

Recursion across Domains

Recursion and self-embedding are at the heart of our ability to formulate our thoughts, articulate our imagination, and share with other human beings. Nonetheless, controversy exists over the extent to which recursion is shared across all domains of syntax. A collection of eighteen studies are presented here on the central linguistic property of recursion, examining a range of constructions in over a dozen languages representing great areal, typological, and genetic diversity, and spanning wide latitudes. The volume expands the topic to include prepositional phrases, possessives, adjectives, and relative clauses – our many vehicles to express creative thought – to provide a critical perspective on claims about how recursion connects to broader aspects of the mind. Parallel explorations across language families, literate and non-literate societies, children, and adults are investigated. The volume constitutes a new step in the generative tradition by simultaneously focusing on formal theory, acquisition and experimentation, and ecologically sensitive fieldwork, and initiates a new community where these diverse experts collaborate.

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Foreword

The chapters in this volume represent a very important set of contributions to the recent debates regarding the nature of recursion in natural language and the typological issues surrounding its (non-)manifestation in the syntax of various languages. In many of the chapters, important new data from the indigenous languages of Brazil are also presented.¹

Although the issues at stake here are long-standing ones in linguistic theory, the immediate stimulus to the conference comes from two papers published in the early 2000s: Hauser, Chomsky and Fitch (2002) and Everett (2005).

Hauser, Chomsky and Fitch (2002) made an important conceptual distinction between the Faculty of Language in the broad sense (FLB) and the Faculty of Language in the narrow sense (FLN). The former includes both the narrow-syntactic component that generates structural descriptions of sentences along with the two principal interfaces (Articulatory-Perceptual, governing the transduction of syntactic representations ultimately into a perceptual modality, speech or sign, and Conceptual-Intentional, converting syntactic representations into objects of thought, belief or judgement). It was suggested that aspects of FLB might not be specific to humans. FLN, on the other hand, was argued to consist purely of the computational system of the syntax, whose central property is discrete infinity: the ability to generate an infinite set of structural descriptions from the iterated application of the single structure-building operation Merge. Merge, as a property of finite human minds, must itself be finitely specifiable. Formulating Merge as a recursive function, able to apply to its own output in iterative fashion with no limit in principle, makes possible the generation of infinite sets from finite means. In slightly more formal terms, Merge can be seen as the intensional definition of a set of structural descriptions, whose extension is infinite (see Watumull et al. 2014 for more detailed discussion of

¹ The papers were presented at a conference held at the Federal University of Rio de Janeiro in August 2013. The project that led to the conference is a result of a partnership between the Graduate Program in Linguistics of the Federal University of Rio de Janeiro (PPGL-UFRJ) and the Language Acquisition Research Center at the University of Massachusetts Amherst (LARC-UMass).

this aspect of Merge). Hauser, Chomsky and Fitch thus argued that the central property of FLN was a recursive operation. They further suggested that FLN, and hence Merge, is a uniquely human trait, and one which is likely to have evolved very recently in human phylogeny, perhaps through exaptation from some other aspect of cognitive or motor function.

The obvious inference to make from Hauser, Chomsky and Fitch's conclusions is that recursion is a property of all, and only, humans. Therefore, evidence of recursive structures of one kind or another should be available in all human languages; in fact, recursion, as part of FLN, forms part of the definition of a possible human language. This view was directly challenged by Everett (2005), who argued that Pirahã, an indigenous language isolate spoken in Amazonas, Brazil, lacks evidence for what is often seen as the clearest form of syntactic recursion, namely sentential embedding. If this conclusion is correct, then the view of FLN espoused by Hauser, Chomsky and Fitch may be challenged (although there are reasons to question this conclusion, as we will see below). More generally, since Hauser, Chomsky and Fitch were articulating a particular version of the general programme of generative grammar as formulated originally by Chomsky (1955/1975, 1957), Everett's conclusions may be seen as a challenge to the entire enterprise of generative grammar as it has been conceived since the 1950s; this is certainly how Everett himself sees them.²

