of human language. This argument rests in large part on the findings that apes fail to comprehend human points (Moll and Tomasello, 2007) although many other species (such as dogs and dolphins) are perfectly capable of the task (e.g., Miklosi and Soproni, 2006; Pack and Herman, 2007). However, several studies have pointed to methodological differences as the largest driver of differential findings between apes and other animals in comprehension of declarative pointing (Mulcahy and Call, 2009; Lyn, 2010; Mulcahy and Hedge, 2012). In addition, a series of studies have suggested that exposure to humans is the most important variable in pointing comprehension abilities in apes (Lyn et al., 2010a, 2010b). This is similar to recent findings in dogs and wolves, again supporting human interaction as the deciding variable in pointing comprehension (Udell et al., 2008, 2010, 2013). These findings beg the question – what is learned by exposure to humans? One suggestion is that it is ostensive cues that support gestural communication that are learned, however, preliminary data with apes support the idea that ostensive cues are basic - for example, simple extensions of an index finger without linguistic markers such as eye contact or gaze alteration do not result in gestural comprehension (Lyn et al., in prep). These linguistic actions serve functional purposes that seem to be the foundation for gestures to be communicative and may be much more widespread in the animal kingdom than has previously been assumed. I will suggest that rather than a misunderstanding of the communicative nature of a point, apes are failing to follow the linear and geometrical nature of the gesture. I will further argue that gestural communication, including point following, is likely a basic communicative interaction that is well within the capacities of many species, given the appropriate communicative environment and learning opportunities.

**Limits, Scopes, and Origins of Infant Communication**
Ulf Liszkowski
Universität Hamburg

Infants’ communication is limited in several ways compared to adults. They have little if no systematic semantics, and rarely if never represent affairs through symbolic or depictive vehicles. Yet, infants communicate extensively with deictic gestures and, like adults, are very flexible at inferring and transmitting meaning based on social-cognitive and cooperative expectations which scale up to ‘theory-of-mind’ skills previously attested to 4-year-olds. This new line of evidence, however, doesn’t lead to evolutionarily ancient traits of human communication, because new comparative results with chimpanzee reveal limits in their use of deictic communication, especially regarding social-cognitive and cooperative expectations. The ontogenetic origins of infants’ communicative skills are seen in social-interactional experiences in the first year of life, as supported by further new experiments and cross-cultural comparisons.
Hand Preference for Symbolic Gestures and Pointing Gestures: Clues toward the Understanding of Language Development
Hélène Cochet
Université de Toulouse II - Le Mirail

Language acquisition involves a continuity between non-verbal and verbal communication: human children engage themselves in episodes of joint attention with adults through facial expressions, gestures, and vocalizations before they are able to use language. This is one of the reasons for which hand preference for communicative gestures has been regarded as a good predictor of hemispheric specialization for language, contrary to hand preference for manipulative actions (e.g., Meguerditchian et al., 2011). But the diversity of the human gestural repertoire may influence the relationship between hand preference for gestures and language, which has led us to take account of different types of gestures. Here I will present several studies focusing on the production of pointing gestures and symbolic gestures in young children and adults. We assessed hand preference for these different gestures and measured some morphological features (hand shapes, body posture). Our results suggest that communicative functions associated with gestures (e.g., imperative vs. declarative pointing) is a key factor in language development and in the emergence of hemispheric specialization for language. Our research may also have important implications for theories of language evolution, especially as several researchers have reported the existence of a right-sided asymmetry for communicative gestures in nonhuman primates. We therefore aim at highlighting the interest of studying gestural communication, by describing several characteristics of gestures and using similar methods across age groups and across species, in order to understand further the emergence of language, both within a developmental and an evolutionary framework.

Epistemic Pluralism and the Evolution of Communication
Nathalie Gontier
University of Lisbon

Throughout the evolution of life we can find a consistent macro-evolutionary trend toward increasingly complex behavioral, cognitive and sociocultural repertoires that enable biological entities to interact meaningfully with the biotic and abiotic world, and one such type of meaningful interaction involves communication. From within the field of evolutionary epistemology, behavioral, cognitive and sociocultural skills are one the one hand understood as systems of knowledge that have evolved by means of evolutionary mechanisms; on the other hand, knowledge itself evolves according to evolutionary mechanisms. Communication systems in general, and languages in particular, are especially intriguing knowledge systems because they result from an intricate symbiosis between various behavioral, cognitive and sociocultural skills that on the one hand are phylogenetically evolved traits of biological organisms; and on the other hand transcend these organisms because many types of communication are expressed at or above a population level during ontogeny. Investigating the phylogeny and ontogeny of communication across species through time therefore requires an understanding of the co-evolutionary mechanisms that underlie this intricate symbiosis. Most of all, it requires a multi- and transdisciplinary research stance. In this talk, we detail how combining the units and levels of evolution debate and hierarchy theory with research on the nature and scope of the extended synthesis (especially eco-evo-devo) enable us to take on an epistemic pluralistic stance from wherein we can provide a rich understanding of the evolution of communication as well as its ontogenetic expression.
The past 10 years have witnessed rapid progress in our understanding of evolutionary and neurobiological foundations of language. This symposium aims at contributing to this body of knowledge by sharpening the characterization of the human brain’s "language-readiness". The term "language-ready brain" has been adopted by several researchers of very different theoretical persuasions, and it has several advantages over its competitors. First, the term draws attention to the brain as the focus of inquiry. Second, it enables us to keep clearly separate two entities: one, the language-ready brain, understood as the cluster of brain properties that sets the stage for language ontogeny and phylogeny, and the other, language, understood as the collection of properties that humans eventually acquire as a result of social interactions. Language-readiness draws attention to the eclectic, mosaic-like nature of the brain networks that make language acquisition and use possible. It highlights the possibility of non-linguistic sources for linguistic properties (protolanguages), and also urges us to move beyond the classical 'Broca-Wernicke' model of brain implementation, as well as casting a wider net concerning language-related genes. 

Building on Broca’s writings, it has often been hypothesized that lateralization patterns are central to characterize the language-ready brain (Crow, 2008). Although we believe that hemispheric asymmetries certainly play a role in characterizing linguistic competence at the brain level, we hypothesize that the relevant autapomorphy is one that has so far received no attention in the context of biolinguistics, and that is most visibly expressed in the globular aspect of the human endocranial morphology, particularly salient in early postnatal development (Vannucci et al., 2013). As Boeckx and Benitez-Burraco (2014) have argued, there are several reasons to claim that the neuroanatomical and physiological properties giving rise to globularity, not only at the cortical level, but also and crucially at the sub-cortical level, contributed significantly to making our brain language-ready. Which are the genetic changes that brought about our language-readiness is one of the objectives of the symposium. Another objective is how the globularity pattern interacts with the pronounced hemispheric asymmetries. A third major objective is the extent of the relationship between language-readiness and the 'musical protolanguage' idea that is (re)gaining momentum in the field. And a last objective pertains to the notion of language-readiness and communicative (speech/sign).

* Speakers *

Genetic Underpinnings of Language-readiness

Antonio Benitez-Burraco¹

¹University of Huelva

Boeckx and Benitez-Burraco, 2014a,b put forth gene networks that we think are related to different aspects of our brain's language-readiness. The first network is centered around RUNX2. According to our findings, the evolutionary modification of this network may account for our more globular head and for the concomitant rewiring of different connections between cortical and sub-cortical structures, which provide the scaffolding for our species-specific mode of cognition. The second network is centered on ROBO1 and FOXP2 interactomes, which emerge from the literature as prominent molecular signatures of vocal learning. The changes in this network may underlie the refinement of our specific way of externalizing thoughts. Here we wish to explore the interactomes of PAX6 and AUTS2, two genes important for the establishment of an optimal balance between excitation and inhibition. Changes within this third component may have contributed to refine the biological machinery necessary for language.
Globularity and Laterality
Constantina Theofanopoulou
Universitat de Barcelona

It is undeniable that the human brain demonstrates functional specialization, including strong hemispheric asymmetries. Recent work by Wang et al. 2014 indicates preferential within-hemisphere interaction was prominent in the heteromodal association cortices and minimal in the sensorimotor cortices. The frontoparietal control network, a key component of the Globularity hypothesis, exhibited strong within-hemisphere interactions but with distinct patterns in each hemisphere. The frontoparietal control network preferentially coupled to the default network and language-related regions in the left hemisphere but to attention networks in the right hemisphere. We explore how globularity interacts with laterality, both at the level of phylogeny and ontogeny.

Globularity and the Rise of Speech as We Know It
Cedric Boeckx
Universitat de Barcelona
ICREA

It’s been argued (Samuels, 2011) that virtually all ingredients entering into human phonology can be found in other species. That is, it may be that what underlies human phonology is a unique combination of abilities, but the individual abilities themselves may be found in many other species. Here we would like to pursue this reasoning and ask why this particular combination of phonological abilities is found in humans. Our general answer is that this is due to the fact that only humans have the sort of recursive syntax that a globular brain allows for. In order for this type of syntax to be externalized, the ‘externalizing component’ (i.e., phonology broadly speaking) must be organized in particular, species-specific ways. From this organization, speech as we know it arises. In particular, we will argue that syntax forces the mind/brain to assign species-specific cognitive values to phonological ingredients such as vowels and consonants, otherwise attested in other species (e.g., Gelada Baboons).

Musical Abilities and Language-readiness
Rie Asano
University of Cologne

It is often claimed that music and language share a process of mental hierarchical structure building, a “syntax”. Although several lines of research point to commonalities, and possibly a shared syntactic component, differences between “language syntax” and “music syntax” can also be found at several levels: conveyed meaning, and the atoms of combination, for example. To bring music and language closer to one another, some researchers have suggested a comparison between music and phonology (‘phonological syntax’), but here too, one quickly arrives at a situation of intriguing similarities and obvious differences. Here we suggest that a fruitful comparison between the two domains could benefit from taking the grammar of action and gesture into account. At this level of comparison, we suggest that some of the differences between language and music could be explained in terms of different goals reflected in the hierarchical structures of action planning.
This symposium aims to discuss the evolution of language, tracing its roots to pre-human's protospeech and gestural-based protosigns and their link with nonhuman primates’ communicative skills and social behavior. According to a purely Darwinian approach, human language-ready brain appears as a result of natural selection, emerging as an evolutionary milestone: the accumulation of various changes throughout the evolution of genus Homo produced the development of the neurophysiological “critical mass”, supposedly necessary for language. Though in principle acceptable, historically revolutionary and still widely adopted, this approach will profit from its integration with current multidisciplinary evidence. The contributed talks will aim to build a broad framework, acknowledging the origin of human language within the complex coevolutionary interactions of a wide set of skills, not necessarily linked with human verbal communication. Primates gestural repertoire, mindreading abilities, and complex intergenerational systems of social learning seem to point at human communication and understanding as a collateral by-product of basic cognitive, social and semiotic skills. Moreover, some of the mechanisms underlying protolanguage, mainly e.g. syntax and recursivity, could have been jointly exploited for both communication and tool-making activities during human evolution. These mechanisms acted as selective constraints for trans-generational transmission of skills and furnished a potential scaffold for social cooperation and language development in pre-human ancestors, as well as in potentially many other primate species, both extant and extinct. In order to present the framework and to encourage further debate on such topics, this symposium will focus on five different approaches: a) historical; b) comparative; c) anthropological; d) semiotic; e) neurocognitive. The first speaker, D’Alonzo, reconstructs the thousands year old philosophical debate on the origins of human language. The second speaker, Dr. Di Paolo, deals with great ape’s symbolic capabilities to speculate about hominines’ protolanguage. Next, Dr. Di Vincenzo investigates, building on paleoanthropological data, the transition from a mimetic-gestural communication system to an acoustic/verbal system. The fourth speaker, Napoli, presents the semio-cognitive capabilities to organize actions and experiences as one of the most important roots of human language. Lastly, De Simone, expanding from recent advancements in theoretical neuroscience, attempts to offer a plausible account for the neurocognitive architecture underlying (proto)language.

* Speakers *

From Gesture to Cooperation. A Brief History of Philosophical Debate on Protolanguage

Jacopo D’Alonzo

Sapienza, University of Rome

This paper discusses the main stages of western philosophical reflection on protolanguage. The ancient epicurean tradition assumed a period when humans lived like animals and denoted the object by gestures and vocalizations. Later, this position was opposed to the Bible’s assumption of divine origin of human language. Several thinkers of Enlightenment considered protolanguage a human, basic knowledge device to organize the experiences. The social dimension, which was present in the naturalistic linguistic tradition since the ancient philosophy, became the crucial point in the nineteenth century. In the same years, Charles Darwin considered protolanguage as a communication system already possessed by pre-human ancestors. During the 1920s, comparisons between human, nonhuman and infants communication systems aimed to reconstruct this protolanguage. Finally, just in the twentieth century, the Marxist tradition first highlighted the coevolution of protolanguage and both work and cooperation.
Symposia

Language not Alone. Looking at Language and Cultural Cognition  
Laura Desirée Di Paolo¹  
¹Sapienza, University of Rome

Apes’ linguistic oriented understanding and use of symbols has been widely demonstrated. Trained everyday with communicative symbols by humans (as trainers, companions or foster parents), some apes strongly show improvements in cognitive abilities — such as reading minds, imitating behaviours and sharing attentional states with others. We cannot explain yet the correlation language training - cognitive enhancements; even so, we can ascribe to apes socio-linguistic skills. Starting from this, we can suppose that hominines shared with extant apes understanding of gestures and symbols as socially meaningful; and with extant humans grammatical structure of sentences and utterances.

Motor Facilitation of the Imitative Vocal Gesture and the Origin of Speech  
Fabio Di Vincenzo¹  
¹Sapienza, University of Rome

Given the validity of a mimetic-gestural origin of language, the explanation of the transition to an acoustic channel becomes central to any evolutionary investigation. In Pan gestures are paired with vocalizations that bring focus upon the action. This way the gesture benefits of the vocalization for its accomplishment, the latter in turn because of its original co-occurrence with action, takes the form of "vocal gesture". The motor facilitation of the vocalizations activates the brain areas that control the linguistic function. The vocal gesture evokes the action and renders it even when the object to which it relates is no longer or not yet within sight. Onomatopoeia for its dependence upon the action that describes, take the form of vocal gestures. The use of onomatopoeia by our ancestors is advantageous with respect to the performance and learning of motor skills and might represent an evolutionary path for the development of speech.

Carve the Experience. Narrativity between Cognition and Language  
Massimiliano Napoli¹  
¹Tor Vergata University of Rome

In this last years, several studies have focused the role of narrativity within the relationship between thought and language, suggesting that it could be structural to human specie-specific cognition. Besides, from a grounded/embodied perspective, many scholars have supposed that logical and strategic capabilities to organize action in social flow-experiences are central to the development of language skills, coming to support that language itself can be considered a tool for carving and sharing patterns of experience. Accordingly, we propose a concept of narrativity as evolutive logical-relational system that organizes experience in patterns which are at the foundation of human comprehension of the world.

The Predictive Brain Hypothesis and the Challenge of Language  
Diego Antonio De Simone¹  
¹Sapienza, University of Rome

According to philosopher Andy Clark, the so called Predictive Brain Hypothesis is a domain independent, neuro architectural framework that underlies and unifies perception, action and cognition. Recent researches in several areas
of cognitive neuroscience seem to support the central idea of the framework about a single, predictive computational algorithm, aimed at minimizing the unexplained information coming from the external world. By carefully considering multidisciplinary theoretical and empirical evidence, the talk will aim to expand on this approach, sketching up a plausible epistemological scenario for the evolution of language.

Prolanguage and Protoreligion Co-Evolution Symposium

Jay Feierman\(^1\), Lluis Oviedo\(^2\), Ivan Colagè\(^2\), Peter Williamson\(^3\), Horacio Favrega Jr.\(^4\)

\(^1\)University of New Mexico  
\(^2\)Antonianum Pontifical University  
\(^3\)Western University  
\(^4\)University of Pittsburgh

Human symbolic language (HSL) and religions are both unique taxonomic features of only one primate species: Homo sapiens. Both are composed of genetic and culturally acquired components. Neither are present at birth and both normally develop in the juvenile period. The specific kinds of HSLs like the specific kinds of human religions are acquired mainly by social learning. However, HSL acquisition is obligatory in normal development. Religion's acquisition is facultative and highly dependent on group norms, which are rapidly changing.

This Symposium will cover the co-evolution of protolanguage and protoreligion and address how they could have influenced each other's emergence through the evolutionary history of our species and the ontogenetic development of the individual person. The questions that the individual speakers will address in their papers are as follows:

1. Have religion and language emerged from common structural design features in brain, whose functions include the generation of the unique human capacity to consider the consequences of two or more courses of action in the future? (Williamson)

2. Can protoreligions be conceived of as atypical types of protolanguages devised by early humans to communicate with what they believed to be supernatural gods? (Oviedo)

3. Did the neurophysiological mechanisms underlying the "flexible" behaviors seen today in the hands, lips and tongue of the great apes and human beings, and presumed to have been present in the hands, lips and tongue of the last common ancestor, move in human beings to the laryngeal muscles used for the production of vocalized language (speech), as protoreligions moved from low scale imagistic ritual modes to larger doctrinal modes requiring speech? (Feierman)

4. Although HSL and religion are both composed of genetic as well as culturally acquired components, and although both emerged early in human evolution through so called gene-culture evolution, are there now elements in the mature forms of both language and religion that emerged through purely cultural evolution outside of the influence of strictly biological evolutionary mechanisms? (Colagè)

5. Since a first person account of evolution of something like religion involves analysis of language and cognition of evolutionary creatures (i.e., forms of awareness, experience, and linguistic/conceptual understanding) as determined by prevailing evolutionary developments, imperatives, and necessities (e.g., natural selection, social and behavioral ecology, changes in brain size and organization), one can ask: how can ideas from comparative and historical semantics and tenets about language of thought (Cognitive Psychology and Philosophy of Mind) be used to understand how religion evolved? (Fabrega).
**Speakers**

**Do Neuropsychiatric Disorders, Language and Religion Emerge from Adaptations in the Human Brain that Allow the Consideration of Consequences of Two or More Courses of Action?**

Peter Williamson

1Western University

While nonhuman primates are capable of some aspects of theory of mind, it is likely that humans alone have the ability to reminisce about the past and imagine the future. This ability arises from a highly adapted network involving the anterior paracingulate cortices, the superior temporal sulci and temporal poles which may be related to the proliferation of Von Economo neurons distributed through the anterior cingulate cortices and anterior insulae in humans. Recent MRI studies have suggested that the neural pathways that underlie uniquely human disorders such as schizophrenia, bipolar disorder and autism may mirror these capabilities. Brain imaging studies of propositional speech suggest that this capability may also involve some of these regions. Many have implicated theory of mind in religious behaviour. Are neuropsychiatric disorders, language, and religious behaviour all related to the maturation of related intrinsic networks through the early years of life? Some evidence will be presented.

**The Role of Cultural Processes in the Acquisition of Language and Religion. A Theoretical Perspective**

Ivan Colagè

1Antonianum Pontifical University

Behavioural modernity (BM) implies mature forms of both Human Symbolic Language (HSL) and religion. BM postdates significantly the appearance of Anatomically Modern Humans (AMH). Although (micro-)evolutionary processes continued to happen during the passage from AMH to BM, strictly biological evolutionary processes may not have played the key role in reaching BM. Instead, genuinely cultural processes could have played a major role. Something similar happened for the invention of written language (dating less than 6,000 years ago). The Visual Word Form Area specifies in the left fusiform gyrus when an individual learns to read even during adulthood. This likely did not imply any biological evolution. The process would have been driven, instead, by cultural dynamics of invention and formal teaching, and would ensue from processes of “cultural neural reuse” affecting human brain anatomy at the level of white-matter connectivity, without involving biological evolution.

May something similar have played a role in passing from proto-language and/or proto-religion to mature HSL and religion? The paper will address this question.

**Speech and Religions' Co-Evolutionary Paths**

Jay Feierman

1University of of New Mexico

Central Pattern Generated movement that is definable by form and function in a natural environment and is species-universal in form); and (2) the more volitional and "flexible" Type II ("individual movements not coordinated by Central Pattern Generators that are describable by form and definable by function in a natural environment and are not species-universal in form"). All vertebrates execute Type I Behaviors in their (Lorenz/Tinbergen) motor instincts. Type II behaviors are seen in the hands, lips and tongue of extant great apes and human beings and presumably also
Sometime in the Pleistocene (2.5 million - 11,700 years B.P.), Type II behavioral capacity moved in humans to the laryngeal muscles. As this occurred, proto-religions could transition from Type I behaviourally generated, imagistic ritual modes to pre-literate, orally transmitted, Type II behaviour generated doctrinal modes.

Religion as a Language: Basic and Developed Expressions
Lluis Oviedo¹
¹Antonianum Pontifical University

Religion is being studied intensively as a cognitive ability, fully framed inside the structure and functions of human mind, and as a result of adaptive pressures. However the ongoing results often provide too simplified patterns far from the perceived complexity of such mental feature. Looking at religion as a language by which believers communicate with what they believe to be a supernatural god allows for a more complex and flexible model, which spans from very elementary forms – or proto-languages – to very elaborated and articulated ones. Such flexibility could help to better understand the evolution of religion, probably moving in parallel to other social and cultural expressions; its plurality of forms, giving rise to many different living versions; and its internal structure between rituals, beliefs and behaviours. Religion and natural languages probably co-evolved, together with other human features.

