The Nature of Grammar, its Role in Language and its Evolutionary Origins

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Abstract

Grammar is more than just order and hierarchy; it is a way of expressing complex multidimensional schemas in one dimension. The need to communicate these schemas is the concern of language, but how they are communicated is the concern of grammar. Because grammar does not necessarily rely on the pre-existence of language, it is possible for the elements of grammar to be prototyped as features of other mental systems before language appears. These elements can then be exapted as needed for language. So the genesis of language and the genesis of grammar do not necessarily need to be considered as a single process.

In this dissertation, the continuity of language with other forms of signalling is reviewed. Language as a communicative act has the same structure as nonhuman signalling: the components in both cases are sender, receiver, message and referent. The sender is always *me*, the first person, and the receiver is always *you*, the second person. These roles are invariant in all signalling, including language, and there is no need for them to be explicit in the signal. The nonhuman signal has to express only the referent or context – a single unsegmented call will suffice. The specific action to be undertaken by the receiver in the presence of this signal is also implicit, but where the referent is significant only to the sender, the action is significant only to the receiver. A single unsegmented call does both jobs simultaneously.

This view of signalling, however, relies on a disinterested viewpoint. It incorporates the individual views of the sender (the context in which the call is made), the receiver (the reaction the call produces) and the third party (the effect the call has on the third party). These three approaches to the signal are all available to the disinterested observer, here referred to as the fourth person. Being able to adopt this fourth-person viewpoint is, however, something very unusual in nature, and it may be that only humans can do it.

This dissertation also looks at both the structure and process of grammar. In linguistics these two aspects of grammar are often seen as difficult to reconcile: the structural approach of Formalist linguistics is contrasted, rather than combined, with the process descriptions of Functionalist linguistics, producing a separation of methodologies and even philosophies. The two approaches are complementary, however, and they need to be combined if the origins of grammar are to be fully understood.

Language, unlike most nonhuman signalling, is segmented. Formalist linguistics shows us that there are distinct forms involved in this segmentation (Noun Phrase, Verb Phrase, Prepositional Phrase, etc); but the fact that some roles can contain others creates a recursive hierarchy in language that is missing from nonhuman signalling. The segmented nature of language is dictated by the various forms, and by the recursive capacity that this hierarchy of forms needs. However, language also differs from nonhuman signalling in that it is multistratal: what is passed in a language message is not a single unambiguous value but a set of interrelated meanings. The meanings involve the relation between sender and receiver, the relation between the message and the coding structure, and the relation between the message and the conceptualised world. This transfer of meaning on three levels is the Functionalist view of language.

An important cognitive difference between humans and nonhumans is the ability to make models of the self. It is shown that this ability is problematic in evolutionary terms. Self-modelling requires the capacity to be dispassionate about the self and see the other party's point of view; but how can accommodating the needs of reproductive rivals become a successful strategy? In this dissertation it is shown that the ability to model others is probably quite ancient, while the ability to model the self can only come about in a co-operative linguistic environment. Yet both self-modelling and other-modelling are deeply implicated in the grammar of language: modelling is the mechanism that powers social calculus, and social calculus is behind the two-argument instigator-action-recipient form which has clear relationships with the three-argument instigator-action-recipient-context form of language grammar.

The dissertation proposes that the development of grammar structures is explicable in terms of social calculus, but the transition from internal social calculus to external language is only explicable in terms of a cultural revolution. Enhanced social modelling creates the conditions for advanced social calculus, and the syntax of social calculus corresponds to the form of simple language grammar. However, social calculus alone did not create the environment in which syntactic language appeared; it required a cultural revolution to create the necessary conditions for co-operation and sharing of the social calculus.

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How Odin Discovered the Secret of Writing

"I trow that I hung on the windy tree,
swung there nights all of nine;
gashed with a blade bloodied by Odin,
myself an offering to myself
knotted to that tree
no man knows whither the root of it runs.

"None gave me bread, none gave me drink,
down to the depths I peered
to snatch up runes with a roaring screech
and fall in a dizzied faint!

"Wellbeing I won, and wisdom too,
and grew and joyed in my growth;
from a word to a word I was led to a word
from a deed to another deed."

Lay of the High One, stanzas 138, 139, 141 (Old Norse verse)

From:
Raymond Buckland. 1974.
The Tree: the complete book of Saxon witchcraft, p15.
Samuel Weiser inc: York Beach, USA.

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1. Discussing Grammar Origins

1.1. Segmented Signalling: something special?

What is it about human signalling that makes it so different from the signalling of other animals? We know that humans have achieved levels of interpersonal co-operation that have few analogues in nature; and language, our mode of signalling, would seem to be heavily implicated in facilitating that co-operation. Yet when we try to isolate the differences between language itself and other forms of signalling, the exclusivity of language becomes conditional and hard to define.