Unsurprisingly, Everett's conclusions have been controversial; for extensive discussion of the nature of the syntactic evidence for and against recursion, and how this may or should be interpreted, see Nevins, Pesetsky and Rodrigues (2009a, 2009b), Everett (2009) and Sauerland (2010b). Everett's views have also received considerable media attention, in the form of two popular books by Everett himself (Everett 2008, 2012), one film, articles in *The New Yorker* and elsewhere, and regular appearances by Everett in the media.³

The central question which the chapters collected here address is then: what is the evidence from the indigenous languages of Brazil and elsewhere for and

² In fact, Everett (2005) goes further than this, in that he suggests that in order to fully understand the grammar of Pirahã it is necessary to take into account certain cultural beliefs he claims to be held by the speakers of that language. As Everett points out, this alleged inseparability of grammar and culture challenges more deeply held views in mainstream linguistics, views which were inherited by generative grammar from the earlier American and European structuralist traditions.

³ For the *New Yorker* article, see www.newyorker.com/reporting/2007/04/16/070416fa_fact_colapinto. For a presentation of Everett's views on American National Public Radio, see www.npr.org/templates/story/story.php?storyId=9458681. The film is *The Grammar of Happiness*, produced by Essential Media (www.essential-media.com/node/119). See also www.bbc.co.uk/radio4/science/thematerialworld_20060622.shtml, an occasion on which Everett and the present author attempted to debate the issues within the confines of a live radio programme, arguably not the optimal environment for this kind of discussion.

against recursive structures in natural language? On the simplest interpretation of what is at stake here, one could think that if such evidence is not directly forthcoming, then it is right to conclude, as Everett and others (notably for example, Evans and Levinson 2009) have, that the Chomskyan programme for linguistic theory is so fundamentally flawed that it must be abandoned. If, on the other hand, irrefutable evidence for such structures is available, then Everett's challenge can be deemed to have failed, and Chomsky's programme is thereby supported. The chapters in this volume certainly tend to favour the latter conclusion. Moreover, such a conclusion would in any case be naive. One could argue, as Chomsky himself has done (Chomsky 2012:30), that the absence of recursion in Pirahã proves nothing about the overall nature of the human language faculty, any more than the discovery of a group of humans who do not walk upright would disprove our innate capacity for bipedalism. Alternatively, one could argue that any linguistic structure containing more than two elements must feature binary Merge and is hence recursive, and so Everett's observations regarding Pirahã syntax are beside the point.

What is at stake in these debates is more than either the question of the correct analysis of various syntactic structures in a range of languages (from Brazil or otherwise, Indo-European or otherwise, "exotic" or otherwise), or the correctness of an influential theory of language. These debates go deeper: they directly address the question of what it is to be human. The capacity for the acquisition of complex language under naturalistic conditions without explicit instruction is universal to, and unique to, human children. The human capacity for language underpins human culture, civilisation and technology. Therefore, our view of the essential nature of language profoundly informs our view of human nature, the human mind and human culture.

For Chomsky, as we saw from the brief summary of Hauser, Chomsky and Fitch (2002) above, the central property of language is the fact that sound and meaning (the two interfaces implicated in the FLB) can be related over an unbounded domain; Berwick and Chomsky (2015:1) refer to this as the Basic Property of human language. This is possible because the two interfaces are mediated by the syntactic component whose central formal property is Merge. Recursion lies at the very heart of the definition of the language faculty (broad or narrow). It is the cognitive capacity to manipulate symbols in a recursive fashion that is central to human nature. To the extent that this ability is not shared with other species, it must be somehow instantiated in the human genome, such that the genetic blueprint for building a human brain contains an "instruction" to create the neural substrate for such representations (in our current state of ignorance, we have no more idea as to how these representations are neutrally instantiated than we do of how any "higher" cognitive functions are). The ability to manipulate such structures emerges spontaneously in human development, as long as (and perhaps as soon as) a child is exposed to

language. Somehow, at some stage since the human lineage diverged from that of the most closely related primates, this cognitive capacity must have evolved (see Berwick and Chomsky 2015 for a recent discussion of language evolution in the light of the Basic Property).