Evolutionary Imperatives, Human Psychology, Semantic Metalanguage, and Origins of Metaphysical Problem Solving
Horacio Fabrega Jr.¹
¹University of Pittsburgh

Biological problem solving skills/activities were sculpted by imperatives and necessities of natural selection in deep history of evolutionary creatures. Human mental and social capabilities constituted necessary (“natural”) preconditions respecting origins practical (subsistence, reproduction) and metaphysical (selfhood, religion) problem solving skills/activities. The prehistory of human cognitive capabilities starts with late Homo erectus (one million years BP). In contradistinction, most accounts of early evolution of religion concentrate on changes during human cultural evolution of Homo sapiens (20,000 yrs BP). Focus of presentation is whether theory in comparative semantics (Natural Semantic Metalanguage or NSM), when embedded in ideas/rationales of cognitive psychology and philosophy of mind (Language of Thought Hypothesis or LOT), can function as an evolutionary behavioral science. I examine the utility of LOT/NSM framework for comprehending the evolution of processes and mechanisms which undergird and explain human cognitive capabilities which foreshadowed and made possible evolution of metaphysical problem solving activities (religion).

The Evolution of Gricean Communication
Richard Moore¹, Dorit Bar-On², Catherine Crockford³, Joëlle Proust⁴, Simon Townsend⁵
¹Berlin School of Mind and Brain
It is commonly held that human intentional communication is characterised by a distinctive ‘Gricean’ intentional structure (Grice, 1957). To the extent that this presupposes a suite of complex cognitive abilities that non-humans are thought to lack – including intentional sign production, meta-representation, and the ability to make difficult inferences about others’ mental states and communicative goals – it is also taken for granted both that the capacity for Gricean communication is uniquely human, and that it emerged in phylogeny prior to language. However, in explaining the evolution of human language and communication, this hypothesis generates an explanatory puzzle. It is uncontroversial that our closest cousins -- the non-human great apes -- communicate using gestures and vocalisations. Moreover, some of these gestures visually resemble our own. For example, bonobos are known to produce ‘beckoning’ gestures to solicit the company of others (Genty et al., 2014). The study of such gestures is often supposed to the hold the key to understanding the origins of human language (Tomasello, 2008) – because they give us insight into the likely communicative abilities of our early hominid ancestors. However, if it is correct that Gricean communication is uniquely human, then this similarity is superficial. If standard accounts of Gricean communication are correct, and if animals do lack the cognitive pre-requisites that these accounts entail, then the mental states and psychological structure underlying such acts must be very different in the human and non-human cases (Tomasello, 2008; Scott-Phillips, in press). Before such gestures could have evolved into human language, our ancestors would first have needed to evolve the socio-cognitive abilities that Gricean communication requires. The phylogenetic emergence of such pragmatic abilities would have constituted a great step in human evolution – a great Rubicon to be crossed on the way to language (Bar-On, 2013a; 2013b).

In this series of talks, we will set out to reconsider a number of questions relating to the Gricean status of non-human communication. Is it true that Gricean communication requires the cognitive abilities that others have supposed? And if it does, does it follow that non-humans could not act with Gricean intentions or understand Gricean acts? Are there some aspects of Gricean communication available to non-human animals? And how should we think of the mental processes underlying acts of animal communication? By beginning to address some of these questions, we will hope to shed light on the nature of developments in our ancestors’ cognition that must have preceded language evolution.

* Speakers *

Expressive Communication, and Origins of Meaning
Dorit Bar-On

The task of explaining language evolution is often presented by leading theorists in explicitly Gricean terms. I first offer a critical evaluation of this conceptualization of the explanatory task facing theories of language evolution, and then take issue with the claim that the main puzzle of language evolution is to explain how signalers could become genuine Gricean communicators. I then motivate, through examination of various animal studies, an alternative, non-Gricean conceptualization of the task, which focuses on the potential of non-Gricean, expressive communication to illuminate the origins of meaning. On the construal of expressive communication advocated by Bar-On (e.g., 2013a; 2013b), animals engaging in expressive behavior show to their designated audience, without intentionally telling – and their audience directly recognizes, without rationally inferring – the expressers’ states of mind. This means that our extinct nonhuman predecessors were already proficient – though non-Gricean – sharers of information. The problem of explaining the emergence of language can then be seen as that of explaining how (and why) the use of meaningful
linguistic expressive vehicles came to supplant (and supplement) the nonlinguistic expressive behaviors to which our nonhuman ancestors were consigned.

The Gricean Status of Chimpanzee Vocal Communication

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Long held assumptions about the nature of intentionality that characterises human intentional communication have recently been challenged (Moore, 2014; submitted). However, even these challenges have focussed primarily on the extent to which ape gestural communication is alike or unlike human communication. Little consideration has been given to the intentional status of ape vocalisations, since it is often taken for granted that they are not produced intentionally. Recent evidence challenges this assumption (Crockford et al. 2012; 2015). In this talk we discuss the intentional status of ape vocal communication in light of recent models of the cognition required for intentional communication.

An Empirical Approach to Studying Intentional Communication in Animals

Simon Townsend¹
¹University of Zurich

The intentional nature of language has been highlighted as a critical feature distinguishing it from other natural communication systems. Specifically, language is argued to depend on a capacity for highly structured intentional action and underlying motivations on the part of a communicator and a recipient. Whilst similar abilities in animals can help to shed light on the evolution of intentionality, such a mental capacity is challenging to detect unambiguously in non-human animals.

I revisit animal intentional communication and suggest progress in identifying analogous capacities has been complicated by variation in approaches investigating communication across different modalities. To move forward, I argue a framework fusing research across modalities and species is required. Specifically, I structure intentional communication research into a series of requirements, each of which can be operationalized, investigated empirically and must be met to demonstrate intentionality. I argue such a unified, broad approach will clarify the distribution of animal intentional communication and subsequently serve to better understand the similarities and indeed differences in intentionality between natural animal communication systems and human language.

On Non-Gricean Communication in Non-Humans and Humans

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Communicational actions are subjected, as any action, to a sufficiency or an economy principle, embodying a trade-off between expected effort and predicted outcome. Three types of trade-offs have shaped communication. Purely Gricean, strategic communication is based on the cognitively costly metarepresentation of prior intentions in both producers and receivers. It might essentially involve a linguistic ability. Impulsive and routine forms of communication, in contrast, are shared by humans and non-humans, and do not need to rely on a prior representation of communicational goals. Impulsive communication includes alarm calls, interjections, facial mimics or verbal utterances. Its function is to convey an affective, evaluative attitude towards a situation. In habitual communication, exemplified in displays and politeness routines, a recurrent social context prompts a communicative act that has a coordination or affiliative function. The two latter forms of communication will be hypothesized to have specific
intentional, representational and dynamic features that explain their communicational efficiency and their persistence as a complement to Gricean communication.

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Iconicity in Protolanguage: Motivating Meaning in Vision and Sound

Slawomir Wacewicz¹, Jordan Zlatev², Przemysław Zywiczynski³

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Language originated as gesture rather than speech: this intriguing idea first proposed by 18-century thinkers such as Vico, Condillac, and Herder, was revived in the 1970s in the works of Hewes (e.g. 1973), and Steklis and Harnad (1976). In the past decade, this gesture-first approach was further developed in influential models by Corballis (2002), Arbib (2005), Armstrong and Wilcox (2007) and Tomasello (2008). Most recently, however, attention seems to have shifted towards multimodal approaches, which have been gaining support from primatologists and comparative psychologists (e.g. Slocombe et al. 2011, Gillespie-Lynch et al. 2014), as well as researchers into sign language (e.g. Sandler 2013) and gesticulation (e.g. McNeill et al. 2008, Kendon 2009).

Although a multimodal approach can be seen as middle ground between the vocal and the visual scenarios, it raises many new questions. For example, did one modality “lead the way”, being initially more important than the other in a “heterosemiotic” signal (Brown 2012)? Did that relative proportion of reliance on gestural/visual versus vocal/auditory channels change throughout hominin phylogeny? Was there a specific division of labour, whereby each modality had its own dedicated communicative tasks in a nonredundant way? Finally, why is the present division of labour the way it is, with voice conveying predominantly combinatorial-segmented information and gesture conveying aspects that are relatively more mimetic (Goldin-Meadow 2008; Brown 2012)?

A particularly important consideration has been the capacity of each modality to convey meaning through iconic (i.e. similarity-based) signs. It is often argued (e.g. Hewes 1973, 1975, 1977) that the visual modality – particularly in the case of hand gestures – allows for a greater degree of iconicity, which facilitates communication in the lack of shared semiotic conventions. Silent gestures, or pantomimes, have been shown experimentally to be more effective than vocalizations when communicating without a shared code (Fay et al. 2013; Fay et al. 2014). On the other hand, the potential role of iconicity in the vocal channel, generally known as sound-symbolism, is far from negligible (cf. Ahlner & Zlatev 2010). It is thus possible that vocalizations contributed to the content of the message through their own...
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iconicity, or, even formed the iconic/motivated basis of protolanguage, with gestures accompanying due to an ancient hand-mouth matching link (Kendon 2014).

To address such questions empirically, we need a better understanding of the iconic potential of each modality, separately, and in combination. This symposium is designed to shed light on this issue by bringing together insight and results from such fields as experimental semiotics, cognitive semiotics, and gesture studies.

* Speakers *

Creating New Sign Systems from Scratch: Gesture has the Upper Hand
Casey J. Lister1, Nicolas Fay1, Mark Ellison1, Jeneva Ohan1
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How does modality affect our ability to communicate with a partner when prevented from using conventional language? Two experimental-semiotic studies were conducted to address this question. In Study One, participants communicated a recurring set of concepts to a partner using either gestures or non-linguistic vocalizations (sounds that are not words). Study One confirmed that participants who gesture are better able to guess the meaning of a partner’s signs across a range of over 800 concepts (comprising adjectives, nouns and verbs). Participants who gestured were also more likely to produce ‘motivated’ signs that physically resembled the concepts they represented; and to align upon a shared sign system with their partner. Study Two addressed a potential confound of Study One, by preventing participants in both Gesturing and Vocalizing conditions from directly interacting with their partner. This allowed for a more balanced comparison of the Gesturing and Vocalizing conditions. The same measures of communication efficacy examined in Study One were assessed in Study Two. Gesture was again found to outperform vocalization on all measures. Together, these studies add further support to the accounts of language origin that suggest gesture played an essential role in bootstrapping human language.

Locomotor and Tool Use Associated Sound in the Evolution of Language
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The motor theory of language has focused on observation of movements. However, imitation and communication through hearing actions may also have played a role. Bipedal gait may have stimulated human musical and vocal abilities, due to the associated rhythmic and predictable incidental sounds of locomotion. Tool-use associated sound (TUS) might have been another stimulator. Tool use commonly involves forelimbs. Motor-processing of the forelimbs is linked to the evolution of vocal communication in vertebrates. Tool use is normally linked with intention, resulting in predictability of TUS. Primate mirror neurons may react to the sounds made by manipulation of an object. Multimodality in the perception associated with tool use may have boosted the brain’s ability to link motor processing with tactile, auditory, and visual information and thereby stimulated the evolution of association chains; TUS, and the mimicry of TUS, might have achieved an iconic function. A gradual change in acoustic properties or meaning of tool use-inspired proto-words could have resulted in arbitrariness and an expanded word repertoire. Sound symbolism in extant languages supports the idea. Humans have been increasingly exposed to TUS over millions of years, coinciding with the period during which spoken language evolved. Tool-use-related sound may be worth further exploration.

Congenitally Deaf Children Generate Iconic Vocalizations to Communicate Magnitude
Marcus Perlman1, Jing Z. Paul2, Gary Lupyan1

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People exhibit strong links between certain visual (e.g., size) and auditory (e.g., loudness) dimensions. Such crossmodal correspondences are theorized to ground the formation of vocal symbols by facilitating the translation of visible qualities into meaningful speech sounds. This raises the question of whether people are able to extend crossmodal correspondences to the production of vocalizations. Must people learn to relate visual dimensions to their voice, or are certain correspondences more instinctive? We examine the ability of congenitally deaf Chinese children and young adults (age $M=12.4$ years, $SD=3.7$ years) to generate iconic vocalizations to distinguish items with contrasting magnitude (e.g., big vs. small ball).

We find that deaf participants and a hearing comparison group ($M=10.1$ years, $SD=0.83$ years) produced longer and louder vocalizations for greater magnitude items, but only hearing children used pitch – higher pitch for greater magnitude. This reverses the hypothesized innate “frequency code” (Ohala, 1994), but fits Mandarin and Chinese culture. Thus the correspondence between magnitude and vocal duration and intensity is robust and not dependent on auditory experience, but size-pitch may be more malleable to language and culture. These findings demonstrate the human potential to generate novel vocalizations that are grounded in our conceptions of magnitude and space.

Multimodality in Event Reenactments
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Would vocalization in multimodal communication offer an advantage when what is to be communicated are whole events? 4 actors “acted out” 16 events involving two participants presented to them as a matrix of 20 cartoon-like pictures, in two conditions: (a) without any vocalization (VIS) and (b) with non-linguistic vocalization (VIS+VOC). The reenactments were video-recorded, resulting in the total of 128 stimuli. These were then shown to two groups of 22 participants, whose task was to identify each enacted event with one of the pictures on the original matrix. Surprisingly, participants performed significantly better in the VIS condition ($p=0.012$). In a post-study we analyzed whether the following factors contributed to communicative success: (a) impersonating both characters, as opposed to just one, (b) representing the age/size difference between characters by means of posture or gaze or (c) vocal pitch and (d) using vocalization to express the emotional valance of the event. The analysis shows when iconic elements of each modality contributed, and when they did not, and thus a better understanding of the potential of multimodal reenactment.
Communicating with Stones: Neanderthal Raw Material Procurement

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Studies of lithic raw materials procurement generally are aimed to determine the origin and proportions of different rock types present or absent in the archaeological record, regardless of chronology. The main question addressed by most of the academia that focus on the research of raw materials selection and exploitation is “where did it come from”. But when going back on older contexts, the lack of variety and quantity of materials requires further questions to get the most information with the few sources available. The strong relationship between materials, land use and structure of acquired knowledge is difficult to prove. The issue of development of abstract thought and symbolic behaviour is one of the most controversial in prehistoric research.

For the study of Middle Palaeolithic raw material selection, exploitation and use contexts in Iberian Peninsula we propose to address new questions such as: "are there symbolic aspects of the material used?", "can different types of rock with different characteristics (colour, texture, abundance) used by different groups be used as communication devices?” if so "when and how you can verify these relationships in the archaeological record?".

The breakthroughs on Neanderthal thinking and possible symbolic behaviour during the last 15 years transform these new issues in increasingly plausible hypotheses. A reflection and discussion of how different perspectives analysing Neanderthal cognitive development is of great importance. The establishment of a relationship between different methodological perspectives and how to break with possible barriers in the dialogue of many disciplines “from A(rcheology) to Z(oology)” is urgent to generate a debate on the approach and methodology to meet current research problems and pose new questions.

Action, Tools and Language Evolution: From Syntax to Pragmatics

Ines Adornetti¹

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In this work we analyze the phylogenetic relationship between language and stone tool-making discussing several studies coming from cognitive archaeology and neuroscience. The idea of a connection between language and prehistoric lithic industry is widely attested (e.g. Arbib 2011; Stout & Chaminade 2012; Uomini & Meyer 2013). The prevalent interpretation is that there is a homology between sequenced action during stone knapping and syntax in language. According to this interpretation, indeed, stone knapping exhibits an underlying grammar with actions organized into recursive, phrase-like structures that are, in turn, organized into overall sentence-like schemas (e.g. Wynn 1993). Studies coming from the neuroscience of stone tool manufacture confirm a model of this kind. They show that there is an overlap of brain activity for language and tool making in Broca’s area suggesting that language and tool making share computational principles for processing complex hierarchical structures common to these two abilities (e.g. Ruck 2014; Stout et al. 2008). Our aim in this work is to show that, beyond the relationship with syntax, the analysis of the neurocognitive processes underlying the making of prehistoric stone tools is a viable proxy for understanding evolutionary aspects of a pragmatic feature of language: the construction of coherent discourses (Adornetti 2015). We show that an important role in the construction of coherent discourses is played by the systems of action planning, monitoring and executing. These systems (which main neural substrate is the prefrontal cortex) are also involved in the making of stone tools (Stout & Chaminade, 2012). Based on these considerations, we propose that the systems responsible for planning and executing action represent the link between stone tool making and language evolution and suggest that they allowed our ancestors to develop forms of protodiscourse governed by coherence.

References


**Towards a Map of Linguistic Phenotypes**

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In the last years a new technique of linguistic analysis have been developed. It combines syntatic analyses of whole copora and formal representations by means of complex networks. Since its first application (Corominas-Murtra et al. 2009) it has been observed that typical children follow the same developmental path of language acquisition, regardless the language aquired. To date, whole corpora of Indo-European and non Indo-European languages – covering one year of the child's life – have been analyzed (Barceló-Coblijn et al., 2012).

The typical developmental path of language acquisition shows three different stages, each of them represented by a type of network: first a chain network, which evolves into a scale-free network, and finally a small-world network. This last stage is characterized by the fact that the number of words and the number of syntactic relationships produced by the speaker tends to be 1:2 (for each word, two syntactic links). Nevertheless, when there are biologically driven factors that affect the typical developmental path, a clear deviation can be observed in the network development.

A linguistic network is thus used as a measurable component unseen by the unaided eye, that shows the path from the genotype to the phenotype. It has been proposed these linguistic networks and their ontogenic progress could be represented in a phenotypic space (Barceló-Coblijn & Gomila, 2014). Artificial morpho-spaces of networks have already been created (Goñi et al., 2013), showing that thousands of networks having the same number of nodes, though different regarding the connectivity (number of edges or links, and their distribution throughout the network).

In the present work data of both typical and atypical populations (Down syndrome, Williams syndrome, Hearing Impairment, Specific Language Impairment) are analyzed from an Evo-Devo point of view, so that each linguistic (complex) network can be seen as a maker of a linguistic phenotype. The more kinds of linguistic phenotypes are analyzed, the more kinds of networks will be available in order to fullfil the linguistic morpho-space.

Finally, the linguistic phenotypes represented by networks will be related to recent neuroimaging studies that begin to have data of the ontogeny of the linguistic pathways of human brain (Saur et al., 2008; Friederici 2012).

Although ontogeny does not recapitulate phylogeny, it seems clear that understanding human evolution goes through better understanding human ontogeny.

References
Decanalization and the Emergence of Modern Language: A Molecular Approach

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Modern language can be regarded as an evolutionary innovation. It emerged sometime after our split from great apes (and according to some views, along with our own species). At the same time the language faculty is very sensitive to damage, to the extent that language disorders show a high prevalence among modern populations. Actually, both circumstances are related. Accordingly, our mode of cognition (involving our language-readiness, that is, our ability to acquire and use a language) resulted from the rewiring of the primate brain. But recently evolved neural networks are expected to be more sensitive to damage because they are endowed with less robust compensatory mechanisms (Toro et al., 2010). At the same time, the molecular changes that brought about this rewiring may have destabilized (or decanalized) the primate cognome, otherwise very robust after millions of stabilizing selection, uncovering cryptic genetic variation. Overall, this may account for the high prevalence of disorders involving language deficits (Gibson, 2009). If this view is correct, we should expect that some buffering mechanism has been reinforced in modern humans in order to deal with all this new variation and make the faculty of language more robust.

In the first part of this talk I will provide with an overview of this evolutionary hypothesis. In the second part, I will delve into the molecular mechanisms that may account for the link between the evolution of our language-readiness and the reinforcement of the mechanisms that buffer variation. I will focus on H2A.Z (one of the key genes controlling biological noise) (Richard & Yvert, 2014) and on the gene network I think accounts for our language-ready brain, which is centered around RUNX2 (a gene that controls brain and skull formation and that has been positively selected in modern humans) (Boeckx & Benítez-Burraco, 2014). Interestingly, H2A.Z, interacts with this network via SIRT1, a gene important for brain function and memory consolidation. I will conclude by claiming that these molecular studies should be central within current approaches to language evolution.

References


Oral Presentations & Posters

Squeal, Laugh, and Take Turns. Differences in Emotional Mechanisms between Speech and Birdsong Learning

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Discontinuity accounts assume that learning and cognitive constraints have prevented the evolution of language until a sudden change occurred in modern humans; perhaps surprisingly, the concept of exaptation is widely adopted in support of such catastrophic accounts. Conversely, this paper investigates the possibility of a continuum hypothesis based on the independent cooption of proximate, rewarding mechanisms for vocal learning in songbirds and humans. Evidence will be reviewed suggesting that learning songs is often rewarded by self-related emotions, visual social displays, and mating, while parent-offspring mutual communication supports the development of both language and social understanding in human infants. In particular, turn-taking in mother-infant interaction reinforces pre-canonical vocalizations into speech and may set the stage for reciprocity. Consistent with this account, squeals, growls, and vowel-like sounds show individually variable emotional flexibility, and volitional control of both laughter and crying vocalizations prelude articulatory control. Not only largely innate vocalizations can be freed from their emotional context, but also rudimentary vocal flexibility in nonhuman primates may be driven by similar affiliative and learning processes. Moreover, emotional, immediately rewarding mechanisms can facilitate higher-order cognitive processing in which both laughter and language are involved over an individual’s lifespan, namely intention attribution and reputation tracking in larger social networks. To sum up, the presumed cognitive constraints preventing the evolution of linguistic capacities in non-modern humans may have been circumvented via cooption of rewarding proximate mechanisms, providing a continuum account based on vocal rather than gestural precursors.