One feature that is largely exclusive to language is segmentation (also called analyticity). Language signals consist of a hierarchy of morphemes (meaningful parts of words), words, phrases, sentences and texts, all of which act as segments for building meaning into the signal. The presence of segmentation is one of the ways we differentiate language from other signals[1].

Linguistic segmentation allows two different outcomes: variation of meaning, or semantic segmentation, and representational variation, or morphemic segmentation. Semantic segmentation and morphemic segmentation are related in that they both break the one-to-one link between a signal and its value to the receiver.

Semantic segmentation means that the same signal can have several different values to the receiver, dependent on features outside of the signal itself. For instance, the word *red* relies on the context in which it is said: among its many possibilities it can refer to a colour (*red sky at night*), a political stance (*reds under the bed*), a football team (*the Reds*) embarrassment (*my face is red*), or anger (*he's red in the face*). This form of segmentation is often referred to as polysemy or homonymy.

Morphemic segmentation means that a signal can consist of more than one sign, each of which has its own value, and which can be brought together to create a new value while still retaining their individual values. For example, *up*, *side* and *down* all have individual directional meanings, but the meaning of *upside down* is not completely predictable from those individual meanings. This form of segmentation is often referred to as compositionality.

[1] **Alison Wray**, Holistic Utterances in Protolanguage: the link from primates to humans. In Chris Knight, Michael Studdert-Kennedy & James R Hurford (eds), *The Evolutionary Emergence of Language: social function and the origins of linguistic form*, pp296-297

Most signals in nature are semantically holistic: they may be complex, like birdsong, but they have only one meaning, or value, to the receiver[2]. When a bird is seeking a mate, its song is valuable to the potential mate only as a device for assessing breeding fitness and offspring success. When a bird is using the same song to mark its territory, it is valuable to the potential rival only as an indicator of the singer's ability to rebuff a challenge. The same song can have different values for different receivers simultaneously, but to each receiver it has only one value, regardless of context, and it is this single value to the receiver that makes it holistic.

In contrast, a segmented signal can be simple and consist of a single undifferentiated form: the human affirmative *yes* is an example. Among its many meanings, *yes* can mean agreement with what the previous speaker said (*it's raining outside*); it can provide information that the previous speaker did not have (*is it raining outside?*); or it can indicate collusion in a joint enterprise (*shall we go out in the rain?*). The receiver of the *yes* relies on context, or reference, to understand what the sender intended; and this context can be within the sender-receiver discourse, or within the shared environment.

In language we see both forms of segmentation at work simultaneously. We use constructs consisting of a series of semi-independent components, and we flag the relationships between the components by relative position or with markers. For instance, in English we use position, so *man bites dog* has a different meaning to *dog bites man*; Latin uses suffix markers, so *homo canem mordet* and *canem homo mordet* both mean *man bites dog*, while *hominem canis mordet* and *canis hominem mordet* both mean *dog bites man*. Both markers and positional effects are part of what we describe as the grammar of language.

Cost is an important factor in understanding signalling: if the fitness costs of a signal to the sender exceed the benefits then Darwinian accounting tells us the signal will not be made; and if the costs to the receiver exceed the benefits then it will be ignored and will not be worth making. Only signals which give relative advantages to both sender and receiver should survive[3].

With holistic signals, the sender bears the cost of the signal. This cost may be in its generation – it is a loud, energy-costly display; or in its utterance – it makes the signaller conspicuous. The

[2] **Jack W Bradbury & Sandra L Vehrencamp**, *Principles of Animal Communication*, pp473-474
[3] **Alan Grafen**, Biological Signals as Handicaps. In *Journal of Theoretical Biology*, 144 (1990), pp517-546

cost of making the signal is a measure of the honesty of the signal: if a signal is expensive to the sender then it will only be made when the sender has to make it[4]. The receiver can concentrate on the quality of the signal and not have to worry about the qualities of the signaller; which means that the value, or function, of a holistic signal has a reliable indexical correspondence with the signal itself.

In contrast, human language is a very poor indicator of honesty. Segmented signals have to be cognitively composed and decomposed: there is a cognitive cost to be paid by both the sender and receiver. The sender has to form the signal properly to ensure that ambiguity of meaning is minimised, and the receiver has to decode a meaning out of the segmented signal offered. In a segmented language signal there are at least two levels of meaning: what the individual segmented components of the message mean (semantic analysis); and what the message itself means (representational analysis). These two levels need not point at the same meaning; so, with segmented signalling, the co-identity of the sign value and signal value breaks down[5]. For example, idioms, like *he's a chip off the old block*, have a meaning as a message that is not predictable from the component meanings. Additionally, the need for conscious cognitive construction of a language signal means that a level of volition is required by the sender, and the sender can therefore adjust the quality of the signal, affecting its indexical trustworthiness[6]. This imposes a further cognitive cost on the receiver: the receiver has to assess the qualities of the sender separate to the qualities of the signal to know whether this particular signal is reliable.