But there is more, at least arguably. The cognitive capacity to manipulate symbols using a recursive schema such as Merge may underlie other human abilities: our ability to manipulate numbers (Merge is formally very close to the successor function, the recursive function S such that $S(n) = n+1$ for every natural number n), our musical capacities (Lehrdahl and Jackendoff 1983), our moral sense (Hauser 2006) and our capacity to recognise and ascribe content to other minds (i.e. Theory of Mind, deVilliers 2007). Thus much of what many would agree makes us human may be traceable to a simple formal property of human mental computation. There is, moreover, a still deeper point at stake here, one with its origins in Cartesian philosophy: the recursive nature of syntax is a necessary component of what Chomsky has called the “creative aspect of language use”, i.e. the fact that humans are able to produce and understand utterances that have never been produced before. This formal property quite literally allows us to give expression to our freedom of will. So the postulation of the ability to produce recursive cognitive representations elegantly captures profound aspects of human uniqueness.

Everett’s view, on the other hand, takes culture as the central concept in understanding human language and human nature. Culture, rather than computation, is the key to the understanding of human nature (although Everett does not deny that humans are capable of recursive cognition; he merely asserts that it is not central to natural-language syntax). In order to understand the nature of human cognition, we must understand human culture and cultural evolution. Language is, as the title of his 2012 book implies, a cultural tool: something that, like other tools, humans have invented; something that may vary greatly from culture to culture, and that has developed through cultural, rather than biological, evolution. The fundamental nature of language is determined by society, rather than by any property of the individual. Hence, since Pirahã culture differs profoundly from “Western” culture, it is no surprise that the Pirahã language should also differ profoundly from (Indo)-European languages, structurally and in many other ways too (see in particular Everett 2005 for details on several strikingly “exotic” aspects of Pirahã).

These two views arguably reflect two rather different historical currents in linguistics (they are obviously also connected in a very general way with rationalist as opposed to empiricist views of epistemology). We can, in a rather superficial but nonetheless useful way, discern two distinct traditions in the linguistics of the past centuries. On the one hand, there is the “comparative/historical” approach, and on the other the “formal/universalist” approach.

The comparative/historical approach dominated nineteenth-century linguistics, leading to the establishment of many of the major language families of the world through painstaking empirical work and the development of the informal methodology of comparative reconstruction. It has its roots in the orientalism of Sir William Jones, Friedrich Schlegel (see Schlegel 1808), as well as in medievalism (see the work by the Grimm brothers on aspects of medieval German language and folklore: Grimm and Grimm 1812–1815), and, more generally, in German Romanticism. This approach to language is particularist, in that details of individual languages are focussed on without regard to issues concerning language universals. The emphasis is empirical and historical, and questions such as the nature of the relation between language and logic play little or no role. Instead, the emphasis is by and large on cultural and historical explanation. Language is, if anything, the mirror of society and history, rather than the mirror of the mind. In addition to Jones, Schlegel and Jakob Grimm, this approach to linguistics is epitomised by Bopp (1816), and was in many respects inherited by Saussure (1916) and Bloomfield (1933) (although both of the latter authors made interesting comments on universals; see Roberts (2007); moreover, starting with Osthoff and Brugmann (1878), a more formal approach to comparative reconstruction based on the regularity of sound change emerged). It is also to a large extent the approach to linguistics that characterises modern language typology from Greenberg (1963) onwards (especially more recent typological work which has moved away from the postulation of implicational universals of the Greenbergian kind in favour of diachronic and areal accounts for similarities across languages; see for example Bickel 2007).

On the other hand, the “formalist/universalist” tradition has its modern origins in seventeenth-century rationalist philosophy (its ancient origins lie in Stoic and Platonic philosophy), in particular in the work of the Cartesian Port-Royal grammarians (see Arnauld and Lancelot 1660). It is primarily concerned with the search for universal features of language. There is a related concern for the relation of grammar to logic, and, more generally, for the connection between the laws of language and the laws of thought. There is a concomitant emphasis on formalisation for precision and clarity. The first attempts in the modern era to formalise thought and language originate with Dalgarno (see Cram and Maat 2001), John Wilkins (Wilkins 1668) and, most intriguingly, Leibniz (see Leibniz 1666; Watumull and Roberts 2014). In the mid-nineteenth century, Boole attempted to formalise thought (Boole 1854), with the great breakthroughs in modern logic coming half a century later (Frege 1892; Russell 1905). Through a well-known historical path (see Tomalin 2003 for details), Russell and Whitehead’s (1910–1912) attempt to formalise arithmetic on logicist principles eventually led to the development of recursive-function theory in the

1930s, and this led directly to Chomsky's formalisation of natural-language syntax (Chomsky 1955/1975).