The “Autistic Neanderthal” Revisited: Autism-candidate Genes and the Evolution of Language-readiness

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The hypothesis that the Neanderthal mind was similar to the autistic mind (in the sense that it was a conglomerate of specialized intelligences, but lack the cognitive flexibility of our mind) has been lurking the field of language evolution for many years. The recent sequencing of the genomes from Neanderthals and Denisovans has revealed that among the genes that have changed in anatomically-modern humans (AMHs) there are many candidates for autism spectrum disorders (ASD). Interestingly, many of these genes also belong to the two gene networks we believe important for language development (in the individual and in the species): a network centered around RUNX2 and responsible of our species-specific mode of cognition (namely, the ability to form cross-modal concepts), and a network centered around FOXP2 and ROBO1, two genes related to speech disorders, which we find important for our ability of externalizing thoughts in the form of strings of sounds (see Boeckx and Benitez-Burraco 2014a, b for details). Moreover, among ASD-candidate genes selected in AMHs we have found as well PAX6 and AUTS2 (and some of its partners), which provide with additional links between these two networks, but which may also account for some other differences between Neanderthals and AMHs, specifically, in the domain of vision (autism entails differences in visual abilities too) (see Benitez-Burraco and Boeckx 2015 for details). In the first part of our talk we will briefly characterize all these genes and the role they play in cellular processes that we find important for (the evolution of) our language-readiness. In the second part we will revisit the hypothesis that the Neanderthals mind was similar to the autistic mind. We will criticize the plain view that autism is an atavistic trait, but at the same time we will highlight how the study of these ASD-candidate genes may help to understand the way in which language evolved.

References
**How Speech Connects with Language: Interactions between Learning Mechanisms and Sexual Selection**

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It may not be a coincidence that many of the most intelligent organisms on Earth, including humans, have vocal learning capacities. In this paper I try to connect both facts by putting forth a new hypothesis for the evolution of a fully-fledged vocal learning system.

If cognition is seen as a system for guiding the actions of an organism¹, we may be tempted to propose the idea that sensorimotor capacities are naturally enhanced as part of the evolutionary changes that lead to more advanced cognition. However, comparing the poor vocal learning capacities of chimps with those of parrots (two animals that are known for their outstanding cognitive capacities) shows us that there is room for mismatches between vocal learning and intelligence. I argue that this apparent contradiction can be solved by seeing sexual selection as the cause for the mismatch.

While the origins of vocal learning used to be accounted for in terms of sexual selection targeting more complex vocalizations², recent findings support the existence of female vocalizations in the ancestor of all songbirds³, and the presence of a vocal learning substrate that is shared by most complex organisms⁴. These observations ask us to reconsider the role of sexual selection not as the cause, but just as a domain-specific enhancer of this common substrate, which can be argued to be a reflection of the sophistication of an organism's auditory cognition⁵.

The presence of sexually dimorphic features in the speech mechanisms of humans⁶, and the evidence for positive selection in the genes that contribute to the development of vocal learning mechanisms⁷ may indicate that sexual selection was part of the evolutionary story of how humans came to speak. However, these changes did not happen in isolation, but took place in a context in which our ancestors’ brains were experiencing important changes that ultimately led to the emergence of language⁸. I explore how these two factors could have interacted between each other, comparing the scenario I trace with a novel, non-selectionist account for the emergence of heterospecific vocal imitation in other vocal learners.

My conclusion is that the story of how human speech evolved is not just a simple tale about a specialization caused by sexual selection, but a complex interaction of factors that explains why speech necessarily connects with language and the rest of cognition, and why general learning and vocal learning tend to go hand in hand.

**References**


Age-related Variability in the Processing of Gestural Information

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Hand gestures are commonly used to represent abstract entities as well as objects, characters, actions and places in the course of daily talk, oral narratives, expository discourse and argumentation. Gestures convey abstract meanings thanks to their spatial and metaphoric properties (Cienki & Müller, 2008). Developmental studies of children’s narratives and oral explanations showed evidence for age-related changes regarding the frequency of use and the formal aspects of gestures of the abstract (McNeill, 1992). Following Goldin-Meadow (2003), we postulate that gesture development is a window into the development of abstraction abilities.

Although gesture production is studied extensively, we don’t know much about the processing of gestural information in adults as well as in children. Nor do we know how people detect and process the abstract use of gestures. Boutet (2010) showed that hand gestures selected from the sole physiological parameters (extension / flexion, pronation / supination, etc.) are easily categorized and seen as bearing meanings. The assigned meanings to gestures by the subjects (to appear/disappear, to offer/refuse, to accept/reject, to consider, etc.) applied both to actions and properties of objects in the physical world and to abstract ideas.

Our study aims to compare the pattern of attribution of abstract meaning to hand gestures in three age groups: children, adolescents and adults who first passed a comprehension test of idiomatic expressions to measure their comprehension capacities. We filmed five hand gestures that have both concrete and abstract representational properties, with which we have developed two experimental conditions used in two sets (a “word” set and a “sentence” set) of three trials each. In the gesture-only condition (G condition), subjects were asked to produce one word/sentence that was appropriate for each gesture they viewed (first trial). And in the bimodal condition (B condition), we showed the subjects audio visual combinations of gesture + word/sentence pairs. They were asked to decide whether each pair was congruent or incongruent (second trial). For this test we used the same gestures with different combinations of words/sentences making up twenty combinations in all. The gesture-only condition was replicated (third trial) to measure the priming effect of being exposed to bimodal pairs.

We hypothesized that all subjects would have high scores in the B condition for concrete meanings, and that adults and adolescents would perform better than children in the B condition for abstract meanings. By comparing the first and third trials in each set, we hypothesized that attribution of abstract meanings to hand gestures not only depends on age, but also on previous exposure to co-speech use of gestures.

References


Alignment as the Key for Communication: An Evolutionary Hypothesis

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Traditional theories of language evolution focus attention almost completely on the analysis of strictly linguistic components, such as grammar. Nevertheless, considering the rise of human communication starting from a symbolic code means assuming a preexisting form of communication which is merely encoded. As a result, these approaches fall into a clear fallacy: they take for granted from the beginning something that must be explained (Tomasello 2008).

In our opinion, a more suitable move in order to account for human language consists in investigating how non-conventional encoded communication has been able to make inroads. From this point of view, rather than referring to an isolated linguistic component, language evolution has to be analyzed in regard to broader capacities that are traceable in general cognition. In this poster, we propose that a key pragmatic function involved in performing joint actions, namely alignment (Pickering & Garrod 2004), was crucially implicated in the origin and evolution of language. More specifically, we argue that the pragmatic abilities that allowed our ancestors to build joint mental representations could account for the strategies employed from the very start in order to provide and construe communicative clues without a full-fledged code. Such perspective assumes that aligning the situation models (Zwaan & Radvansky 1998) of speaker and listener – that is, attuning the multi-dimensional representations of their contextual framework – forms the basis of successful communication. After having discussed the theoretical and empirical reasons why we might identify in alignment the key for communication, we make reference to the devices required so that alignment of situation models is achieved. Our proposal is that the early forms of alignment have to be considered sensory-motor in nature (Gambi & Pickering 2011). To this extent, a network of mechanisms involved in the immediate representation of other’s actions supports moment-by-moment coordination in early language use. By emphasizing the role of this grounded form of alignment between speaker and listener, we suggest that the origin and evolution of language has to be interpreted in terms of proto-conversation.

References


Advertising Fertility as a Pathway to the Evolution of Proto-language

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Sexual selection has received support as an explanation for language evolution but also criticism, often because of a perceived difficulty in explaining why women are equally adept at language as men. However, recent evidence suggests that women's voices become more attractive to men during their most fertile period, suggesting reproductive hormones may play a role in voice attraction and could be a proximate mechanism for male mate choice. To examine the origins of this phenomenon we must include our closest living relatives, but comparative evidence from non-human primates is scant. A handful of studies test the hypothesis that female primate copulation calls advertise fertility, but they have produced mixed results. Finding out whether female primates advertise fertility through everyday vocalisations could be key in advancing our understanding of the evolution of primate vocal communication, including language.

Gibbons are the only non-human ape to produce loud and elaborate “songs” whose structures are based on combinatorial rules and context-specificity. Gibbon song therefore has the potential to offer a fruitful avenue for...
research into the evolution of complex vocal communication in the primate lineage. This study tests the hypothesis that female gibbons (Hylobates lar) use their songs to advertise fertility. We used behavioural observations, acoustic analyses and non-invasive endocrine monitoring for five cycling, paired females in five UK zoos. Preliminary results show the structure of their daily elaborate “great calls” differs between the fertile and non-fertile phase of their menstrual cycles, with extra elements present during the fertile phase. These results suggest that advertising fertility could be an important function of female vocalisations in gibbons and that males in the wild could use this information to choose and then guard their mates. There is also the possibility that males may prefer more complex vocalisations (extra elements), although playback studies are needed to confirm this. If advertising fertility were a generalised function of female primate calls, and early man found complex “fertile” calls attractive, it could provide an explanation for the initial evolution of female vocal prowess among early humans. In light of this study and their pair-bonded social systems, gibbons may be a good model species for investigating the kinds of pre-linguistic utterances our human ancestors may have produced.

**Linking Actions and Intentions to Discourses: Towards an Embodied Pragmatic Theory of Language Evolution**

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Evolutionary theories of language have generally adopted a bottom-up approach, according to which minimal units which are inflexibly associated to their meanings are the evolutionary starting point. Here I will defend a top-down perspective on language evolution, which focuses on the abilities required to process larger linguistic units such as discourses. This approach involves the necessity to focus on the pragmatic abilities of our ancestors and on the biological mechanisms underlying them. My main purpose is to show that such a top-down approach to language evolution is compatible with an embodied account of cognition. In order to do so, I will focus on the notion of affordance, that is, the dispositional properties of an object or environment that, in combination with a particular bodily structure, determine possibilities for actions (Gibson, 1979).

The argumentation proceeds along three cornerstones: first, I will analyze two alternative models of language which, on the basis of different predictions concerning the role of discourse-level contextual information in semantic processing, characterize the interpretative process as a two-step or a single-step procedure. I will present the results of an experimental investigation that supports a single-step model, showing that the context of discourse has pervasive top-down effects on the processing of individual words and sentences (Ref. edited for the review process). Second, I will address the question of how the empirical investigation of current language processing can shed light on the issue of language evolution. I will argue that a two-step model of language processing is incompatible with evolution and that evolutionary considerations lead to assume a top-down perspective according to which pragmatic processes enabling inferential communication were necessary to the evolution of language.

Finally, I will show that a top-down model of language evolution is consistent with an embodied account of cognition. Focusing on a basic mechanisms of affordance perception, I will claim that this mechanism supports core pragmatic processes by enabling the individual to determine not only her own action possibilities in the physical environment but also the action possibilities of others and, thereby, enabling her to determine other people's intentions. The main result of this investigation will be to introduce the notion of embodied pragmatics as a key to account for the evolution of language.

**References**


**Investigating Phonosymbolism with an Implicit Judgement Task in French**
One of the key questions regarding language origins deals with the emergence of convention: how did a shared conventional, i.e. symbolic, vocal code appear in humans? This issue has been addressed abundantly in the literature, especially in the field of computer science (Harnad, 1990; Steels, 2008). However, most studies have focused on the self-organizing processes taking place at group level, with agents already equipped with symbolic abilities (e.g. Steels, 1997; de Boer, 2000). Very few have focused on the prerequisites of such ability (until the recent advent of experimental semiotics (Galantucci, 2010)). We think that this ability is built on a previous crucial step where an iconic relation exists between sounds and meanings. Indeed, for convention to emerge, i.e. to be able to equate other’s production with our own (Foucault, 1966), signals must be as stable as possible. Iconicity can ensure such stability.

“Sound symbolism” is a growing field of research, with results demonstrating that the physical properties of segments are partly iconically associated with semantic ones. Onomatopoeia, ideophones or phonoaesthemes are known examples of sound-meaning pairings, but iconic associations are also found in phonemic contrasts (Schmidtke et al., 2014). In Huambisa, for example, /i/ is associated with birds, and /a/ with fishes (Berlin, 1994). Other scholars looked at the emotional quality of phonemes and found tendencies in particular languages (Whissell, 1999; 2000; McIntosh et al, 1997; Fonagy, 1983). Finally, several studies also highlighted more general associations between different modalities, like pitch with size, brightness, height or shape (Spence, 2011). Von der Marsburg (1981) proposed as an explanation his “cross-modal binding problem”, according to which different correlating perceptions are associated via the synchronic activity of neuronal firing. A certain amount of variability is to be noted either across languages or in the associations themselves, and understanding which segment bears a semantic role in a word is sometimes difficult.

We investigate phonosymbolism with a psycholinguistic experiment on French speakers. The rich vocalic inventory of French allows a fine-grained testing of the iconicity of phonetic features like height and rounding. Furthermore, we chose an implicit task to avoid conscious strategies which cannot be ruled in more common explicit judgment tasks. The task consists in associating animals (controlled in size, color, dangerousness and repulsion) with pseudo-word varying in their phonetic constitution, in order to test imprecise previous findings. Results of this experiment will be presented as well as cross-linguistic perspectives.

On the Origin of Language between Gestures and Sounds

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Given the validity of a mimic-gestural theory of the language faculty, the explanation of the transition to a predominantly acoustic channel becomes pivotal for any evolutionary investigation. Non-human primates exhibit a certain degree of semantic referentiality, despite lacking the neuro-physiological bases for language. Among the apes, chimps display an efficient combination of gestures accompanied by vocalizations, which reinforce each other in their pragmatic meaning and take the form of a sort of "vocal gesture". This combination activates the frontal (Broca) and temporal (Wernike) areas of the brains that in humans are related to language. In addition, the motor facilitation of vocalizations has been recognized increase correctness and velocity of motor tasks. At the neuro-physiological level, this facility is implemented in the left pre-frontal hemisphere and involves populations of mirror neurons called Echo. As visual mirror neurons, the Echo associate a sound perception to the corresponding action, thereby making it possible not only to the recognition (via embodiment), but also its subsequent reproducibility. The vocal gesture, as theorized by Wundt and then by Gehlen, is therefore associated with the action; in humans, the vocal gesture makes it ideally present even when the object to which it refers is no longer (or not yet) within sight. This allows one of the fundamental characteristics of language, i.e. the spatial and/or temporal displacement between referent and meaning. The articulatory capacities of archaic humans (i.e. Neanderthals) remain controversial, but the controversy concerns the ability to produce the full spectrum of phonemes reproducible not the reproduction ever. In our species, the
articulatory abilities fully develop with the lowering of the larynx, which is an apomorphic trait of our species. During childhood, the vocalizations allowed by the vocal tract are composed of phonemes simple and repetitive. This "childish" conformation of the supra-laryngeal tract (present also in archaic humans) would be in itself sufficient to reproduce in the form of onomatopoeia and ideophones various sounds that accompany many of the activities, which are essential for the survival of our ancestors, starting with the animal sounds to the "rhythms" (not just noise) that punctuate the production cycles of the Paleolithic and facilitate their learning and memorizing. It is therefore from the co-evolution of a cortical system gesture/sound that has made possible the exaptive transition to articulate speech in which, in early evolutionary stages, the sound produces positive effects on motor facilitation, retention and recall of memory, attention and learning.

**Compositional Syntax in a Cooperatively Breeding Bird**

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A defining feature of language is its compositionality: morphemes can be combined together with the meaning of the higher-order structure resulting from the individual meaning of each of its components. While elucidating how this generative capacity evolved is a non-trivial task, the comparative approach provides one fruitful potential avenue of investigation. Recent observational work has demonstrated the propensity for animals to combine context-specific, ‘meaningful’ signals into sequences that resemble compositional structures in language. However, in these examples playback experiments demonstrating a compositional understanding of information are lacking. Here we demonstrate for the first time that cooperatively breeding pied babblers (*Turdoides bicolor*) can extract meaningful compositional information from combinations of context-specific vocalisations. Specifically, observational and experimental work provides evidence that pied babblers combine two context-specific vocalizations, alert and recruitment calls, when mobbing terrestrial predators, with the sequence suggested to function to specifically recruit group members in a dangerous situation. To our knowledge, this is the first experimental evidence for semantically compositional syntax outside of human language and supports recent observational work suggesting the ability to combine and process meaningful structures of vocalisations in a compositional way is not a de novo evolved human language trait.

**Mental Time Travel, Storytelling and the Evolution of Language: Insights from Autism Spectrum Disorder**


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In this talk, we propose a narrative hypothesis on the nature of language and a proto-discursive hypothesis on the origin of language. Our proposal is founded on two assumptions: 1) that the essential proprieties of language functioning emerge at the level of discourse and narration; 2) that a fruitful way to study the origin of language is to analyse the cognitive systems involved in discourse processing. Specifically, we maintain that discourse global coherence is one of the properties underlying both the functioning and the origin of language and that Mental Time Travel (MTT) (Suddendorf & Corballis 2007) – the ability to project themselves in past and future – is one of the main cognitive systems implied in global coherence processing.
To test the involvement of MTT in discourse production, we study the narrative abilities of children (ranging from 6.0 to 10.11 years of age) with Autism Spectrum Disorder (ASD). It is widely attested that subjects with ASD have deficit in storytelling and in global coherence processing (Baron-Cohen et al. 1986; Diehl et al. 2006). Traditionally, this kind of deficit is interpreted in terms of Theory of Mind (ToM) difficulties (Baron-Cohen et al. 1986; Frith 1989). We maintain that this interpretation is just a part of the story and it has to be extended by referring to other cognitive systems. Recently it has been shown that ASD have problems in MTT (e.g. Terrett et al. 2013). The aim of our study is to test if some of the narrative deficits of ASD might be linked to their problems in mental projection in past and future. The narrative assessment was performed on the story-tellings elicited with a picture-description task with temporal constraints. The results we present confirm the involvement of MTT in discourse processing. We discuss these findings in reference to a protodiscursive origin of language hypothesis.

References


Do chimpanzees and bonobos communicate differently?

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The evolutionary scenario that led to the dawn of human language remains a highly debated issue. By investigating the communicative abilities of our closest living congeners, bonobos (Pan paniscus) and chimpanzees (Pan troglodytes), it might be possible to draw inferences about behaviours of our extinct ancestors. Surprisingly, although comparisons of the two Pan species revealed a dichotomy in (i) agonistic quality, (ii) degree of cohesiveness, and (iii) development of social behaviours, a direct systematic comparison of their communicative skills is to date non-existent (Halina et al. 2013; Call & Tomasello 2007; Rossano 2013). The aim of the present study was therefore to examine whether bonobos and chimpanzees also differ in their communicative abilities. To do so, we investigated the communicative behaviour of 25 mother-infant dyads in two bonobo (LuiKotale; Wamba, DRC) and two chimpanzee communities (Tai, Côte d'Ivoire; Kanyawara, Uganda) in the wild. Focusing on the context of leaving, we addressed two questions: First, does species affiliation affect the variability and timing relationships of signal production in mother-infant dyads? To answer this question, we investigated communicative interactions in relation to usage of carry-initiating gestures and actions, role (mother/infant), age, but also temporal ‘signal-response’ structures such as occurrence of response waiting, sequences and coordinated responses. Second, do bonobo and chimpanzee infants differ in the development of spatial independence and, if yes, are these differences related to communicative differences? To answer this question, we investigated proximity patterns across development and carry frequency. We analysed a total of 735 leaving interactions filmed during more
than 2000 hours of observation. The results showed that communicative interactions of bonobos and chimpanzees differed in relation to (i) role (mother/infant), and (ii) infant age. In addition, chimpanzees showed a higher frequency of gesture-initiated carries, response waiting, and gesture sequences and hence, more communicative persistence. In contrast, bonobo carries were more frequently solicited by coordinated responses, i.e. responses to carry-initiating acts were produced while signallers were still in the process of soliciting. Our findings thus add another facet to the Pan dichotomy, which are discussed in relation to hypotheses concerning self-domestication, social structure and aggression quality.

References


The Development of Sophisticated Forms of Communication in Humans
Bruno Galantucci

One of the hallmarks of our species is that we develop sophisticated forms of communication. However, there is growing evidence that we exhibit important limitations when we are asked to perform tasks that require communicative sophistication. I will illustrate some of this evidence, which comes in part from research on the emergence of novel communication systems in the laboratory and in part from research on the use of natural language. Then I will focus on the question of how individuals who have limited communicative skills manage to develop sophisticated forms of communication.

I propose three non-mutually exclusive hypotheses to address the question. The first hypothesis is that communicative sophistication does not originate from sophisticated individuals but emerges in the public arena, as the result of a cultural ratchet effect. The second is that there may be great variability in communicative skills within the human population and that the development of sophisticated forms of communication may be driven by a minority of exceptional communicators. The third hypothesis turns the question on its head, suggesting that human communication may often be much less sophisticated than we think.

I will present various kinds of evidence supporting the second and the third hypotheses and argue that the latter can help us reduce the conceptual gap between the study of human communication and the study of other forms of coordination in humans and animals.

Economy of Linguistic Behaviour. Against the Example of Bilingual Conversation in the Context of Rational Choice Theory
Michał Głuszkowski

The phenomenon, when one speakers’ speech contains elements in wider or narrower range of two languages is probably as old as the language contact in general. In the literature of this field two terms are used to describe this state (except of the borrowing phenomenon, which is of other nature): the CM (code-mixing) and CS (code-switching). After P. Auer we will use the term CS for “those cases in which the juxtaposition of two codes (languages)
is perceived and interpreted as a locally meaningful event by participants.” (Auer 1999: 309; 1991: 410). These are intersentential switches and functionally meaningful intrasentential switches, e.g. between clauses or phrases in a clause. The changes of code without functional meaning, observed in simpler units, word forms inclusive, are here considered as CM. However, switches between clauses and phrases (CS) and inside simpler units (CM) are only prototypes, and we can observe a wide range of phenomena on a continuum between these two poles.