The extra cognitive costs in segmented signalling are not trivial: brain cells are one of the most costly cell types in the body[7], so there should, theoretically, be just enough to get the jobs of survival and reproduction done. In humans (and, to a lesser extent, in all primates) there would appear to be much more brain than is needed for these simple tasks[8]; yet it is only in humans that the extra brain is set to the job of communicating complex messages to others. The ecological niche for primates has required them to live in increasingly complex social groups, and their extra brain mass seems to be largely dedicated to survival and reproduction via social manipulation. This social manipulation involves dealing with conspecifics (animals of the same species) as objects that have intentions, using what Byrne and Whiten call Machiavellian

[4] **Amotz Zahavi & Avishag Zahavi**, *The Handicap Principle: a missing piece of Darwin's puzzle*, ch2
[5] **Umberto Eco**, *A Theory of Semiotics*, pp163-167
[6] **Chris Knight**, Play as Precursor of Phonology and Syntax. In Chris Knight, Michael Studdert-Kennedy & James R Hurford (eds), *The Evolutionary Emergence of Language: social function and the origins of linguistic form*, pp113-114
[7] **Leslie C Aiello & Peter Wheeler**, The Expensive Tissue Hypothesis: the brain and the digestive system in human and primate evolution. In *Current Anthropology*, Vol 36 No 2 April 1995, pp199-221
[8] **Leslie C Aiello & R I M Dunbar**, Neocortex Size, Group Size and the Evolution of Language. In *Current Anthropology*, vol 34 no 2 April 1993, pp184-193

Intelligence[9]. Any information an individual has about other group members becomes key to survival and reproduction, and the more the individual alone knows the greater its manipulative potential. To give away information in this environment is to give away advantage. Signalling should become less rich as the need for more sophisticated social interaction grows and voluntary signals become subject to cognitive deception strategies[10].

Additionally, segmented signalling is in part a response to a problem that just does not occur in most signalling. Signals have to be distinct from each other to ensure rapid apprehension: if the range of required signals grows beyond the range of possible signals then combinatorial signals become necessary. In human language, the potential range of signals is incredibly large (some say infinite[11]), and the distinct sound formants that humans actually use in language production are quite limited[12]; but for most animals the number of signals they need to produce and apprehend is considerably less than the number of distinct signals they could produce. The English word *bat* is differentiated from *pat* by voicing on the first phoneme, and *hat* is differentiated by lip positioning: small formant changes make large semantic differences, because our sign-to-sound landscape is so cluttered. In contrast, the leopard, snake and eagle warning calls of the vervet monkey (*Cercopithecus aethiops*) are very different, and there are no intermediate signals[13] – the vervets just don't have that much to signal to each other vocally.

Any genetic explanation for segmented utterance in human signalling has to address these three issues: the cost of comprehension, the willingness to give away free information, and the need for signals to be highly combinatorial. Appealing to the advantages of language to explain these features is circular: the features have to be in place before language, with its advantages, appears.

There are some examples of segmented signals in nonhuman signalling. Among others, Klaus Zuberbühler has identified a diana monkey (*Cercopithecus diana*) warning call with segmentation used for conditionality[14], Con Slobodchikoff has controversially identified

[9] **Richard W Byrne**, Evolution of Primate Cognition. In *Cognitive Science* Vol 24 (3) 2000, pp543-570
[10] **Michael Tomasello & Josep Call**, *Primate Cognition*, pp233-242
[11] **Noam Chomsky**, *On Nature and Language*, p46
[12] **David Crystal**, *The Cambridge Encyclopedia of Language 2nd edition*, p162
[13] **Dorothy L Cheney & Robert M Seyfarth**, *How Monkeys See the World: inside the mind of another species*, pp119-120
[14] **Klaus Zuberbühler**, Referential Labelling in Diana Monkeys. In *Animal Behaviour* 2000 59, doi: 10.1006/anbe.1999.1317, pp917–927

adjectival segmentation in the warning calls of prairie dogs (*Cynomys gunnisoni*)[15], and Karl von Frisch's work with honey bees (*Apis mellifera*) has demonstrated that their waggle dance has several segmentational meaning-changing markers[16]. There is no good reason, therefore, to see segmented signalling as an exclusive feature of *Homo sapiens*; but the way in which we use it (to produce and comprehend complex, easily subverted, highly combinatorial signals) does seem to be exclusive.