It would seem obvious, even on the basis of this superficial presentation, that Chomsky epitomises the “formalist/universalist” approach, while Everett may represent (perhaps a rather extreme version of) the “comparative/historical” approach. But this is not really my point here, and again I leave the readers to their own conclusions on this (and, indeed, on the validity of the distinction I have tried to make). What I would like to suggest, instead, is that the chapters in this volume, with their great attention to the empirical detail of certain constructions in the indigenous languages of Brazil, their concentration on psycholinguistic experimentation, and/or the emphasis on the detailed study of aspects of child language, in fact represent a consilience of these two strands in linguistics. What we see in the chapters that follow is a set of highly empirical studies of linguistic phenomena in the service of attempting to resolve a profound question about the nature of human language and thought. The two historical strands converge. Most strikingly in the discussions of the indigenous languages of Brazil, we see very clearly how close attention to fine empirical detail and a clear, precise, formal sense of the overarching theoretical questions fundamentally inform one another. This book is testimony to what, when the right questions are posed and the answers are carefully and intelligently sought, modern linguistic theory can achieve. At its best, as here, modern linguistic theory is the true heir to both traditions.

Ian Roberts

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Interlinear Gloss Abbreviations

1	First person
2	Second person
3	Third person
&	Coordinating conjunction
A1	First person agreement, Class A
ABS	Absolutive
ABS.AGR	Absolutive copular agreement
ACC	Accusative
ADMON	Admonitive
ADVZ	Adverbializer
AFFEC	Affected
ALT	Alternate
AN	Anaphoric
APPL	Applicative
ARG	Argument
ASSERT	Assertive
ATEL	Atelic
AUX	Auxiliary
B1	First person agreement, Class B
CAUS	Causative
CCERT	Complete certainty
CLS	Classifier
COLL	Collective
COMP	Complementizer
CONTR	Contrastive subject
COP	Copular
CORR	Co-referential prefix
DECL	Declarative
DEIC	Deictic
DEP	Dependent
DES	Desirative
DIFF	Diffuse

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xxiv Interlinear Gloss Abbreviations

DIM	Diminutive
DISLOC	Dislocation
DIST	Distal
DPAST	Distant past
DS	Different subject
DUB	Dubitative
EMB	Embedded verb form
EMP	Emphatic
EP	Epenthetic vowel
ERG	Ergative
EVID	Evidential
EXCL	Exclusive
EXRT	Exhortative
FACT	Factual
FOC	Focus
FRUS	Frustrative
FUT	Future
GEN	Genitive
HSAY	Hearsay
IMP	Imperative
IMPF	Imperfect
IMPRS	Impersonal
INCL	Inclusive
INF	Infinitive
INFER	Inference
INS	Instrumental
INTNSF	Intensifier
IPAST	Immediate past
ITER	Iterative
LNK	Linking consonant
LOC	Locative
LOG	Logophoric
MASC	Masculine
MIR	Mirative
MOT	Motion
NEG	Negation
NFUT	Non-future tense
NMLZ	Nominalizer
NOM	Nominative
NONPRES	Non-present tense
NONVIS	Nonvisual
OBJ	Object

Interlinear Gloss Abbreviations

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OBL	Oblique
OFC	Object focus construction
PAST	Past tense
PERF	Perfective
PL	Plural
PNCT	Punctual aspect
POSP	Postposition
POSS	Possessive
PROG	Progressive
PROX	Proximal
PURP	Purposive
Q	Interrogative
QUOT	Quotative
RCERT	Relative certainty
REF	Referential
REFL	Reflexive
REL	Relational
REM	Remote
S	Subject
SG	Singular
SS	Same subject
SUPP	Suppositional
TEL	Telic
TOP	Topic
UDPAST	Unattested distant past
V	Verb
VIS	Visual

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