The language choice in each turn of a conversation entails an expectation that the newly introduced language will be taken up by the interlocutor (Alfonzetti 1998; Jørgensen 1998; Meeuwis and Blommaert 1998). Language choice as well as the switching may be perceived by the interlocutors as marked or unmarked. According to the theory of rational choice (RCT) the participants of the language situation “consider” all advantages and disadvantages of their language behaviour what affects the process of language in bilingual conversation (cf. Myers-Scotton, Bolonyai 2001: 7-8). The speakers are aware of some consequences of their choices, but only under certain conditions they can take all of them into consideration; many choices are internalized through their experience and also affect the choices. Basing on the differentiation of conscious (CS) and unconscious (CM) choices I am going to precise to what extent the economy of bilingual speech may be a conscious behaviour. The examples of conversational CS and CM will be taken form the sociolinguistic material gathered during 13 expeditions to the Russian Old Believers’ community in Poland in the years 1999-2014 and 2 expeditions to the Polish language island in Siberia – the village of Vershina near Irkutsk.

References


**Distance Encoding in Chimpanzees Communicative Behaviors**

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The aim of this study is to investigate spatial reference in captive chimpanzees (Pan troglodytes). Reference is the ability to communicate with others about events or objects in the environment. It is a fundamental component of human communication, playing a crucial role in social skills and language development. Spatial reference concerns more specifically the spatial location of objects being referred to. Individuals divide the space into different areas (most often, near versus far space), and consequently resort to appropriate linguistic and gestural signals, to efficiently and accurately locate a referent. This distance contrast (near/far), thereafter referred to as distance encoding, appears to be a robust feature of referential communication, present in all aspects of multimodal pointing. The distance of a referent is thus encoded at a lexical, high language processing, level, and at a motor, low language processing, level. In other words, individuals use distance-specific linguistic units (such as “here” versus “there”), but also distance-specific oral and manual gestures, to designate a close versus a distant referent. This suggests a close connection between
linguistic structures and communicative gestures. We believe that looking for such distance encoding in our closest living relatives signaling could provide valuable information on the emergence of referential communication. We are thus investigating the ability of eight captive chimpanzees to adjust their communicative signals according to the spatial properties of a referent. For that purpose, we are using a food-requesting paradigm, where a piece of food is located either in the chimpanzees proximal space (‘near’ condition) or in their distal space (‘far’ condition). Besides, chimpanzees are tested for their requesting behavior in two conditions, either with a human interlocutor (‘with human’ condition) or alone (‘without human’ condition). This will allow us to assess the communicative nature of the observed behaviors. Intentional communicative signals, such as pointing gestures, attention-getting gestures, and vocalizations, will be categorized as visual, auditory, or audio-visual signals. The relative proportion of each signal, and some qualitative features of manual gestures (e.g. shape, orientation, and position of the hand), as well as those of each signals combination, will be compared between the ‘near’ and the ‘far’ conditions. Distance encoding, that would be here a systematic variation of the signals depending on the distance of the food, could manifest itself in many ways, including for instance a multimodal strategy (i.e. combinations of unimodal signals and/or use of multimodal signals per se) to designate a distant referent.

Ways to Proto-Morphology: What Complex Words Reveal about Human Cognition and Cultural Evolution

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Morphology has been called “the conceptual centre of linguistics” (Spencer & Zwicky, 1998). In language evolution research, however, the emergence of morphological patterns has been neglected so far. One notable exception is Carstairs-McCarthy’s (e.g. 2010) work on the evolution of morphology. Carstairs-McCarthy argues that phonologically conditioned alternations (‘proto-allomorphy’) can be seen as the most likely starting point for non-concatenative morphology, which, in his scenario, preceded affixal/additive morphology. The present paper starts out with a critical reappraisal of Carstairs-McCarthy’s approach, contrasting its foundational assumptions with a usage-based conceptualization of linguistic morphology. In this view, the questions to be asked are fundamentally different from those proposed by Carstairs-McCarthy: For instance, the question “Why does syntax alone not take care of all complex linguistic items?” (Carstairs-McCarthy 2005: 169) becomes obsolete, as a usage-based approach sees redundancy as a major design principle of language (Langacker, 1988; Beekhuizen et al. 2013). I will argue that a usage-based conceptualization of language allows for a straightforward account of the emergence of morphological constructions through processes of constructionalization (Traugott & Trousdale, 2013). More specifically, the emergence of morphological structure can be understood as an instance of procedural constructionalization, which involves “an increase in schematicity and productivity and a loss of compositionality” (Traugott 2014: 10). The division of labor between ‘lexical-contentful’ and ‘grammatical-procedural’ constructions can be seen as a result of competing pressures for learnability and expressivity (Smith et al. 2013; Pleyer & Winters, 2014). Importantly, the emergence of morphological structure, as well as of linguistic structure in general, is seen as a process of cultural evolution, in line with Smith et al.’s (2013: 1351) hypothesis that “we can explain why language is structured without recourse to invoking an evolved, domain-specific faculty of language.” The key questions concerning the evolution of morphology can therefore be reframed as:

a) Which factors lead to the emergence of ‘proto-morphological’ structures, i.e. linguistic units which can be reanalyzed as “complex and bound” items (Croft, 2001)?

b) Which factors determine the productivity of a morphological construction, i.e. its ability to be extended to new cases, which bridges the gap between ‘proto-morphology’ and a full-fledged morphological system?

Given that “there is every reason to assume that the very first grammatical constructions emerged in the same way as those observed in more recent history” (Bybee, 2010: 202), developments in the traceable language history can give valuable clues to the origins of morphology and help answering the questions just outlined. Drawing on a variety of examples such as the dynamics of the fairly complex German prefix system and the emergence of so-called affixoids,
I will discuss the implications of cross-linguistically well-attested patterns of morphologization and morphological change for an evolutionary theory of morphology.

References


Communicative Relevance and Morphological Complexity: An Iterated Learning Approach

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It has often been noted that different languages have different ways of encoding the same type of information. According to the influential model of morphological classification going back to Schleicher and Humboldt and developed further by Sapir, languages can be arranged on a continuum ranging from analytic (isolating) languages, which tend to adhere to the ideal of “one morpheme - one meaning”, to (poly)synthetic languages, exhibiting considerable morphophonemic alternation and even suppletion (cf. e.g. Greenberg, 1974; Croft, 2003). The question why languages differ so strongly in morphological complexity is still subject to considerable debate. In this paper, we investigate different factors leading to the emergence and maintenance of morphological complexity from a usage-based point of view.

Starting from the hypothesis that language structure is shaped by domain-general learning and processing biases as well as by communicative strategies employed in interpersonal interaction (cf. Chater & Christiansen, 2008; Bybee, 2010; Smith et al. 2013; Pleyer & Winters, 2014), we explore the cognitive advantages of different language types using an Iterated Learning setup. In this approach, participants are trained on an artificial language and then produce
linguistic behavior which subsequent “generations” of participants learn from. Thus, the cultural transmission of language is simulated in a laboratory setting (Kirby et al. 2008; Kirby et al. 2014). In our study, participants learn expressions for a variety of items which vary along the dimensions of color and number. In the complexity condition, these dimensions are jointly encoded in one portmanteau morph (as is often the case in polysynthetic languages). In the isolating condition, by contrast, color and number are encoded as individual words. Participants then use the learnt items in a communication game with a virtual interlocutor, which requires them to productively use the number and color constructions. In one of the three communicative conditions, color is highly relevant to the situation presented as context for the communication game; in the second condition, number is relevant, whereas in the third condition, both dimensions are equally relevant. The paths of development taken by the initial stimuli in the different conditions can give valuable clues to the ‘adaptive’ traits of different kinds of language structure. Emphasizing the role of communicative relevance, our experimental setup can help elucidating the role of interactional factors shaping language structure.

References


Gender Difference in the Representation of Linguistically Related Iconic Gestures in L1 Urdu Speakers

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Speech and gesture are planned unconsciously together in speech production, and where languages differ in the way they syntactically encode similar meanings, accompanying gestures will also differ (Gullberg, 2010). Recent studies have shown cross-linguistic differences in how motion events are encoded both in speech (Talmy, 1985) and linguistically related gestures (Kita, & Ozyurek, 2003; Hussain 2014). Urdu is one of the verb-frame languages. Urdu native speakers use two separate verbs in speech and produce two iconic gestures to represent manner of motion event to goal (Hussain, 2011). However, the present study investigates gender differences between male and female L1 Urdu speakers in the gestural representation of manner of motion events to goal. A total number of twenty male and female participants were shown a video clip from an animated movie of Shakespearian play, a scene in which a character danced across the bridge. This is an example of ‘manner of motion event to goal’. In typical Urdu sentence this might be expressed as:

(i) Wo nachtay howay pull kay par gea.

He dancing (particle) bridge (particle) across went.
He went across the bridge while dancing. L1 Urdu speakers used two separate verbs one for manner nachtay howay (dancing) and the other for path pull kay par (went across) to express this event in speech. Simultaneously they produced two separate iconic gestures, one for manner dancing and the other for path went across. During data collection, these participants were asked to retell the story and meanwhile they were videotaped. The data was analysed through annotations. The results showed that L1 Urdu male participants used more free space in gestural representation of manner of motion event to goal than their female counterparts. The study concludes that within a single linguistics community, gender based variations in gestural representation of manner of motion events to goal might be found. This study also shows that iconic gestural representation of manner of motion event is influenced by cultural stereotypes.

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The Uniquely Human Cognitive Bias that Makes Language Learning Possible
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In order to learn meanings of words, memorizing the association between the sound and the object is not sufficient. A female chimpanzee was trained to associate symbols to a set of color chips (Kojima, 1984, Asano et al.,1982). After training, the chimpanzee became able to choose the designated symbol for each color, as trained. However, when the directionality of the contingency was reversed (i.e., choose the correct color for a given symbol), she failed, indicating that she did not understand that the relation between a color and a symbol is bi-directional. This shows that, for human infants to initiate language learning, they first need to understand the bi-directional relationship between symbols (i.e., words) and their referents.

Humans have a strong tendency to generalize the learned contingency to the reverse direction: Having learned that a contingency in one direction (A→B) holds true, people assume that the reversed contingency (B→A) also holds true, even though this reasoning is logically incorrect. For example, having heard someone say ‘if X happens, I will come’ and he actually appeared, people naturally infer that he came because X happened, although he may have come for other reasons.

In contrast, numeral studies with various animal species have shown that non-human animals rarely generalize a learned contingency to the reverse direction (e.g., Lionello-DeNolf, 2009), as the above episode of the chimpanzee shows. A key question concerning the ontogenesis of language is whether human infants possess the bi-directional reasoning bias prior to language learning.
To address this question, we investigated whether 8-month-old human infants and adult chimpanzees show this bias, using the same stimuli and comparable experimental procedure (preferential looking paradigm) across the two species. Both species were familiarized with ‘A(object) B(motion)’ contingencies, and were then shown either the ‘B→not A’ or the B→A’ contingencies. We expected that humans but not chimpanzees would show the bi-directional reasoning bias, detecting anomaly in the ‘B not A’ contingencies.

As expected, only human infants showed the bias, showing dishabituation upon the ‘B→not A’ contingency. Although the chimpanzees detected the violation of the contingencies in the learned direction (‘A→not B’), they did not show any sign of finding anomaly upon the ‘B not A’ contingency.

The results suggest that the bi-directional reasoning bias may be a uniquely human cognitive bias available at birth, which makes language learning possible and is behind the fact that only humans possess language.

Artifactual Theory of Words
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When we introduce an individual word to an existing language we do it to fulfill a purpose. In this sense, words are not different than other human artifacts; they are creations of human beings that are supposed to serve certain purposes. I argue that there is a particular kind of purpose, which I call referential purpose that enables us to refer to (or to name) an object, a property, a relation, or an event of a certain kind. By restricting candidate meanings for the new word, referential purpose helps us to fix its meaning. In other words, referential purpose partly determines what meanings should count as candidates for the meaning of the new word. Therefore, when we want to introduce a new word to our language like ‘electron’ the referential purpose of this new term can explain why we should not be worried about being able to exclude alien meanings like table, mountain, galaxy, or the number three from the list of candidate meanings. The paper has three parts. In the first part, I locate the artifactual theory of words within the context of recent debates in metasemantics. In the second part, I lay out the view that I call artifactual theory of words. I argue that introduction of new words to an existing language requires purposes of certain kinds which, most of the time, correspond to the needs of a linguistic community. The view is neutral on various semantic and metasemantic theories. I argue that some of these theories do better when supplemented with the artifactual theory of words. In the last part, I look at reference magnetism as a case study; a prominent view that is sketched by David Lewis (2007) and put at work by various philosophers for different uses. I take up Ted Sider’s (2011) version of reference magnetism, which he relies on in his account of metametaphysics, and I argue that in order to avoid some serious problems, Sider’s version requires adopting a view like an artifactual theory of words.

Meaningful Mistakes in Language Behaviour as a Basic Factor in Its Evolutionary Dynamics
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As opposed to the main lines of research in language evolution, the bulk of research in linguistics has been concentrated on written material, which results in the widely debated „written language bias in linguistics“ (Linell, 2005). This purely descriptive approach, which is particularly characteristic of the traditional study of modern languages, inevitably leads to taking negative and patronising attitudes towards linguistic errors, which effectively makes it impossible to make any causal claims about the dynamics underlying the changes observable in the language resources of a particular social group. It looks more promising to concentrate on several classes of mistakes that can be viewed as manifestations of evolutionary processes, especially because it can provide an opportunity to explore the
constant tension between the bio-cognitive capacities of individuals and the socio-cultural pressures operating at the population level.

One powerful approach to modelling information transmission in populations is the Iterated Learning Model (Smith et al., 2003). In this framework the evolution of language is modelled on artificial mini-languages (for which I introduce the term ‘evolects’), which are applied in simulations *in silico* and in laboratory settings. An important contribution of this work is the identification of the main selective pressures acting at the combinatorial level of lectal structure, which are responsible for the emergence and further development of fundamental structural properties of language resources. Having surveyed some recent results obtained with these methods (especially in the experimental design proposed by Kirby et al., 2008), I will present two exploratory case studies aiming to address these questions empirically and discern the same adaptive processes occurring *in vivo*. To this end, I will be using samples of linguistic data from Polish, evidenced in the lively communicative behaviour of Internet users. This seems to be the only reliable way to collect such material, because in on-line activities people often ‘write as if they were speaking’, spontaneously making ‘combinatorially meaningful’ mistakes, which become part of their language resources.

Embedded in the complex dynamics of other adaptive systems (Beckner et al., 2009; Kirby, 2012), the morphosyntactic structure undergoes many subtle changes on the glossogenetic timescale and adapts itself to various ‘bottlenecks’, such as cognitive and social-pragmatic constraints, differing availabilities of exemplary data, and, last but not least, the normative pressure to use ‘appropriate’ expressions in verbal interactions. Drawing on the selected exemplary data (in one qualitative and one longitudinal study) I will demonstrate that the morphosyntactic innovations are mostly due to a simple associative mechanism, which is based on a combination of very frequent parts of linguistic items and constructions. The results of such ‘reproductive blending’ are propagated through generations of language users, and the underlying mechanism may be seen as a force that paradoxically stabilizes the evolving structure of an ethnolect. Whether it could also be at work at the very beginning of an emerging protolect (drawing on the uniformitarian assumption) remains an open question.

References


Evolutionary Perspective on Imitative Patterns in Pantomime Vocalisations

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The aim of the present study is to investigate vocal strategies utilised by participants of a reenactment task, taking into account the evolutionary perspective. The study encompasses four subjects, two males and two females, using a range of vocal tactics in non-linguistic situations. They were supposed to “act out” 16 randomised scenes, either egalitarian or hierarchised, single-sex or mixed-sex, agreeable or hostile. The total of 64 scenes were interpreted by 22 judges who were to connect each enacted scene with the images on the original matrix of 20 diversified events. Due to the imitative nature of the task along with the unambiguous instruction for the participants, the vast majority of the recorded sounds had a mimetic character. The observed forms have been divided into three categories - forms...
Oral Presentations & Posters

imitating corporeals (Hinton et al. 1994), that is to say sounds expressing human internal states, both emotional and physical (e.g. coughing), forms imitating environmental sounds (e.g. music) and sounds compensating for speech. The results obtained suggest that there is a statistically significant disproportion between the distribution of the aforementioned strategies. Forms imitating corporeals seem to prevail in aggressive events. What is more, the actor's choice of a vocal strategy has its repercussions for the identification accuracy rate. The outcome suggests with 95% confidence that speech compensation constitutes a less effective tactics than the remaining ones. The results of the study may constitute a valuable contribution to the discussion on the role of the iconic sign in the process of language evolution (Allott 1973).

Protolanguage Possibilities in a Construction Grammar Framework

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Protolanguage, as an intermediate stage in language evolution, must simultaneously both be an improvement on earlier communication systems, and lack enough language features to be distinct from full human language. Identifying possible levels of protolanguage becomes an exercise in decomposing language into separable features that can be added sequentially (cf. Johansson 2006, Jackendoff & Wittenberg 2014). This exercise critically depends on the underlying nature of language, on which there is little consensus among linguists. Language theories vary widely in evolvability.

In this presentation, I will investigate the protolanguage potential and evolvability of Construction Grammar (CG; e.g. Goldberg 2006). CG is used in evolutionary linguistics mainly for modelling the cultural evolution of grammar (e.g. Steels 2011). Biological evolution of language in a CG context has received less attention, with Hurford (2012) a notable exception. Postulating that CG is a biologically real description of language, its evolvability through a sequence of intermediate protolanguages can be investigated. The list below is one possible evolutionary sequence coming out of such an analysis. The numbers denote steps in the evolution of CG, and letters some protolanguage possibilities during that step.

1) “CG” just a simple extensible lexicon, with one-to-one mappings between form and meaning.
   a) One-word stage.
   b) Juxtaposed words, similar to the protolanguage of Bickerton (1990).
   c) Holistic learning of common juxtapositions – filled idioms.
   d) Links from juxtaposition entry to its components.

2) CG permitting gaps in constructions, to be filled with words.
   a) Generalize over juxtapositions with one component in common. Constructions with gaps – partially filled idioms. Similar to pivot grammar in language ontogeny.

3) Categorizing constructions into constituent classes, and labelling gaps with the constituent class that normally fills it.
   a) Similar to previous step, but grammar partially replaces pragmatics. Computational improvement.

4) Recursive gap-filling.
   a) Sentences with hierarchical structure.

5) Generalized abstract constructions, with no filled slots (ditransitive, passive, …). Inheritance hierarchy.
   a) Similar to previous step, but more open-ended and powerful. Computational improvement.

6) Recursive application of abstract constructions.
   a) Full modern language.

The details and order of the sequence are speculative, but it is clear that CG is eminently evolvable, with many levels of proto-language along the way. Each step is evolutionarily small and arguably provides improved language. There is scope for biological/cultural coevolution, and grammaticalization (cf. Heine & Kuteva 2007) comes naturally. CG appears to be a promising framework for further evolutionary studies.
References


On Modeling the Emergence of Language: The Case of a ”Horde” of Autonomous Robotic Agents

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A number of cognitive/computer scientists are interested in the question of emergence of communicative competence (e.g. Steels, 2011) and the emergence of language. Some of the traditionally considered issues can be addressed through simulations involving the development of groups ("hordes") of grounded robotic agents interacting with their environment and communicating in accordance with their own lexicon and grammar emerging as a result of their own evolution. The paper is a result of author’s participation in such a research program.

One of the tasks of the research is to hypothesize (and test) the minimal conditions for the emergence of language. I am convinced that these conditions would (partially) answer the question: what could be protolanguage.

The first aim of my presentation is to indicate assumptions of the project and their connections with up-to-date results in linguistics, psychology etc. To answer the question about the mechanisms (preadaptations) that made language possible (Swarup & Gasser 2007) we should assume - in my opinion - the following factors:

• cognitive capacities necessary for emergence of capacity for language - innate in their basic form and developing with experience. Initially, the ability to detect patterns (in consequence: similarities), the ability for association based on contiguity as well as the ability to mimic other's behavior are assumed. The capacity for symbolization probably should be also assumed (Swarup & Gasser 2007);

• a community of interacting agents - based on an assumption that language emerges in a community as a result of the need to cooperate in execution of some tasks;

• changing environment in which interaction takes place – non-stationary environment should force members of a community to develop (or at least change) their communication system to meet the new challenges.

The assumption that communicative competence develops gradually (to reach language-level) requires postulation of the possible stages. Jackedoff (1999: 272-273) suggestion seems to be particulary useful in the context of robotic simulations. The stages embrace: usage of symbols in a non-situation-specific fashion, usage of open set of symbols together with the ability to create new symbols as well as ability to concatenate symbols together with ability to encode semantic relations into (decode them from) linear position.

The second aim is to present (hopefully) initial results of the project, in particular results of manipulation of some basic factors involved in the process of evolution of communication, e.g. differentiation of initial cognitive abilities, differences in sensitivity to environmental factors, the size of the “social” group etc.
Tool-use, Thorax Asymmetry, and Human Handedness: A Re-evaluation of the Warfare Shield Theory
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The evolutionary background of human right-hand-preference is indefinite. Around 1870, Carlyle and Pye-Smith independently, launched the warfare-shield-theory suggesting that right-handers carrying the shield in left and weapon in right hand would experience mortal wounds less often than left-handers due to thorax’ asymmetry. However, the idea became abandoned since shields were developed long after human right-hand-preference. The hypothesis presented here is that, also without shield use, right-handers may have had a selective advantage in combat. Handedness may influence the level of exposure of the left hemi-thorax, as holding a sword in unilateral grip will determine which area of the thorax is most exposed to an enemy’s weapon; e.g. left-hand-grip exposes the left hemi-thorax more than the right side, in attack as well as defence.

CT-scans from 24 men demonstrated that the fraction of the heart situated left of the midline was larger; with a mean ratio (right:left) = 0.37 (SD=0.13). Eleven physicians without knowledge of the purpose or the hypothesis estimated outcome of a wound penetrating the trunk at a random point. Eight estimated left-side injury to cause higher mortality, three estimated equal mortality (p=0.008); the estimated mean mortality for left-side trunk injuries was 74 %, and right 66 %.

Handedness is not associated with violence in societies, and men’s prevalence of left-handedness is higher than women’s. This seems to contradict the hypothesis but might be due to frequency-dependent selection. Interactive sports shows a left-hander advantage, probably due to right-handers being unfamiliar when facing left-handers; around 10% left-handers may reflect equilibrium between their frequency-dependent advantage and deleterious effects of left-handedness (1). Winning a fight may influence fitness in various ways e.g. survival, improved rank, social status, and fecundity (1) possibly resulting in complex interactions between handedness and other heritable traits. With few left-handers their advantage in combat will increase, which may compensate their increased exposure of vital organs. Increased vulnerability in combat may be among left-handers deleterious effects, which may have contributed to the development of right-forelimb preference. To explore other lateralized behaviour in the context of heart protection, e.g. right paw preference of walrus, and anti-clock-wise turning preference of humans and cetaceans, would be of interest.

References

It has been contended by many (Bates et al. 1988; Studdert-Kennedy 1998, Wray 1998, Givón 1995, 2009) – although there is still ongoing debate on the issue (Tallerman 2005, Smith 2008) – that early sentences displayed a basically holistic structure. In any case, when complex combinatorial patterns emerged, our capacity-limited working memory had to face ever increasing processing demands, but proved inadequate to resource its full capabilities (Wray 1998). Studies from different domains (Neely 1977, Swinney 1979, Chafe 1994, Givón 2002) estimated the processing rate of a lexical word between 100 and 350 msecs, and that of an entire clause at approximately 1 second – albeit the processing of sentence structure alone seems to take between 100 and 200 msecs. (Friederici 2002). As noted by Givón (2002), this extremely fast pace may have imposed directing as much information as possible to pre-existing automatic, less-effortful processing channels, requiring fewer allocation of cognitive resources. In other words, language processing may have exploited automatic processing channels that had already arisen independently to perform other, non-linguistic tasks (Shiffrin & Schneider 1984).

In this contribution, we put forth that the entrustment of relevant amounts of information conveyed by linguistic utterances to automatic processing modalities has been possible due (among other things) to the emergence of two functional categories of Information Structure: Topic and Presupposition. In earlier and recent literature on the subject, these units are outlined as carriers of information that fall outside the sentence illocution and are marginal with respect to the fulfillment of the utterance’s communicative purpose (Cresti 2000; Lombardi Vallauri 2009), which is why they are bound to be processed less consciously by the addressee. This property of Topic and Presupposition has received experimental backing in the domains of psycholinguistic and neurolinguistic research (Lofthus 1975, Birch & Rayner 1997; Erickson & Mattson 1981; Wang et al. 2009). Capitalizing upon these findings, we propose to lay out an evolutionary account of topical and presuppositional packaging as strategies to achieve an optimal trade-off between the pressing need to transact greater amounts of information in a single utterance and the severe limitations of human working memory.

The role of Topic and Presupposition in utterances would have been (and, we believe, still is) to instruct to less controlled processing and to treat the information they convey as already familiar, and therefore not worth attending to in a more conscious and more costly manner. One of the most strikingly adaptive implications of this scenario is that communicative interactions could be speeded up and simplified in their architecture, since utterances became more capacious containers of relevant contents, at overall bearable costs for both speaker and receiver. Further consequences – paralleling exaptation mechanisms observable in other domains – are found in the practice of linguistic persuasion, since information processed with less effort proves more likely to elude critical attention and rejection (Lombardi Vallauri & Masia 2014).

References


Standing approaches to language evolution are governed by the conviction that the activity of speech (or signing) is too limited to furnish syntactic structure. To rehearse (e.g. Boeckx, 2010): words are spoken one at a time and so through speech could only be organised sequentially, but sequencing cannot provide the rich, hierarchical organisation characteristic of syntax. Consequently syntactic structure is hypothesised as issuing from elsewhere, in cognitive/neurological processes evolved within individuals, and the syntactic patterning of speech is regarded as a mere "code" for such underlying sources. However the conviction is false. Humans are adept at organising their activity. There is another, more fertile, way to organise words through speech: we r

Differential Composition - How to Grow a Language

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A vocabulary is a network of differences: the identity of a word rests upon its difference from others, phonetically and semantically (Saussure, 1983/1916). And, since phonetic patterning of words is arbitrary, word differentiation must be publically agreed. At some, protolinguistic, stage humans put pairs of words together (Bickerton 1990, 1995, etc.) and then, we propose, began organising pairs by differentiating, or contrasting, the places their words occupied; e.g. by their precedence, or tone, or affixing. (There are many such contrastive techniques, essentially phonetic.) I.e. they constructed differentiated, or "ordered" (math), pairs, the initial step of Δ (cf. Luuk & Luuk, 2014), and simple to conduct. It provided semantic advantage: ordered pairs of words, ⟨A, B⟩, define an antisymmetric syntactic relation, in virtue of which any one, ⟨a, b⟩, can express a semantic relation between the denotations of a and b; i.e. express sense. That is more than can be done by mere combination.

The prospect then opens of different contrastive techniques being used to express different relations. But how to distinguish one technique from another? For they are arbitrary, and though materially different their function is to exert a contrast, in which regard they are equivalent (interchangeable). The solution is to re-engage Δ, by contrasting contrasts in their turn. This requires construction of pairs which exemplify three syntactic patterns, in which the contrasts are overlaid but distributed differently relative to each other (extending Kuratowski, 1925). Thus Δ recursion is multiplicative. Algebraically, the organisation of such a differential network, wherein each syntactic pattern differs from every other, is unique, necessary and complete. It has many alternative varieties depending on the techniques employed. Further recursions require increasingly many longer and more complex patterns, containing densely nested contrasts, and the network expands and metamorphises. Just one contrast, common to all, is transitive and becomes
linear. Again, such construction must be public; arbitrary selections can only be resolved by speakers agreeing in their practice; cf. Wittgenstein (1953), Tallerman (2014).

The interest of such a socially orchestrated, evolving, differential network is that it gradually stabilises, in fractal style, and its patterns become familiar as those of a natural language. They contain hierarchically organised contrasts (Merge and LCA are derivable) and include declarative/imperative; categories N, V and attendant P, A; functional furniture of auxiliaries, deixis; etc. (Long, in preparation). And semantically they are very powerful. This suggests that hypothesising sources for syntactic patterning elsewhere, within each individual, is idle, though of course brains are required to enable, sustain and retrieve such complex activity.

References


What Language Is for: A View from Cognition

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Most thinking about the function of language has centered on its role in communication and transmission of information. On this view, language is often seen as a medium through which pre-existing thoughts are transferred between individuals. I will present an alternative account on which language plays a critical role in cognition. Although the original functions of language may be unknowable, understanding the role language plays in human cognition can help us make educated guesses about its role in creating the modern human mind.

I will discuss three ways in which language augments human cognition, supported by empirical findings from cognitive psychology and neuroscience:

1. Categorization: The ability to form categories is foundational to cognition. Words appear to impose categories and not merely reflect pre-existing categories (e.g., Lupyan, Rakison, & McClelland, 2007; Lupyan, 2009)

2. Perception: The effects of language, e.g., naming an object, appear to penetrate even low-level perception. Language changes what we see (e.g., Lupyan & Ward, 2013)

3. Memory: Language provides a unique set of ‘portable retrieval cues’ allowing for bringing previously learned information to bear on the current task in a much more flexible and productive way (e.g., Lupyan, 2008). An especially provocative possibility is that it is language that makes autobiographical memory possible (Fivush & Nelson, 2004). These finding can be integrated into a general theory of language-augmented thought (Lupyan, 2012). Rather than “mapping” onto concepts, words are cues that directly modulate sensorimotor representations, helping to transform them into a task-relevant form. Within a hierarchical predictive-processing model of the mind, words and larger constructions play the role of high-level hypotheses (Lupyan & Clark, in press).

I will conclude by suggesting that the cognitive functions of language listed above can be fulfilled by a language with fairly minimal grammar. To the question of why modern languages are so much more complex than they ‘need’ to be,
I will suggest that much of this complexity may actually be illusory, a consequence of attempting to think about language in terms of words and rules.

References


Imitative Iconic Embryo-stage in Human Proto-language: From Environmental Sounds to Early Phonemes

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A strong bias affects the understanding of the origin of human oral language: 'arbitrariness'. Indeed, the rise of human speech implies an early 'embryo-stage', existing long before any proto-language could have come into existence, and demands tracing back meaningful sounds/noises in the environment and daily life of prehistoric Homo Sapiens. Like the evolution of 'writing' from pictograms to alphabetic forms, the history of human language can be rewound back to its imitative-iconic start. The original keys to the understanding of both communication systems seem lost; however, while the history of writing can be reconstructed from surviving signs, printed onto suitable surfaces of different types and materials, oral language lacks ancient fossils and documents testifying early events. A parallel abstraction process exists in the history of 'money' from barter to current e-money, as to its features and materials. Similarly, a 'loss of memory' affects onomastic and toponomastic systems of modern languages, where names, surnames, toponyms may lose their true etymologies and show no link between names and related items. German 'Wagner' and Italian 'Ferrari' can be examples of such family names. Glottochronology, lexicostatistics, genetics, probabilistic models of sound change for automated reconstruction of ancient proto-languages, are capable to reach deep time limits (up to 10,000 years) but it seems they cannot extend further beyond.

The blamed 'multilateral comparison' system is able to identify vocabulary units from a supposed human proto-language: a valid set, except for the fact that a revision of 'global etymologies' is currently needed, as it will be shown. However, the next step along the process of deep historical reconstruction can be a simple one: it implies analysing environmental sounds, caused by atmospheric phenomena, animal calls, human activities, accidental noises. Basic sounds, which refer to fundamental human needs - hunting, water/food gathering, cooking, protection against environmental risks and predators - are currently being reviewed, Tool manufacturing, skin working and other technical operations are also taken into account. Interestingly, words indicating social interactions among different human groups, like peace agreement or 'pact', and similarly names of musical instruments, all show parallel deep relationships between real tools/actions and related sounds/noises. It is also widely accepted that 'zoonyms' are iconic
and derive basically from animal calls. The 'acoustic etymologies' of terms, such as 'water', 'cook', 'fish', can recall the imitative start of oral language and therefore explain its first evolutionary steps.

References


The Construction of Abstract Idea of Time by Native Punjabi Speakers

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For a long time, philosophers, linguists, anthropologists and psychologists have been trying to find out a relation between language and thought, and how language can influence the way we perceive the world around us. The idea of diversity in human thinking and its association with language is linked with the works of Edward Sapir and Benjamin Lee Whorf in 1930s. Even though their ideas were highly appealing, ironically, there was an extreme lack of scientific evidence to support these views. The Sapir-Whorf Hypothesis (linguistic relativity) has two fundamental beliefs: (i) languages are relative; (ii) linguistic expression of concepts has some degree of influence over conceptualisation in cognitive domains, which need not necessarily be linguistically mediated. In 1970s many scholars were disillusioned with linguistic relativity, and they almost abandoned working on these questions. However, in recent decades, a considerable amount of scientific studies and empirical research has shown how language is shaping thinking (thought). These scientific findings have overturned the established doctrine about universality and offer fascinating insights into the origin of knowledge and the construction of reality. The empirical studies have found cross linguistic differences in the representation and conceptualisation of time and space, cardinal direction and temporal progression. The difference in talk has led to have difference in thought. Do we human think, feel, and experience the world around us in a similar or different way? Language may help us to answer these fundamental questions of humanity. Several studies for example, Boroditsky, 2011; Athanaspoulos, 2008; Everett and Caleb, 2013…etc, have shown that the world we see around us, is influenced by the language we speak. This may lead us to assume that speakers of different languages may think, feel, and experience, the same event and object in a different way. These studies help us to answer the fundamental questions of universality in thinking patterns of human mind (in cognitive science). The construction of the abstract idea of time is prevalent in the world languages. However in present study the conceptualisation of the idea of time by native Punjabi speakers, is investigated. The data was collected from 168 mixed gender adult native Punjabi speakers from adjacent area of Punjab, Pakistan, by using a special methodology adopted from that of Boroditsky, (2011). The results revealed that the native Punjabi speakers, construct the abstract idea of time by employing the metaphor of front and back, therefore, they conceptualise past in the back and future towards the front. This study argues that in the construction of reality and knowledge, language plays a very important role.

References


Laryngeal Vocalization in Communication, Development, and Evolution
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A ‘grunt’ is considered a primitive vocalization, typical of nonhuman primates, and hardly of significance in relation to ‘real language’. In fact, the typical grunt vocalization, found so annoying by some tennis competitors when emitted by their opponents, is the epiphenomenon of a critical biological function. Under biological stress, the larynx reflexively locks and the intercostal muscles engage, creating pressure in the lungs that enhances oxygen exchange. Breathing rhythms break the cycle, and with a grunt (audible in larger mammals; ultrasonic in rats) normal breathing returns. This has been shown in rat pups exposed to the cold, human infants with hyaline membrane disease, and horses when galloping and is likely a universal biological phenomenon across mammals.

Nonhuman primates, including gorillas, chimpanzees, bonobos, and vervet monkeys, among others communicate primarily by grunts. Systematic acoustic variation in production allows laryngeal vocalizations to serve varied functions, including movement regulation (all species) and signaling regarding food (chimpanzees). Chimpanzee and vervet infants demonstrate learning processes in acquisition of the form and functions of the grunt vocalization. In human adults, laryngeal vocalizations have long been known to serve as back channel responses (e.g., uhuh, mm), produced by the listener indicating understanding and encouragement to continue speaking. Laryngeally-based ‘Huh’ occurs across languages and is proposed as a universal word signaling a need for clarification.

Recent research demonstrates that laryngeal control forms the basis for upper tract articulation and the development of upper tract vocal motor control in infants learning four different languages, with laryngeal action responsible for numerous sources of variation that account for a wide range of auditory qualities.

A developmental sequence for the grunt vocalization indicates that infants’ initial autonomic occurrences are followed by laryngeal vocalizations signaling attention to environmental events, and finally, specific communication with their mothers. This suggests an endogenous learning process where association with effort (a natural response) leads to voluntary production under conditions of consciousness of meaning and the desire to communicate. Only at the onset of grunt communication did the infants studied begin rapidly developing lexical comprehension and/or production.

Evolutionary attention has not emphasized the potential of laryngeal vocalization as a contribution to the evolution of language, yet comparative and developmental research argues that patterns of use shown in present-day species may have significance for laryngeal vocalization in pre-human species as a foundation for vocal language.

References


Musical Emotions at the Intersection between Philosophy and Psychology
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The debate on the purported evolutionary origin of our love for music typically revolves around two possible functions: (1) group cohesion/promotion of cooperation; (2) strengthening infant-caregiver attachment bounds. These hypotheses do not focus on the same musical dimensions: while (1) focuses mainly on temporal/rhythmic aspects (e.g., Kirschner and Tomasello, 2009), (2) is more committed to the melodic dimension. As I am particularly interested in the role of melody for communication and emotional exchange, I will pursue the infant research direction. According to many developmental psychologists, protocommunication has a musical nature. In describing the vital forms exchanged by an infant and her caregiver, Stern (2010) employs musical attributes such as crescendo, diminuendo etc, while Malloch and Trevarthen (2009) characterize protocommunication “Communicative Musicality”. In both cases, the authors stress the emotional nature of this quasi-musical activity, which strengthens interpersonal bounds and promotes the creation of an ideal environment to exchange meanings. Undoubtedly, rhythm takes part in those processes, but the prosody/melody of verbal and gestural communication seems to be prior.

On this background, I suggest that philosophical research can provide some interesting contributions to our understanding of musical emotions. According to the well-known contour theory (Kivy, 1980; Davies, 1994), we evolved a modular mechanism that forces us to perceive emotions vocally and gesturally expressed in the temporal development of sound, and specifically in the melodic line. At the same time, Kivy (1980) denied that music can induce any emotional experiences in listeners. While Kivy recently abandoned the contour theory, taking its evolutionary foundations to be empirically dubious, other authors (e.g., Davies) worked it out, stressing not only that we perceive emotions in music, but also that perceived emotions trigger emotional experience, primarily by contagion.

As regards to Kivy, today he himself recognizes that music has an emotional impact, but takes emotional experience as strictly related to aesthetic quality: what sadden us is not sad music, but ugly music. We have thus three different positions:
- Emotional recognition without experience
- Emotional experience, mainly by contagion
- Emotional aesthetic experience.

As I alluded above, this philosophical debate not only is interesting for musicologists, but could also shed light on some important aspects of the psychological research. Given the musical nature of protocommunication, an analysis of the relationship between musical contour and emotions will help clarify the nature of precocious interpersonal relations, which in turn are crucial to scaffold development in many (meta)cognitive domains. Not least important, that same analysis should lead us to rethink on well grounded epistemological bases the possibility of a new scientific music therapy able to handle with communicative and emotional disorders.

References

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Most researchers dealing with evolutionary linguistics agree that it is undesirable to fall into the fallacy of a single origin, which means that models relying on one single „purpose” of language should be avoided. According to evolutionary theory there must have been several different types of pressure leading to the emergence of such a complex system that now we refer to as human language, and our models should at least try to take into account more than one of these possible factors. From a social-cognitive perspective, we believe that the most important factor leading to the evolution of speech was that humans are social animals. According to the gossip theory, the growth of group size was the pressure that lead to the emergence of language (Dunbar, 2004). However, this hypothesis relies solely on solidarity between group members, but seems to ignore the importance of hierarchy in the social structure. All social animals, including humans live in somewhat hierarchically structured groups. The more complex an animal is, the more likely they are to challenge authority within their group. Studies regarding animal behavior prove that due to the relative complexity of their social structure, apes have high social intelligence, often regarded as the Macchiavellian mind (Humphrey, 1976). Psychological experiments also claim that humans either tend to challenge authority or surrender to it, however, these mechanisms heavily rely on linguistic terms (Aronson, 2007). The study argues that along with solidarity and cooperation, verbal aggression, manipulation, and debates also play an important role in reducing the actual physical aggression between the group members, thus helping to relieve stress and solve conflicts. This could be traced in several different ways using tools and theories from rhetorics, pragmatics and even media related studies, fields that usually do not take part in evolutionary linguistics, even though they prove that a remarkable amount of our use of language is aimed to establish or maintain social structure. The research aims to prove that language replaced different types of social behavior along with grooming and plays a role in not only sexual selection but the establishment of social construct as well, thus helping to decrease the level of aggression. It also claims that these properties played an important role in the emergence of complexity in language, acting as a pressure in the co-evolution of language and human societies.

References


Not a Monolith: an Evolutionary Odyssey from Ape Vocalizations to Human Music
Alessandro Miani

Music is a universal species-specific activity among humans (Sloboda, 1985). However, many communicative convergent behaviors have been also traced in nonhuman animals: e.g., social learning (Tomasello, 2014b), critical period (Marler, 1999), babbling stage (Doupe & Kuhl, 1999), and dialects (Payne, 2000). Advances in genetics show that such a deep homology is due to the convergent evolution of the FOXP2 gene (Fitch & Jarvis, 2013), which controls brain and lungs development and assures the ability to learn non-innate vocalizations (Vargha-Khadem et al., 2005). Neuroanatomical studies have demonstrated that this ability relies on a specific loop between motor and
auditory areas connected by basal ganglia (Patel, 2006), an important structure for sequential movements (Doupe & Kuhl, 1999) and for processing temporal patterns (Grahn, 2012). Yet, genetics alone does not suffice for a comprehensive explanation of such a stunning human-unique phenomenon and thus, a plausible candidate for bootstrapping music is the so-called intentional communication, which allows agents to understand gestures and vocalizations as communicative acts (Tomasello, 2008).

Adopting a multicomponent perspective (Honing et al., 2015), the aim here is to provide an evolutionary account for the emergence of psychological and (functional) neuroanatomical prerequisites required for the emergence of music in human lineage. In particular, it is claimed that, driven by ecological factors, a change in intentionality (individual, joint, and collective; see Tomasello, 2014a) allowed for progression from ape to modern-human cognition, paralleled by the shift from apes' indexes of emotions to modern-human's symbolized iconic indexes of emotions (i.e. music; see Miani, 2014): (i) music originated from ape vocalizations as an unintentional expression to an emotional state performed by individual-intentionality agents; (ii) joint-intentionality allowed for early humans to escape from a mechanistic and unintentional reaction to an emotional state and gave them the ability to imitate an expression of emotions out from the here and now, which can be understood due to the recursive mindreading and the time-travelling memory; (iii) in big groups, collective-intentionality occurred when modern humans conventionalized such holistic vocalizations through musical instrument's discretization in order to musically cooperate, and transmit the musical heritage. Thus, musical communication recursively works in a way that “I want you to know I am pantomiming (so, I want you to know) a conventionalized expression of emotion”.

This evolutionary hypothesis takes into account that music is not a monolithic entity (Honing et al., 2015), but a technology made up from different cognitive domains relying on a specific anatomical and genetic infrastructure. It can be also explained the apparent paradoxical evidence of music and language dissociations (from neuropsychology) and processing overlaps (from neuroimaging) (Patel, 2003), resonating with the neuronal recycling hypothesis (Dehaene & Cohen, 2007).

References

Expressive Sounds: Gesture, Interjection and Onomatopoeia in E. B. Tylor’s Theory of the Origin and Development of Language

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The origin and evolution of human language is probably one of the most discussed topics of the last 50 decades. Once abandoned purely syntactic theories, modern researchers are now exploring the concept of language as a cognitive tool, supporting the idea of the preeminence of expressive functions in protolanguage. Curiously the same issue has been addressed by Victorian scholars after the formulation of Darwin’s theory of evolution.

In my talk I will focus on Edward Burnett Tylor's theory of the origin and development of language, expressed in his *Researches into the Early History of Mankind* (1865), in *Primitive Culture* (1871) and in *Anthropology* (1881). In the former — influenced by Darwin and Max Mueller — he argued that the difference between Man and lower animals lies in linguistic abilities and tried to explain the rise of human language from what he labelled “Gesture-Language”. This brought him into the discussion of the relation between objects and names, which led him to the conclusion that primitive minds cannot separate “objects” from “ideas”, a conception which would constitute the backbone of his most renowned theory, i.e. primitive animism.

Tylor’s theory of “Gesture-Language” as the missing link between animal and human communication was in sharp contrast with Mueller’s idea of language as the “Rubicon” between Man and Animal. Such contrast would be analyzed in *Primitive Culture* and in *Anthropology*, in which Tylor explicitly discussed the origin of language in relation to interjectional and imitative theories.

At the core of the dispute between the two scholars lie their different epistemologies: while Mueller’s theory reflected the Romantic idea of the inseparability of thought from language, Tylor intended linguistic abilities as some mental faculties among the others, reducible as such to “physical sense impressions”.

The rehabilitation of what Mueller had ridiculized as the “bow-wow” and “pooh-pooh” theories was necessary to Tylor in order to explain the rise of human mental abilities as a result of evolution.

References


The Emergence of Systematic Structure in Artificial Gestural Communication Systems

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Language exhibits systematic structure; signals are not independent of each other but form part of a system. Previous work has shown that emergence of such structure aids the learnability of a system, and that the pressures of transmission drive this emergence (Kirby et al., 2008, Cornish et al., 2013). Additionally, a link has been posited between systematic structure and the arbitrariness of a system's signals; that is, as signs become more arbitrary, the systematic re-use of signs increases, further aiding learnability (Theisen et al., 2010; Theisen-White et al., 2011).

We present a study that examines how systematic structure emerges in gestural systems, from pantomime to more language-like gestures. Using the Silent Gesture paradigm (Goldin-Meadow et al., 2008), in which hearing participants communicate using only manual gesture, allows us to study how linguistic communication evolves in a modality that is used non-linguistically by participants. Furthermore, it offers the tools to assess how modality-specific strategies may be used to scaffold the development of systematicity.

We trained initial participants on pantomimic gestures performed by individuals, and then asked pairs of participants to communicate the same concepts using only manual gesture. Their gestural output was then transmitted to another pair of participants as training, through the process of Iterated Learning (Kirby et al., 2008), and this process was continued for five cohorts of participants in each transmission chain. The meaning space was designed to assess how participants gesture concepts with similar meanings but different grammatical functions. We use a combination of gesture coding and direct video analysis to posit that the sets of gestures participants produce become more systematic as they are transmitted. By using a measure of pixel intensity, we examine the difference in the range of movement used in a gesture, and we suggest that the range of movement used by participants reduces as these systems are transmitted. We also present data displaying a gradual increase in the use of explicit markers to distinguish between items in the meaning space, markers which are reused across meanings which share features. The reduction in form as well as the re-use of markers across categories suggests a move away from iconic pantomime, so that forms across the signal space become systematically more similar. Our results indicate that signals for particular meanings are no longer independent of each other but function as part of a system, and further corroborate the link between systematicity and arbitrariness.

References


Hands, Tools and Signs: The Features of the Relationship between Manipulation and Representation in Sign Languages

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The aim of this work is to offer an integration between some of the fundamental issues of the debate concerning cognition, language, action and the specific studies dedicated to sign languages. Over the years interdisciplinary research has highlighted the continuity between action and thought, focusing on: i) the role of the sensory-motor
system in conceptualization and language (Gallese & Lakoff 2005); ii) the phylogenetic relationship between the human language faculty and other operative and practical abilities (Rizzolatti & Arbib 1998, Tomasello 2008, Adornetti 2014); iii) the ontogenetic connections between action, gestures and language (Capirci et al. 2005). This theoretical frame may find interesting links with some features of sign languages, seen as linguistic systems that connect in codified ways representation and manipulation; i.e. manual operations performed by the subject in his practical interaction with reality. In particular, I will examine the continuity between some phonemorphological components of signs and actions made by the hand, bringing into focus: i) the modalities by which action verbs are represented within these languages (Panunzi, De Felice, Gregori, Jacoviello, Monachini, Moneglia, Quochi, & Russo 2014); ii) the features of handling handshapes, by means objects are denoted through the handshapes needed to manipulate them (Taub 2001, Benedicto & Brentari 2004). These aspects are useful to highlight to what extent the only other language modality developed by human beings in addition to the acoustic-vocal one grounds its representative capacity on action.

References


Language in Action.

Holophrases as Verbal Motor Gestures in Holistic Protolanguage

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The present work is focused on the debate relating to the analysis of protolanguage’s nature under an evolutionary perspective. In particular, the main assumption of our proposal is based on the idea that the transition from communication to language has to be explained with regard to those cognitive systems that make possible for an organism to act in his own environment. What we want to suggest is that the holistic protolanguage has to be considered as a limited inventory of non-propositional speech and routinized motor gestures (Van-LanckerSidtis 2012), each representing a complex communicative goal-oriented behaviour.

The lively debate about the nature of early forms of language is intimately related to the semantic complexity of the protolinguistic units – namely compositional view (e.g. Bickerton 1990) VS holistic account (e.g. Wray 1998). In line with complex-first view, our idea is that the holistic structure of language predates its parts, and our purpose is to demonstrate that such protolinguistic form arose from a previous stage characterized by the conventionalization of pantomime and gestures. In considering formulaicity as a legacy of the ancestral holistic protolinguistic ability, the
first step of our study will be represented by the description of the functions and the properties of formulaic language in conversational interactions, so as to highlight its role in pragmatic tasks and in communication effectiveness (e.g. Gibbs, 2007; Kecskes 2014). Clinical data derived from studies of productive language in Alzheimer’s disease (e.g. Van-Lancker-Sidtis 2012) demonstrate that the production of formulaic expressions involves significantly the activity of both the right hemisphere-subcortical prefrontal circuitry and the basal ganglia structures. Particularly interesting in our framework is the fact that these same cognitive systems are significantly implicated in action-oriented behaviors. Finally, Parkinson’s disease - a pathology that precisely involves dysfunctional basal ganglia - represents the test-bed of our holistic communicative protolanguage hypothesis. Clinical data (e.g. Bridges et al., 2013) precisely demonstrate that the holophrastic linguistic structures are holistically produced, each as a complete gesture, benefiting from the motor organization and from the processes of the basal ganglia.

References


Environmental Affordances Shape Linguistic Coordination in the Maze Game

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Language plays a predominant role in social interactions where communities of agents face collective problems (Tylén et al. 2010). It has thus been argued that linguistic meaning is grounded in concrete usage situations and continuously evolves as it is coordinated between agents (Steels 2008). It has been repeatedly observed how shared task-specific linguistic strategies emerge and stabilize in experimental contexts, where agents have to solve joint coordinative tasks (Garrod and Doherty 1994). In such usage situations, the task environment provides agents with a set of affordances that call for different types of actions (Gibson 2013). From this follows the prediction that different communicative strategies will evolve adaptively in response to varying environmental affordances. This hypothesis is addressed in an experiment extending Garrod and Anderson’s (1987) “maze game” paradigm: Communicating through a chat interface, participants had to guide each other through maze-like structures. In three different conditions these varied in terms of their environmental layout, affording different linguistic strategies. Results indicate that dominant strategies from previous experiments only prevailed in the regular condition, where square-like mazes were used. The stratified and irregular conditions featured mazes with salient horizontal displacements and resemblance to figural objects, respectively. Here, emerging linguistic conventions relying on these salient ecological aspects turned out to be significantly stronger attractors and much more stable over time. In other words, different environmental affordances motivate different linguistic practices in otherwise identical tasks. This suggests that linguistic interactions and routines are not only the result of automatic priming mechanisms as suggested in the Interactive Alignment Model (Pickering & Garrod 2004). Rather, linguistic adaptations between interlocutors are highly sensitive to factors of the shared task environment. This observations has implications for research in the cultural evolution of language. If cultural conventions arise not merely due to socially interacting populations with the necessary brains, but are also in selective response to environmental affordances, an ecological force should be considered to underlie the evolution of language besides social, biological and cultural processes that have been described (cf. Steels 2011). Increasing evidence from diverse
contexts (Everett, Blasi & Roberts 2015; Lindsey & Brown 2002; Majid et al 2004) points to the persuasive role of environmental factors in shaping culturally specific linguistic practices. Our experimental study provides a systematic way to test hypotheses to assess ecological factors of this kind to inform studies of language and cultural evolution.

References


Self-regulators: A Hidden Dimension of Conversational Cooperation?

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Cooperative communication (defined as “sharing honest information with nonkin”) is often considered a "central puzzle" in language evolution. In linguistics, the cooperative nature of conversation has traditionally been taken for granted, but recently more research has addressed the origins and foundations of this cooperativeness. Particularly interesting is the idea that ‘Gricean’ (verbal and relatively higher-level) cooperation may be grounded in and dependent on nonverbal and relatively lower-level mechanisms, such as coordination by postural alignment or regulatory gestures. In our research, we aim to target the basic, minimal mechanisms of cooperative structuring, focusing on what we call self-regulatory movements: self-touches, posture shifts and object manipulations.

We present the results of a study of ten conversations in dyads in the form of a casual semi-scripted interview between the Host and the Guest. The conversations were videorecorded and annotated with the ELAN software for the presence of self-regulators. Based on our pilot studies and literature on the related phenomenon of mimicry, we expected to find resonance: a tendency of Participants to produce a self-regulator following (“in response to”) a self-regulator by their interlocutor. In other words, we hypothesised that in the time slots immediately following self-regulatory actions by the other conversant, the frequency of self-regulators would increase. A paired-samples t test revealed no such effect (p > 0.05) in our material. However, we observed a significant correlation (r=0.642) between the total number of self-regulatory sequences in the Host and the Guest across the conversations.

In a follow up-study, we investigated the perception of the videorecorded fragments in which self-regulatory movements were performed by the conversants in close temporal proximity (i.e. in a 4-second time window). The fragments were shown to 50 naïve observers, who were asked to categorise the self-regulator sequences as causally
related ("action – response") or unrelated. Complemented with a qualitative analysis of self-regulator types, the results of the study were used to determine which configurations of self-regulators are perceptually salient and how these perceptions may account for the dynamics of conversational interaction. In a further post-study analysis, we looked at the relation between the distribution of self-regulatory movements and the turn-taking organization of the dialogues. We discuss these results in the context of the evolutionary approach to language, pointing to the role that resonance of self-regulatory movements may have played in the setting up, development and stabilisation of cooperative communication.

**Semiotic Exaptations in the Homo Genus: The Unique Morphology of the Human Eye**

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The idea I will develop on this talk builds heavily on the embodied mind thesis from an evolutionary perspective. Even though this notion is widely held in conceptual investigations in the cognitive sciences (Lakoff & Johnson, 2008; Zwaan, 2004), less have been the experimental studies that have tried to test it, and their preoccupation was mostly with how our bodily features have an influence on cognitive processes that, in turn, subserve linguistic production in a variety of constrained circumstances (Boroditsky, 2006; Casasanto, 2009; Richardson & Matlock, 2007). My project is intended to focus on more straightforward aspects of this body-mind relationship. In particular, I will be preoccupied with adaptations that a) set us apart from all other primates, and b) play a major role in human communication in virtue of their formal properties. In the following I will describe the rationale behind a project that intends to explore in depth one such adaptation - the unique morphology of the human eye (Kobayashi & Kohshima, 2001a; 2001b). More concretely, I will focus on the implications that this adaptation has in shaping the communicative abilities of humans (Tomasello, 2007), and the possibility that this unique trend in our genus offers to shed light on the issue of the evolution of language.

I will do this by elaborating on the results of an experiment in experimental semiotics that I designed as part of my MA thesis. My experiment is designed to further our understanding of how linguistic and ocular signals intertwine in face-to-face encounters. I will also comment on an ongoing trend of interdisciplinary studies (cf. Mendizábal & Ferreras, but also Dediu & Levinson, 2013) approaches to the study of the evolution of language, which I intend to ultimately integrate with the data derived from my own approach.

**References**


The Vocal Iconicity Challenge!
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De Saussure's principle of the arbitrariness of the sign has dominated modern linguistics and theories of language evolution. Indeed, many prominent theories of language evolution build on the assumption that, outside of marginal cases of onomatopoeia, spoken languages bear only trivial potential for iconicity, defined as a sense of resemblance between form and meaning (e.g. Arbib 2005, Tomasello 2008; but see Vigliocco, et al. 2014 and much more). In contrast, gestures lend themselves naturally to iconicity, which can serve to ground the formation of conventional symbols, as in signed languages. Consequently it is argued that gestures were necessary to bootstrap the formation of the first spoken languages. Yet is it true that vocalizations lack the potential for iconicity? How did ancient hominins create the first spoken words? We report the results of a contest—The Vocal Iconicity Challenge—designed to shed light on these questions by examining people's ability to generate novel vocalizations that can be correctly interpreted by naïve listeners (see http://sapur.psych.wisc.edu/vocal-iconicity-challenge/). The team whose vocalizations are guessed most accurately will be crowned Vocal Iconicity Champion! and awarded the $1000 Saussure Prize. We are soliciting submissions until July 15. The winner will be officially announced at Protolang 4.

Contestants are tasked with devising a system of vocalizations for a set of “Paleolithic-relevant” meanings. The meanings include three semantic classes: 8 actions (e.g., eat, cook, sleep), 12 animate and inanimate things (woman, tiger, rock, knife), and 10 properties (good, big, this). Contestants submit one vocalization per meaning, not longer than 2 seconds. Submitting words or any other sort of conventional sounds is prohibited. Contestants also provide us with the rationale used in creating each sound. Vocalizations are tested with naïve listeners on Amazon Mechanical Turk in two phases. In the first phase, listeners must select the meaning from a set of within-semantic class alternatives (e.g. actions only). In the second phase, listeners must select the meaning from a set of between-semantic class alternatives (i.e. from among actions, things and properties).

Our analysis evaluates the degree of success that is attained for the individual items and each semantic class. We analyze the qualitative strategies used (e.g. metonymy, cross-modal mappings), as well as the acoustic properties of the vocalizations (e.g. duration, pitch, intensity, harmonicity) and the relationship between properties of the vocalization and its interpretability. Our ultimate goal is to understand the human capacity to create meaningful vocal symbols from scratch.

Iconicity in Spoken Languages and Its Relation to Age of Acquisition and Lexical Class
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Iconicity, or a sense of correspondence between form and meaning, pervades the lexicons of signed languages, and is also prevalent in ideophones across many spoken languages, particularly those of non-Indo-European descent (Perniss & Vigliocco, 2014). Insofar as words (and signs) with forms that somehow depict their referents are easier to learn, iconicity may exist because it helps word learning (Imai and Kita, 2014). Here we show evidence that English and Spanish—Indo-European languages often assumed to lack iconicity except onomatopoeia—actually exhibit iconicity that is distributed across their early-learned lexicons according to age of acquisition and lexical class. These results hint that iconicity may be a universal property of spoken languages and, critically, that it has consequences for language learning.

In five experiments we asked participants to rate the sound/meaning correspondence of 500 words from the MacArthur-Bates Communicative Developmental Inventory (Fenson et al., 1994). In Experiments 1-2 native English
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speakers rated words (written or spoken) for their degree of iconicity, and in Experiment 3, they rated how accurately a space alien could guess each word’s meaning from its sound. In Experiments 4-5, native Spanish speakers rated the iconicity of words from the Spanish MCDI.

In each experiment, we found a negative relationship between iconicity ratings and age of acquisition: words learned earlier tended to be more iconic. This relationship held after accounting for several other factors including frequency, concreteness, and systematicity (or “relative iconicity”, see Monaghan et al., 2014), and also after removing sound effect words (e.g., quack). Additionally, fitting with semantic patterns of ideophones (Dingemanse, 2012), iconicity ratings varied between words from different lexical classes. In both languages, adjectives were judged more iconic than nouns and function words. However, English and Spanish differ typologically in how they express manner of motion (Talmy, 1985): compared to English, Spanish tends not to express manner information in the semantics of its verbs. Correspondingly, English verbs were rated as highly iconic (comparable to adjectives), and Spanish verbs were not (comparable to nouns).

These results show that more iconic words are learned earlier than less iconic words. Moreover, word classes like adjectives (and, in English, verbs) that index sensorimotor information appear to be most iconic, suggesting iconicity grounds language in our sensorimotor system, and helps learners connect word forms with their meanings. We conclude that the evolution and historical development of languages strikes a dynamic balance between iconicity and arbitrariness. central within current approaches to language evolution.


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The Darwinian perspective has gained a leading role in contemporary debates concerning the first origin of language since at least the major work by Pinker and Bloom (1990). Continuism among species, involving mental faculties and communication skills, has become a preeminent field of study throughout the last decades.

In my paper I will try to give an historical perspective to this trend by analysing the theory of the evolutionary biologist and psychologist George J. Romanes (1848-1894) in the post-Darwinian debate on the origin of language and the evolution of the human mind. In his Mental Evolution in Man (1888), Romanes aimed to blend Darwinian continuism among species with the ultimate results of comparative philology: language was considered the pivot to understand the development of self-consciousness, which belongs to humans only, but which nevertheless shares its very first origin with the mental faculties of the so-called “lower animals”.

Moving from Locke’s classification of ideas, Romanes isolated three distinct kinds of cognitive objects: percepts, recepts, and concepts – the latter belonging only to humans. In order to attain the ideation of concepts, man should have reached what Romanes termed the denominative stage of sign-making, which followed the indicative, denotative, and connotative stages – these ones easily attainable by the most intelligent non-human animals. He reserved a particular attention to the topics of gesture, tone, and imitation, as semiotic counterparts of the first stages of human mental faculties. The uniquely human denominative sign is then defined as “a connotative sign consciously bestowed as such, or with a full conceptual appreciation of its office and purpose as a name” (Romanes 1888: 162).

Philology provided the utmost means to retrace the steps of this development. Drawing from the past debate on the origin of language, Romanes recalled Max Müller’s belief that the first roots of language originally expressed some already existent general idea, which he supposed to be inherent to primeval human beings. By considering his series of 121 alleged primitive concepts, Romanes argued that they could not correspond to the actual first elements of speech, for they scarcely reached the conceptual stage, being more adherent to a receptual and pre-conceptual phase. With his work, Romanes intended to overturn the classical 19th-century statement that saw language as the “Rubicon” between humans and brutes (Müller 1861: 340). On the contrary, and in a way very similar to later theories, he tried to show that the theory of evolution by means of natural selection is completely compatible with the emergence of human language.
Since Darwin's time several debates on the origin of human language and symbolic mind have been mainly focused on the opposition between a “continuist” versus “discontinuist” perspective. We aim to show that the debate seems now old-fashioned.

As examples of a current “discontinuist” approach, we briefly summarize the point of view of Hauser et al. 2014, who consider human language as a sudden and still mysterious emergence; on the “continuist” side, we recall the position of Pinker and Bloom, who argue that human language is a direct adaptation gradually evolved by natural selection for communicative functions.

The first goal of the presentation is to briefly highlight the similarities between these current approaches towards the problem of language, and the leading views on the same issue held at Darwin’s time. On the one hand, we recall Darwin’s “continuist” approach, according to which the human and animal mental powers are different only in degree and not in kind, being the products of a gradual evolution. On the other hand, we mention the “discontinuist” views held by A.R.Wallace and Max Müller, who considered the articulate language as the “Rubicon” which no evolutionary process will ever be able to cross.

In the final part of the talk we aim at sketching an alternative solution to the problem based on the key concepts of "exaptation" and "mosaic evolution". According to such concepts, the evolution of human language should be understood as a mosaic of traits, each one being evolved for other functions (or for no function) and later co-opted for its current functions. Considering human language as a mosaic of traits evolving with different ways and pace (gradual and punctuated), may pave a promising way to go beyond the dichotomy between continuism and discontinuism.

References

Gestures and vocalizations are integral parts of children’s earliest communicative repertoires and are used as communicative strategies before children produce their first spoken words at the age of nine to twelve months. Their usage is temporally related with other socio-cognitive domains outside of communication such as tool use and joint attentional behaviours. This pre-linguistic time window has therefore been identified as an important milestone of human communicative development, representing the first step into the collective enterprise of human language and cognition. Consequently, communicative skills have also been studied in great detail in nonhuman primates as a possible window onto the factors triggering the evolution and development of language and cognition. Surprisingly however, although several studies on human infants have stressed the power of early developmental experiences in shaping social communication and cognitive abilities, the development of communicative skills and the impact of social experience is relatively little understood in our closest living relatives. The present paper thus aims to highlight the need for integrated developmental research in Comparative Psychology by providing an overview of the state of the art in light of contemporary theories of social communication and cognition, current limitations, research biases and criticisms.

References


Protolanguage and the Dynamics of Meaning Construal in Interaction

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Investigating the dynamics of meaning construal and their interactional, embodied, and (socio)cognitive foundations can offer significant insights into the evolutionary emergence of language. This paper will explore the contribution of Interactional Cognitive Linguistics (Brône & Zima, in press) and Dialogic Syntax (Du Bois, 2014) to language evolution research (cf. Pleyer & Winters, 2014).

I will explore the hypothesis that protolanguage and subsequently language emerged as an instrument to take, set, share, and foremost negotiate perspectives in cooperative interaction. Language, on this view, is embedded in an interactional matrix of mechanisms employed by interacting agents to achieve joint social-interactive projects. Interacting agents try to accomplish social understanding, which can be defined as a dynamic, multimodal process of intersubjective, participatory sense-making, and mutual incorporation of embodied perspectives. Language has evolved as one of the crucial scaffolding mechanisms for dynamic meaning construal.

Language acquisition and construction learning proceed via abstractions from instances of actual language use employing general cognitive mechanisms such as schematization and analogy, as well as social-interactional capacities. These include joint attention, the shared intentionality infrastructure underlying cooperative behaviour, and common ground between interlocutors (cf. Tomasello 2003, 2008).

Grammar, on this view, is an emergent phenomenon that is built and co-constructed in dialogic interaction between interlocutors (Hopper, 1987; Du Bois, 2014). Constructions emerge in interaction, stabilize and become more structured within an interactional community through processes of grammaticalization (Heine & Kuteva, 2007; Traugott & Trousdale, 2013). The interactional and cognitive factors involved in the emergence of constructions thus can be seen as evolutionary prerequisites for the emergence of protolanguage and subsequently language. Instead of having a clear-cut meaning, constructions can be said to have ‘meaning potentials’ (Allwood, 2003). Their interactional meaning is realised in actual language use in particular contexts, using particular cultural models and cognitive resources (Croft & Cruse, 2004; Fauconnier, 2004; Ziem, 2014). Constructions, then, are part of an integrated system for dynamic meaning construal in multimodal, embodied interaction and their meaning is instantiated in context.

In this paper, I will explore these processes of negotiating meaning in interactions and their sociocognitive foundations by analysing data from child language acquisition. Using the CHILDES corpus (MacWhinney, 2000), I will investigate the cognitive and interactional factors that are involved when children and their interlocutor(s) use linguistic constructions to co-construct and negotiate meaning (cf. Köymen & Kyritzis, 2014). These processes identified in language acquisition research will in turn offer insights into the evolutionary pre-requisites for the emergence of protolanguage and language that constitute the human interaction engine (Levinson, 2006) and made the human brain language ready (Arbib, 2012).

References


“Creative” Imitation. The Case of Parody

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Research on imitation, refreshed since the discovery of mirror neurons, confronts the “correspondence problem” (what pattern of motor activation makes the imitation look like the model’s movement) and the “selection problem” (what features to single out and reproduce, and what to leave out, for the imitation to be recognized). This paper investigates the cognitive processes underlying imitation starting from the analysis of parody.

A parody is a verbal or multimodal communicative act (discourse, song, fiction) that performs a distorted imitation of another verbal or multimodal behaviour, to elicit laughter (D’Errico & Poggi, 2013). Both persons and texts (songs, poems, dramas) may be an object of parody; in political satire, a Parodist performs a distorted imitation of a politician (Victim) to make fun of him, aiming at cruel criticism or benevolent irony. Often the parody is not a faithful reproduction of the Victim’s actual visible or audible behaviours, but a “deep” imitation: the parodist extracts an underlying ridicule aspect of the Victim and imitates the behavior that would display it. How does the Parodist select the features to imitate, when does he decide to tackle underground features and display them creatively? What kinds of distortions does he apply to imitation?

To investigate these issues, in a corpus of 40 parodies and corresponding videos of their Victims in real contexts, we comparing Parodists’ and Victims’ multimodal behavior by analyzing, through a devoted annotation scheme, which acoustic and visual features of the Victim are faithfully imitated (regional accent, voice quality, dressing, gestures, facial expression and tics), which are distorted, and which of them are displays of underground features. Results point at a hypothesis about the cognitive processes of parody production and comprehension. If the Parodist does not easily find a “ridicule flaw” of the Victim, a negative property funny by itself, or if this property is not visible or audible – a moral or intellectual flaw – he devises a “characterization” of the Victim by including it in a category of people stereotypically characterized by that flaw, and imitates the typical appearance and behavior of the stereotype: for instance, to convey a Victim’s submissive behavior, the Parodist represents him with a white pinnny as if being a waiter. Therefore, while surface parody requires retrieving the Victim’s physical features from memory, deep parody involves imagination: figuring out a deep flaw and how it would be displayed, and imitating that image.
Language Evolution in Social Media: Investigating Glossogenetic Phenomena in Twitter Hashtag Streams
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At present, Internet users generate unprecedented amounts of data, especially through social networking services (SNS). Twitter is one of the most prominent social media used, and with its open policy regarding data access, it has become an important empirical source for researchers from different fields. Evolutionary linguistics, likewise, has an opportunity to utilize these quantities of data to investigate genre-specific dynamics at the relevant level of glossogeny, and in incomparably higher resolution of detail than has been possible before.

Evolutionary aspects of Twitter investigated so far concern mainly changes of the social medium itself, i.e. its functionalities, type of content, user networks (Liu et al. 2014; Bruns & Burgess 2011), user behaviour (Kwak et al. 2010), and information diffusion (Rossi & Magnani 2012; Wu et al. 2011) among other. Attempts to address language evolution on Twitter are rather scarce (e.g. Cunha et al. 2011), hence the need for research that will fill the niche emerging at the intersection between evolutionary linguistics and social network analysis (SNA).

This paper discusses the results of an implementation of the model proposed in Pokornowski 2014, which relates to the Iterated Learning (IL) framework (see Kirby & Hurford 2002; Kirby et al. 2014) in supporting the core claim that (linguistic) structure emerges and changes via cultural transmission, even in non-communicative contexts. The model assumes that Twitter hashtag discussions provide a legitimate setting for the verification of the IL proposition since, by design, it is easy to track tweets relating to a given topic (through the hashtag feature), not all participants see all contributions, not all contributions are communicatively targeted at a particular recipient (optionality of the mention feature), and linguistic content is constantly iterated.

The implementation comprised of three steps. In the first step, two short-span (n < 6 months) and two long-span (n < 5 years) hashtag streams were selected for crawling. The data gathered was then filtered to build sets of relevant English tweets that have been segmented with three time frames of different sizes. This operation created batches of varying temporal resolution in order to identify the levels of analysis suitable for tracking particular changes. In the second step, the batches were processed with a selection of NLTK 3.0 tools (a set of python-based libraries for natural language processing), generating corpora annotated with n-grams, dependencies, and named entities. The third step was a statistical analysis of the processed data on a segment-to-segment basis, which uncovered a number of glossogenetic phenomena within the linguistic content of the hashtag streams. In the conclusions, insights for the language evolution research are presented, confirming that closer cooperation between data science and evolutionary linguistics is a legitimate methodological direction.

The Evolution of the Human Vocal Learning Pathway
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Vocal learning is a rare trait across the animal kingdom, and it is a necessary component of the human language faculty. Specialized vocal learning pathways have been identified in vocal learning birds. However, the evolution of vocal learning pathways in humans hasn’t been properly outlined. In this paper, we provide a possible explanation for the evolution of the human vocal learning pathway. Two human specific FOXP2 mutations play a crucial role: one of them (along with mutations in other genes) leading to the enlargement of the human brain (Tsui et al, 2013). The posterior pathway (the direct corticolaryngeal connection) is duplicated from the caudal cortiospinal pathway. Due to the other mutation, the anterior pathway (the cortico-basal ganglia-thalamic-cortical loop) is exapted from the existing motor learning loop, the key innovation being the posterior pathway, which is a prerequisite of the exaptation of the anterior pathway.

In humans, the anterior pathway and the posterior pathway are analogous to the ones in vocal learning birds, but studies are mainly focused on the former. For vocal learning birds, Feenders et al (2008) propose that the two pathways
are duplications of the existing motor pathways and suggest that this can also be applied to humans. We argue that, because evolution is parsimonious, there is no need for the anterior pathway to be duplicated if it can be exapted for a novel function. The anterior pathway was exapted from the existing motor imitation pathway connecting the BA44 to the basal ganglia circuit, where there is a homolog between the monkey mirror system and the human Broca’s area (Arbib, 2006). The posterior vocal pathway in humans is a physiologically different pathway from the corticospinal one, and it is most likely, as Feenders et al (2008) proposed, a duplication of the caudal corticospinal pathway (Rathelot & Strick, 2009) for skilled motor production in some species of primates. Moreover, the formation of the posterior pathway is a prerequisite of the exaptation of the anterior pathway. In a species of suboscine bird who is not a vocal learner, it has been found a rudimentary posterior pathway without finding any signs of the anterior pathway (Liu et al., 2013). Besides, it has also been observed that the size of the posterior nuclei is significantly correlated with the size of the anterior nuclei in songbirds, indicating the evolutionary enlargement of the posterior nucleus is driving the enlargement of the anterior one (Devoogd et al, 1993). The two human FOXP2 mutations play an important role. In agreement with Deacon’s (1989) proposal of competition between innate vocalizations and voluntary vocal control, the enlargement of human brain size gave rise to the corticolaryngeal connection, resulting in the direct cortical control of the muscle of larynx. One of the two FOXP2 mutations shared with carnivores is responsible for the enlargement of the neocortical size, which prepares the spacial condition for the generation of the posterior pathway; the formation of this vocal production pathway connected to the basal ganglia circuit, driving it to adapt learning to a new modality—vocal learning, in which the other humanly unique mutation is responsible for the basal ganglia circuit exaptation. Our proposal provides new directions for testing the evolution of human vocal learning pathway, providing further details about the externalization of human language.

References


The Multimodal Origin of Human Speech

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It is up for debate whether gestures or vocalizations are the origin of human speech. In this paper, we propose that the origin of human speech is multimodal, and that both gestures (visual) and vocalizations (auditory) can be put in evolutionary perspective under a biolinguistic framework. We provide the following points to support our hypothesis:

1. Corballis (2002) postulates that gestures were at the origin of language, with the spoken modality coming later and taking over as an invented cultural innovation. However, it seems unlikely that it took so long (around 100,000 years) for humans to discover the benefits of spoken language (Huford, 2002a).

2. Through studies on mirror neurons, the location of which in macaque is similar to the location of Broca’s area in humans, Rizzolatti & Arbib (1998, et seq.) and others also consented to a gestural origin of human language. However, these systems are not confined in the visual modality. Mirror neurons are divided into two subcategories, communicative mouth mirror neurons and Audio-visual mirror neurons, which fire both when children observe the articulatory gestures performed by the speaker (conspecific), and when they produce the same sounds themselves (Huford, 2002b).
3. Assumptions also emerged on the continuity of animal communication calls and human speech. Several animal species possess a reconfigured vocal tract similar to our own, but do not use it in speech production (Fitch, 2010). The descended larynx, once thought to be a uniquely human trait, is not unique to humans after all (Fitch & Deby, 2001).

4. In terms of neural pathways that produce vocalizations and gestures, it has been reported that some primates retain a new caudal corticospinal pathway for high-skilled motor production (Rathelot & Strick, 2009), with voluntary control subserved by the cortical anterior cingulate periaqueductal grey pathway (Jürgens & Zwirner, 1996).

5. Kuhl & Meltzoff (1982)’s experiment on infants showed that vocal imitation is cross-modular, both auditorially and visually.

6. Taglialatela et al (2011)’s experiment on vocal signaling in chimpanzees points to a multimodal origin of human language.

Based on the arguments above, we propose a multimodal origin of human speech, that is, human speech originated from both vocalization and manual gestures.

References

Communicative Gestures in Human Infants and Chimpanzees
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Using a descriptive approach typically found in studies on non-human primates, the sensory categories of the first communicative gestures of infants between 8-12 months were analyzed and compared to data on 0-20 months chimpanzees reported in Schneider et al. (2012). In an intra and interspecies level, the use of the different sensory categories was examined, as well as how these categories varied depending on the gender of the sender. The infants’ data also allowed to examine how sensory categories varied according to the attentional state of the audience, gestures efficacy in function of age of the recipient, and the variation of sensory categories in time. The two species show the same dominant sensory categories (visual gestures, followed by tactile, and finally by auditory gestures), but proportions differed significantly (more visual and less tactile in humans). Unlike in chimpanzees, in humans females gesticulate more. Visual gestures in humans were mainly used when the recipient was in the sender’s field of view, and
the auditory and tactile modalities were more often chosen when the recipient was out of the field of view of the sender. Gestures were more likely understood as communicative acts when directed to other children rather than adults. There were no significant differences in the use of sensory categories between 8-10 months and 11-12 months infants, whereas developmental differences were found in chimpanzees (9-14 months, 15-20 months). The similarities found in the communicative repertoire of these two related species suggest their presence in a common ancestral, which is in line with the gestural or the multimodal hypothesis of the origin of language. In general, it is possible to observe continuity in the preference of the perceptive channels used in gestural communication in human phylogenetic closest relatives and in humans, at least at the pre-verbal stage in which gestures in human children are the predominant mean of communication.

The Transmission of Entrenched Linguistic Knowledge through Iterated Learning among Native Speakers of Italian

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The methodology of iterated learning has recently become one of the most valuable insights into the transmission of linguistic structures and the consequent evolution of the linguistic code. Basing on a simple “alien fruit” experiment originated by Kirby et al. (e.g. 2008), it is possible to overcome the most commonly held accusation against the EoL studies, namely that as languages do not fossilise, they cannot be studied empirically. The process of emergence and development of an experimental mini-artificial-language (referred to as “evolect”, after Jasiński 2013, in press) can be observed within several hours instead of several thousand or even hundreds of thousands of years (Wacewicz 2013, in press).

The experiment in question was replicated among native speakers of Italian. Similarly to the results obtained by Kirby et al., the evolect was becoming more and more structured with each consequent iteration. Nevertheless, despite various bottlenecks applied, it seemed impossible to eliminate the influence of entrenched linguistic knowledge on the emerging evolect, which had also been noticed during similar experiments with Polish participants (Rogalska and Pokornowski 2013). It occurred that any structures unrelated to previously acquired linguistic knowledge were immediately displaced. On the other hand, “trendsetters”, i.e. signals exhibiting entrenched linguistic knowledge bias that immediately prove adaptive and successful across subsequent generations, were able to “survive” through (almost) all the generations from the moment of their emergence. The research conducted by Kirby et al. did not report that phonological and/or morphological similarities between the structures stored in participants’ minds and those of the emergent evolect influence directly the learnability and, consequently, the survival of a given unit. Therefore, it may be suggested that entrenched linguistic knowledge directs the emergence of evolects in the context of the iterated learning methodology.

References


The Cultural Evolution of Functional Morphology in an Iterated Learning Experiment

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Human cognition made possible the evolution and maintenance of a communicative system that shows both combinatorial and compositional syntax (Hurford, 2012). It was the evolved capacity to abstract away from selectional restrictions that paved the way to syntax in language: it allowed humans to develop relationships between lexical items (Deacon, 1997) and these items to have a schematic type of meaning that is independent of the entities in the world that words refer to (Evans, 2014). Often these syntagmatic relationships can only be processed hierarchically as Phrase-Structure Grammars (Chomsky, 1957). The current project analyses the nature and the cultural evolution of a minimal requirement for the existence of syntactic phrases and syntagmatic relations: syntactic categories. It does so through an Iterated Artificial Language Learning (IALL) experiment with a meaning space constituted by basic motion events. The IALL framework (Kirby, Cornish & Smith, 2008) provides us with a clean tool to investigate the emergence of explicit syntactic categories and thus to observe the interaction of conceptual systems and grammar construction without any language-specific lexicon previous to performance. Coherent with previous results (Kirby et al., 2008), languages become more learnable along with the emergence of structure as shown in Figure 1 where we observe a significant ascending trend in structure/systematicity (L=2170.0, m=8, n=9, p<0.001). For the first time, resulting systems within the IALL framework under laboratory conditions show the split of lexical and functional morphology in the construction of lexical syntactic categories. Along with it, phrase-structured event predicates constituting quite complex grammars are obtained (see Figure 2). An intergenerational analysis of the artificial languages also highlighted functional elements as syntactic categorizers defining the constructions of motion events. Further work is required to conclude the hinted syntactocentric approach to categorization, i.e. constructions define syntactic categories. The current project provides evidence (1) for higher syntactic complexity emerging through cultural evolution through (2) the emergence of functional morphology that at the same time determines (3) the construction of syntactic categories (4) that formally show high variation bounded only by the relationships of the argument components of the motion events.

Examples of the evolved communication systems in the lab:

a) Monadic condition: Iteration & no interaction

Square.pl Figure Circle.pl Ground.pl Slide Terminated
'A group of squares slides towards a group of circles.'

b) Dyadic condition: Iteration & Interaction

Square Pl. Slide.Ongoing Circle PL
'A groups of squares slides towards a group of circles back and forth.'

References

Measuring Linguistic Handedness in Deaf Signers of British Sign Language: A New Assessment Tool
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Measures of handedness act as a surrogate for direct measurement of cerebral dominance for motor activities and also for lateralisation of language. Handedness has been assessed in three main ways in the literature: categorisation by writing hand preference (McManus, 1984), preference inventories on a range of skills (Oldfield 1971), and direct measurement of relative proficiency (Annett, 1976). Laterality researchers have often debated the degree of validity of such measurements (reviewed by Bishop, 1990). There has also been a debate about whether preference or proficiency is the best measure of handedness. The use of the hands for linguistic output is likely to provide a more direct relationship to lateralisation for language. Sign languages offer this unique perspective for exploring the link between handedness and cerebral lateralisation for language as the hand acts as a linguistic articulator. Signers display evidence of hand dominance while signing and fingerspelling. In one-handed signs and fingerspelling, the dominant hand is predominantly used. In two-handed signs and fingerspelling, the dominant hand is the active articulator with the non-dominant hand acting as the base.

Past studies on handedness in deaf population showed a reduced incidence of right-handedness (Conrad, 1979; Bonvillian et al., 1982; Arnold& Askew, 1993; Mandal et al., 1999; Dane and Gümüstekin, 2002). These studies looked at non-linguistic and non-communicative tasks. The present research adopts a different view and looks at handedness patterns for linguistic and communicative tasks like signing and fingerspelling in Deaf population. This study provides the latest handedness statistics for signing in Deaf population using British Sign Language (BSL). In contrast to previous studies, this study did not find a low incidence of non-right-handedness in the deaf population. The present study argues that the most likely reason for the differences between the findings of this study and those of previous studies is in the approach to measuring handedness. Most previous studies have relied on self-report measures such as the Edinburgh Handedness Inventory (EHI) (Oldfield, 1971) or similar checklists. No previous study has modified the questionnaires for Deaf populations and none have used performance measures. The EHI does not include items relating to signing or fingerspelling, primarily including consideration only of non-linguistic or non-communicative hand use rather than hand use for communication (linguistic and non-linguistic). The absence of data on signing and fingerspelling means that one of the most prominent features of handedness in Deaf signers is omitted. Additionally, since both hands are used for signing, but with different roles for the dominant and non-dominant hands, linguistic handedness is one of the best measures of a Deaf signer’s handedness.

This paper presents the BSL Handedness Screen which is an assessment tool for measuring linguistic handedness in signers. The items in the screen are based on sign typology, it can be adapted for use with any sign language, and used both for self-report and as a screen by researchers or clinicians to score observed handedness. The use of a self-assessment hand preference questionnaire allows for the reporting of handedness along a continuum. By also using the same tool to measure performance, any differences between the two sets of measurement can be identified. Data and results from Deaf signers using this screen is also presented.

‘Index Spectrum Protolanguage Hypothesis’: A Perspective from Comparative Biolinguistics
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Katz and Pesetsky (2009) put forth the following ‘Identity Thesis for Language and Music’: All formal differences between language and music are a consequence of differences in their fundamental building blocks. In all other aspect,
language and music are identical.’ However, from a evolutionary perspective, Katz and Pesetsky (2009)’s proposal cannot explain why language has today superseded music as the primary communicative medium of our species. In this paper, we propose a ‘Index Spectrum Protolanguage Hypothesis’ (henceforth ISPH). Contrary to Katz and Pesetsky (2009), ISPH proposes that language faculty and music system not only share the basic syntactic operation but also the elementary, generic building block. Following the insight of Boeckx (2014), ISPH claims that the generic building blocks in language includes two indices, one of which pointing to the systems responsible for interpretation, the other to the systems responsible for externalization. At first the index for externalization takes over the whole interface system, and the logical consequence is the emergence of music protolanguage. During the process of human cognitive evolution, and due to the increasing complexity of information used in the social lives, the index for interpretation competes for dominion for the interface system. The logical consequence of our proposal is that the evolutionary trajectory of interpretation index forms a spectrum of language evolution. In our framework, it is meaningless to debate whether protolanguage is holistic or analytic.

The empirical evidence comes from comparing Merge and Linearization in both music and language. Based on the module of linearization sub-operation proposed in Boeckx, Alvarez & Leivada (2014) we highlight the parallelism between music and language. We propose that the lack of Internal Merge (movement) in music is linked to the evolution spectrum of the index for interpretation human language.

References


Storytelling without Telling: Pre-linguistic Origins of Narratives from an Evolutionary Perspective

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With the cognitive turn, the study of literature, or – more broadly speaking – storytelling, has shifted toward determining its cognitive functions (e.g. Turner 1996; Herman 2007) and characterising it as an evolutionary adaptation (e.g. Boyd 2009), giving rise to disciplines such as cognitive poetics or the so called Darwinian literary studies. These disciplines, however, see storytelling as managed merely by means of language. Research from beyond literary studies has also often seen storytelling as a solely verbal enterprise (Victorri 2002; Collins 2013; Wiessner 2014; von Heiseler 2014). However, “telling” stories does not necessarily need to be verbal. In this paper, storytelling is synonymous with composing narratives, i.e. reporting sequences of displaced events – real or fictive – in a manner different from description (cf. Genette 1980; Herman 2007). Thus understood, storytelling does not need to be executed by means of words alone. I argue that it is possible to tell stories by deploying a much wider array of semiotic resources: including gestural, pictorial or vocal-mimetic. As such, storytelling (or ”proto-storytelling”) can have roots as early as in the mimetic stage of culture (Donald 1991) and have accompanied the development of human symbolic capacity ever since.

This paper is a critical examination of the existing body of evidence on the origins – and not only cognitive/adaptive functions – of human ability to tell and comprehend stories from both a cognitive-narratological and evolutionary perspective, aimed at showing that narratives are not restricted to the verbal medium, and as such could have emerged earlier than fully-fledged language. In order to prove that, I provide a definition of narratives (which in the Darwinian literary and culture evolution studies has been treated rather intuitively) as well as the characteristics of the elements necessary for a narrative act to occur. I also identify the pre-adaptations crucial for the baseline forms of storytelling. As I prove, in its early forms, storytelling can be characterised by its dependence on the ability to understand, connect,
recall, and imagine events, as well as its dependence on displacement, shared intentionality and theory of mind. It is also, just as language (Knight 2000), strongly anchored in play (Boyd 2009). By delineating these, drawing on a number of disciplines (narratology, cognitive narratology, Darwinian literary studies), in this paper, I present insights into the early forms of storytelling that can be incorporated not only into literary theory, but also into language evolution studies.

Ontogenetic Ritualization and the Emergence of Gestural Symbols in Autonomous Robot
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Ontogenetic ritualization (OR) is one of the key processes for the development of early gestural symbols in infants. OR has been widely studied in non-human and human primates (Tomasello, 1996) and it has been identified as a basis for the emergence of meaningful gestures from bodily actions. For example, OR is a plausible mechanism for the development of pointing from grasping. Despite its importance there are few models of ontogenetic ritualization except for some initial work which does not focus on communication per se and omits modeling the role of the tutor in the dyadic interactions underlying gesture learning (Hafner & Schillaci, 2011; Arbib et al 2014; Sheldon & Lee, 2010). Our work incorporates the modeling of the emergence of gestures in a complete framework that can also handle other aspects of language development such as vocabulary and grammar learning.

In our experiments, gestures such as pointing emerge from the interaction of the learner with tutor robots from bodily actions of grasping in 4 stages. 1) The learner learns how to grasp or touch an object. 2) The learner fails to grasp an object because it is too distant. There is a tutor present who recognizes the intent of the learner and moves the object to him, which allows the learner to grasp the object. At this point the learner learns a new sensorimotor plan that includes information about the tutor. (See Figure 1 for an example) 3) The learner schematizes the motor programs for grasping into a more and more pointing like action for reaching the same goal. 4) The learner also schematizes the meaning of the gesture and learns that he can attract the tutor’s attention using the same gesture. We found that a number of systems are necessary for seeing the emergence of pointing gestures in learners. First, learners need to be able to act in the world using a planning system and basic motor control primitives. Second, learners need the capacity to recognize and possibly incorporate other agents (the tutor) in their plans. Third, processes of simplification (reduction of motor effort) are necessary for the continuous adaptation of the gesture, so that ultimately a schematized version of grasping can become what could be recognized as pointing. Fourth a similar mechanism of continuous adaptation of the meaning of the gesture is necessary to broaden the usefulness of the learnt gesture. In our model these components together organize the emergence of pointing and other gestures in a process or OR. Importantly, the same mechanisms can also give rise to other developmental trajectories such as the
emergence of pointing from touch or other motor actions. Our results demonstrate a promising route for modeling the acquisition of symbolic communication in robots.

The Role of Tool Use and Tool Making in the Evolution of Language
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My work stresses the role played by tool use and manufacture in the evolution of language. This approach is by itself not completely new (Arbib 2011, Barceló-Colblijn 2012 are examples), but it supplements a common view that emphasizes human sociality. For instance, two recent and justly appreciated monographs (Fitch 2010, Sterelny 2012) have very little to say about what role tool use and manufacture might play. Two things setting us apart from other animals are that we have a language, and that we use tools. We can find something like language in other animals, and occasional use of tools among a few species (Beck 1980), but the extent to which humans structure their lives through the use of tools and language has no matches in the animal world. In fact, tool use and language use are normally viewed as signs of higher intelligence. There are good reasons for this. Tool use rests upon more complex thinking than a pure stimulus-response model can offer, and toolmaking will often require quite complex mental activities on the part of the maker, such as causal reasoning, planning, memory, executive control, and something like teaching (Preston 1998, MacCormack et al. 2008, Vaesen 2012). It is known that there are some shared neural correlates for language and tool use (Higuchi et al. 2009).

Language use will require and foster more complex thought as well. One of the remaining problems in understanding the evolution of language is to understand our ability to employ and understand the recursiveness found in natural language. Hauser, Chomsky and Fitch (2002) have dubbed this recursive ability the faculty of language in the narrow sense, and they find it difficult to give a plausible account of how this ability could have evolved, since there allegedly are no precursors of the ability. There are a few suggested explanations. Some candidates are social cognition (Cheney & Seyfarth 2007), visual cognition and pattern recognition (Pinker & Jackendoff 2005), spatial cognition. Darwin made a passing suggestion that tool use was essential. Other recent attempts to show the importance of tool use for the evolution of language include Arbib (2011) and Barceló-Colblijn (2012).

The present poster suggests that one central precursor of the recursive ability is the role tool-using and tool-making play in the evolution of human cognition. There are several possible ways this matters. Some such explanations are areas for further exploration. Things such as tools help shape our mind (Malafouris 2013), so theories of cognitive evolution need to take this into account.

References

Niche Construction and Plasticity: The Evolution of Language within an Updated Evolutionary Research Programme

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The evolution of language is an old evolutionary problem: many evolutionary hypotheses have been proposed and a heated debate among scholars coming from different disciplines is still going on today (Pievani, 2015b). In order to gain a proper set of explanatory tools, we should look at the overall evolutionary theory which is facing itself an important process of updating (Pievani, 2015a, in press). Some scholars think that some factors should gain more importance in the evolutionary explanation; four phenomena in particular will be taken into account: niche construction, inclusive inheritance, phenotypic plasticity, developmental constraints (Laland et al., 2014), within a multilevel framework of analysis, from the ecological to the molecular level (Anton et al., 2014). These elements combined may provide a deeper understanding of the selective pressures acting during human evolution, helping reconstructing the evolutionary scenario in which the language faculty could have emerged. The traditional explanatory structure based only on continuative monofunctional selective pressures (characterizing most of the hypotheses proposed so far) may result too simplistic once applied to the complex issue of language evolution. We show how, in human evolution, biological and cultural evolution are complexly intertwined, bringing the example of the cascade of effects produced by a behavioral modification such as the control of fire (Wrangham & Carmody, 2010), suggesting the usefulness of adopting a gene-culture coevolution viewpoint as a framework for the emergence of language in human evolution (Fisher & Ridley, 2013).

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Evolution by Selection in Iterated Language Learning Experiments

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Iterated learning experiments claim to model the evolution of languages. In this study, we test to what extent the languages in these experiments actually follow evolutionary dynamics. Specifically, we look for the signature of evolution
(descent with modification) and of selection (adaptation to environmental factors) as the languages change over generations.

In order to do this, we ran a modified version of the classic Kirby, Cornish & Smith's 2008 (henceforth, KCS08), experiment 2. In that experiment, individuals organized in diffusion chains were trained on 50% of a language (excluding homonyms) and then had to produce labels for 100% of the meanings. The languages showed a gradual decrease in learning error and an increase in systematic structure over generations.

Apart from using a different meaning space, the main novelty in our version was the tree-like structure of the chains (Fig. 1).

This allowed us to obtain a set of final languages (shaded circles in Fig. 1) with a known phylogeny.

![Figure 1. The tree-like design of our iterated learning experiment. Each circle represents a language, and each line, a participant.](image)

In order to check whether the changes in the languages are consistent with evolutionary dynamics, we reconstructed a phylogenetic tree based on the final languages only. Phylogenetic tree building works on the assumption that change is the result of descent with modification. The reconstructed tree was similar to the veridical tree, strongly indicating that change in our languages is, indeed, the outcome of descent with modification.

We also found three quantitative signatures of selection in the languages. First, a series of Mantel tests (Mantel, 1967) revealed a consistent, directional increase in systematic structure over chains, which indicates that the languages are adapting to being easy to learn and expressive (KCS08). Second, RegMap analyses (Tamariz, 2011), which measure the mutual entropy between segments of the words (initial, middle and final characters) and features of the meanings (colour, shape and motion), confirmed a cumulative rise of regularity in the mappings between meanings and signals; this is a signal of adaptation of the structure of the languages to the structure of meanings. Third, a computer model of the spread of word segments over time, based on Tamariz et al. (2014) found a significant departure from the patterns of evolution expected by the neutral (or drift) model, which clearly manifests the effects of selection.

References


Gorillas Combine Gestures into Sequences for (at least) Two Different Reasons

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The great apes produce gestures intentionally and flexibly, and sometimes they combine their gestures into sequences, producing two or more gestures in close succession (e.g. Hobaiter & Byrne, 2011; Tanner, 2004). Considering how humans combine words to communicate more complex meanings in language, researchers have examined the gesture sequences produced by apes to understand their function and the extent to which they are homologous to linguistic sequences. Much of this research has focused on a particular communicative function of gesture sequences and elaborations (e.g. negotiating social interaction; persistence after misunderstanding). Here we present evidence that apes actually produce (at least) two different kinds of gesture sequences, each with a distinct function. Some sequences are composed of gestures that depict action in an iconic manner, typically requesting movement by the partner (Tanner & Byrne, 2004). Other sequences contain gestures – often percussive in nature – that are performed in situations of play or display and seem to primarily exhibit the performer’s emotional activation and energetic fitness.

We make our argument based on two lines of evidence: i) re-evaluation of previous findings related to ape gesture sequences (e.g. the two clusters of gesture combinations presented by Genty & Byrne, 2010), and ii) qualitative analysis of video recorded gesture sequences produced by western lowland gorillas housed at the San Francisco Zoo (details of the recording reported in Tanner & Byrne, 1999). Our analysis reveals functional parallels between iconic action sequences and human language on one hand, and display sequences and rhythmic music and dance on the other. More like language, the iconic action sequences appear to have ‘meaning’ in that they typically function to request a particular action by a partner. However, in display sequences, we find qualities of music and dance. These sequences vary systematically in form and exhibit structural development, but have no obvious functional goal or meaning. We further illustrate how displays of multiple sequences exhibit creativity that is constrained by hierarchical and combinatorial patterns in the substitutions of particular component gestures. In conclusion, we suggest that it is illuminating for studies of ape gesture to go beyond ‘meaning’ in the conventional linguistic sense and look at gesture from a more ‘musical’ point of view.

Can Adequate Cognitive Phylogenies Be Constructed?

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The shift of perspective that took place around 10 years ago in comparative psychology, well captured by de Waal and Ferrari 2010, has led to a re-appraisal of the cognitive powers of non-human animals, and has contributed to fill the gap between uniquely human attributes and mental powers of both distant and closely related species. The shift in question is one that approaches cognitive domains from the bottom up, recognizing that complex cognitive functions have to be decomposed into more primitive ones, which can then be traced back to earlier evolutionary (“proto”) stages.

For all the promises that this paradigm shift offers, we think that many studies have approached it in a non-optimal way. Beginning with Hauser, Chomsky and Fitch’s 2002 distinction between a faculty of language and the narrow sense and a faculty of language in the broad sense, researchers have been influenced by traditional, “linear cladogram” thinking in their attempts to reconstruct cognitive phylogenies. In this talk we would like to highlight the pitfalls of this representational format and suggest that it be abandoned. Specifically, we wish to stress that the cladograms arrived at are incapable of depicting the complexity with which traits are distributed across species. As a matter of fact, the labels of the nodes of these traditional representational systems do not succeed in capturing the ‘tinkering’ nature of evolution.

In addition, current cognitive cladograms tend to represent fossilized behavioral patterns, but they are supposed to represent the evolution of cognitive mechanisms. These mechanisms, if they are to be implemented in brain wetware, will have to be phrased in terms of low-level circuit functions (e.g. gain modulation, phase coding, selective inhibition) that are instrumental for the implementation of cognitive functions. But once this is done, cladograms of the sort
being proposed are woefully inadequate: linear, uni-dimensional tree structures disintegrate into entangled, multi-rooted, multidimensional branches.

We are aware that some of the difficulties we highlight are not specific to cognitive phylogenies, but apply to the field of cladistics as a whole. However, we feel that these difficulties are magnified in the context of cognition, and that these issues ought to be resolved if we are to make progress in understanding the paths of descent of language and other cognitive attributes of our species.

References


Experimental Evidence for Phonemic Contrasts in a Nonhuman Vocal System

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The ability to generate new meaning by rearranging combinations of meaningless sounds is a fundamental component of language. Although previous research suggests animal vocalizations often comprise combinations of meaningless acoustic elements, evidence that rearranging such combinations generates functionally distinct meaning is currently lacking. We present evidence for this basic ability in calls of the chestnut-crowned babbler (Pomatostomus ruficeps), a highly cooperative bird of the Australian arid zone. Using acoustic analyses, natural observations and a series of controlled playback experiments, we demonstrate that this species uses the same acoustic elements (A and B) in different arrangements (AB or BAB) to create two functionally distinct vocalizations. Specifically, the addition or omission of a contextually meaningless acoustic element at a single position generates a phoneme-like contrast that is sufficient to distinguish the meaning between the two calls. These results indicate that the capacity to rearrange meaningless sounds in order to create new signals occurs outside of humans. We argue that phonemic contrasts represent a rudimentary form of phoneme structure, and a potential early step towards the generative phonemic system of human language.

The Phonetics of Chimpanzees: Articulatory Acoustic Analysis

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In the continuity model, protolanguage was an animal vocal-gestural communication system which evolved into modern human language. In order to estimate what kind of form protolanguage could have taken, we can compare and contrast human language with the communication of our nearest evolutionary cousins, the chimpanzees. This allows us to better understand, on the one hand, the similarities that point to a continuity of evolution, and on the other hand, the differences that make human language unique. Chimpanzee communication includes gestures, postures, eye gaze monitoring, and vocalisations. We focus here on the vocal repertoire. For an exact comparison of human and chimpanzee vocal production, a common notation system is required. The IPA (International Phonetic Alphabet) is used to describe human speech sounds. In contrast, chimpanzee vocalisations are described with acoustic measures and subjective terms such as "bark" and "scream".

Our aim is to comprehensively describe the phonetic repertoire of chimpanzees and compare it to the human phonetic repertoire. We analysed videos of wild chimpanzees at TaÔ National Park, Ivory Coast, vocalising in a variety of
known contexts such as feeding, fighting, traveling, and grooming. We documented acoustic and articularatory parameters including fundamental frequency (F0), first formant (F1), second formant (F2), lip opening, lip rounding, and lip protrusion. We checked for correlations between these in order to test whether lip movements are responsible for sound distinctions. Our analyses revealed that F0 and F1 are not correlated in all cases, which shows that F1 is being modified away by action of the articulators. Our results suggest that chimpanzees use degrees of lip opening to modify F1 in vowel-like sounds.

This pilot study allowed us to address the difficulties of raw data quality (naturalistic video recordings from a distance without elicitation; background noise; overlapping calls; multiple contexts), data preparation (scripts needed to define sound boundaries and formants; coding; inter-rater reliability), statistical analysis, and units of analysis (we define several levels from the segment to the utterance).

The next phase of this project will focus on the articulatory and acoustic correlates of nasalisation, diphthongs, onsets (consonant-like sounds), the range and structure of sound combinations (morphology of syllable-like units), the structure of utterances (syntax), the timing of vocal exchanges (conversational turn-taking), and the meanings expressed (contexts).

We are producing the first articulatory-acoustic-phonetic catalog of chimpanzee vocal production, that can shed light on a possible form of protolanguage.

**Encoding Serial and Simultaneous Grammars: Insights from Newly Hatched Chicks**

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Learning mechanisms and computational capabilities can be assessed using grammars with different features and complexity (e.g. presence/absence of adjacent repetitions). Differences in performance with specific grammars can be due to computational abilities or perceptual, memory and attention constraints.

We investigate whether performance with two simple abstract rules that do not impose harsh limitations to working memory and attention – XYX and XXY – are processed similarly in newly hatched chicks of the domestic fowl (Gallus gallus). We instantiated these rules using video presentations. We prepared simultaneously presented triplets or serially presented triplets and used them as imprinting stimuli. After 24 hours of exposure chicks were presented with the choice to approach either the familiar or the unfamiliar pattern at the ends of a runway. Chicks of the naïve condition were exposed to the same monitors and background in the absence of XYX and XXY stimuli and then tested with the choice between XYX and XXY presented on two monitors located.

Differently from naïve chicks, which exhibited no pattern preference, chicks imprinted on the patterns showed a preference for the XYX pattern. Moreover, chicks modulated their performance differently with serial and simultaneously presented stimuli, suggesting the use of different mechanisms in processing serial and simultaneous patterns.

To investigate the role of the two hemispheres in processing these rules we tested chicks monocularly. Our data suggest that the right hemisphere is more involved than the left hemisphere in judgements of familiarity, and that the left hemisphere is more involved in the discrimination of patterns.

**The Pullo-Vorenus-Hypothesis**

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There are hundreds of theories about language evolution. However, most of them contain the same mistake: They are based on the popular myth that the genetic divergence between humans and their closest of kin, the chimpanzees, is rather slight. This misconception is based on the fact that the respective predecessors of chimpanzees and humans
diverged only about 6 million years ago. However, evolution occurs at very different pace. Recent studies suggest that humans developed through a “super-fast” evolutionary process found nowhere else within the animal kingdom, (Hughes, et al., 2010), (Lahn, et al., 2004) (Bird, et al., 2007), (Burbano, et al., 2012), (Pollard, et al., 2006). Lahn (2004) shows that the development of cognitive abilities in our ancestors was accelerated at about 1500% compared with other primates. This suggests a discontinuity in the evolutionary process itself (similar to the emergence of sexual reproduction, or in the development of the cell nucleus): a major transition in evolution (Maynard Smith & Szathmáry, 1995). In this framework, we propose the following hypothesis: A new system developed, one that created its own elements in the form of humans, language, culture, and the like. This new evolutionary system consists of two feedback loops, with a backchannel between them; the lower loop producing the variations needed for selection in the upper loop to take place. By “backchannel” we mean a structure enabling the selection of the lower loop (sexual selection) to “anticipate” the selection of the upper one (group competition). The content of this backchannel is displaced action encoded in narration. The starting point for this major transition in evolution is the unique social structure of hominin.

Hominini do not interbreed arbitrarily in a given habitat, but do build groups to do so. There is evidence that this social structure exists in humans: Recent tribes (e.g., the inhabitants of Amazonas, New Guinea, and the Andaman Islands) do not intermix, and often engage in conflicts. Comparing the structure of the human male germline (Y-chromosome line) and the female germline (mtDNA-line) produces a similar result. In an earlier study, we showed that language contains design features that could be interpreted as footprints of a selection for storytelling (von Heiseler, 2014). We showed that not only the human brain and language but also most of the unique human faculties (including theory of mind and episodic memory) are adapted almost exclusively to developing the function of the backchannel (narration) at a super-fast evolutionary pace.

References


Modelling the Role of Theory of Mind in Language Evolution

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One striking feature of human language, when compared to the communication systems of other animals, is that it is ubiquitously used to convey honest information (i.e. declaratives as opposed to imperatives). Such honest signalling poses an explanatory challenge for evolutionary theory because it involves giving away information to the benefit of the receiver at the cost of the signaler (e.g. Ale et al., 2013). Modern theories of the evolution of honest signalling do not just place the selective pressure for this trait in environmental circumstances (e.g. collaborative foraging), but rather point to the interaction (mutual enforcement) between language and other socio-cognitive traits that are
uniquely high-developed in humans (e.g. Sterelny, 2012; Tomasello et al., 2012; Whiten and Erdal, 2012). Two of these traits that have been put forward as providing positive feedback for each other are language and theory of mind. Theory of mind - the ability to reason about the mental states of oneself and others - plays a crucial role in language use and acquisition. To be able to communicate successfully both speaker and hearer need to have a model of each other’s knowledge and interests, and the space of overlap between them (i.e. their common ground). The other way around it has also been argued that language is crucial for the development of full-blown theory of mind in humans (Heyes 2012; Heyes & Frith 2014), through providing (i) labels for mental states (ii) representational structures for mental states, and/or (iii) conversation about mental states.

Although the interplay between language acquisition and theory of mind development on an individual level can be investigated through experimental and observational studies, the effects of this interaction on a population level and evolutionary time-scale are less straightforwardly explored; especially if we assume that most (if not all) of this effect is instantiated through cumulative cultural evolution rather than biological adaptations.

In order to investigate these effects we present an agent-based model of communication in which theory of mind plays an active role. Agents in this model are required to learn a function that allows them to infer which meanings are more salient for the interlocutor than others, ultimately allowing them to be more successful in communicating and acquiring new vocabulary. We explore the effects of such an individual-level interaction of cognitive capacities on the population-wide dynamics of establishing and maintaining a stable signalling system – thereby connecting proximate and ultimate causes of language evolution.

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