1.2. Why Segmented Signalling is Important

Although segmentation is an important difference between human language and nonhuman signalling, it is not the only difference; nor, as we have seen, is it an absolute difference. Segmented signalling does, however, have particular significance in language: because language grammar is a rule system for combining separable meaning units, the segmentation function is intrinsic to grammar. An explanation of the origins of segmented signalling is also, in part, an explanation of the origins of grammar.

An explanation of the origins of segmented signals will also provide clues to the continuing process of grammaticalization, which is at work in any living language. Grammaticalization is the process whereby lexical forms become grammatical markers and rules, and *vice versa*[17]. For instance, the repeated use of a phrase can give it idiomatic value, merging the morphemes until they cease to be constituents of meaning and become merely syllabic forms: *decision* no longer means the outcome of cutting, although we can see the way in which the former morphemes (*de*, emergent from; and *cissere*, to cut) formed the new meaning of *decision*. If we understand the conditions that led to the original segmentation in language then we will understand better the dynamics which create continued pressures for analytic separation and formulaic merging of language signals.

Human language is unusual in that it is involved not just in *telling*, but in *telling-about*; it is representational as well as referential[18]. A sender is able to express to the receiver a relationship between two other things. The parties *in* the message do not necessarily co-identify with the parties *to* the message, so they are not fixed by the signalling process and must be made explicit. By itself this does not require segmented signalling, but the range of separately identifiable

[15] **C N Slobodchikoff**, Cognition and Communication in Gunnison's Prairie Dogs. In Marc Bekoff, Colin Allen & Gordon M Berghardt (eds), *The Cognitive Animal: empirical and theoretical perspectives on animal cognition*, pp257-264
[16] **Karl von Frisch**, Decoding the Language of the Bee, *Nobel Lecture*, December 12, 1973
[17] **Paul J Hopper & Elizabeth Closs Traugott**, *Grammaticalization*, ch1
[18] **Marc D Hauser**, *The Evolution of Communication*, pp504-509

things and the multiplicity of relationships between them soon exhaust a holistic signalling system.

For instance, if we assume a hominid tribe of 30 individuals in which each individual has a relationship with every other individual, then these relationships can be described, at their simplest, as positive, negative or ambivalent. In order to signal all these relationships (a-relationship-b), no fewer than 2,610 different holistic informative calls would be needed. Contrast this with the 33 meaning-units that a combinatorial system needs and it is clear that, even in the most basic *telling-about* environment, segmented signals create semantic economies that vastly expand the range of possible signals.

In human signalling, unlike nonhuman signalling, the form within the message can reflect the form around the message. In traditional models of signalling systems the form consists of three components linked by a fourth: there is a sender of the signal, a receiver of the signal, and the referent (or context or cause) of the signal, all linked by the instantiated signal itself[19]. The other three components don't just support the signal, they define it: without a sender there is no signal; without a receiver there is no function to the signal; and without a referent there is no value to the signal. The components have single, discrete roles, but each of the roles can be occupied by a range of objects: different senders can send the same signal to different receivers about different referents. At the level of signalling as a system there is already segmentation, and this is in the nature of the signalling process itself, not in its conventions.

Additionally, the fact that there are three components linked by a fourth means that the structure of signalling has to be two-dimensional. One dimensional topology is the topology of the line, and a line has only two terminators; a one-dimensional linking of components would allow only simple chaining, with each component having at most two components linked to it. The fact that signalling requires three components (sender, receiver and referent) to be linked to the fourth (the instantiated signal or message) means that a one-dimensional model is not adequate to describe signalling.

This fact by itself is trivial, many processes in nature are combinatorial and require two-dimensional (or multi-dimensional) descriptions; and, as long as the signalling process itself

[19] This model goes back at least to **Aristotle** (*Rhetoric*, Book I Part 2), who described three functions of persuasion: the speaker, the listener and the speech itself. He goes on to describe the speech in terms of its content and its truth-values, which correspond largely to message and referent in the terminology used here.

does not need to be signalled, the dimensionality of signalling cannot affect the signal itself. However, the fact that we *tell-about* in language means that we need to tell-about signals made by others – we need to reflect the structure of signalling in the signal itself; and the fact that we use speech, a one-dimensional medium, means that we need hierarchy to convert the two dimensions of signalling into the one dimension of speech.

Traditionally, language grammar is described in terms of sentences, which consist of a verb and one, two or three noun phrase arguments. Many verbs must take two arguments as subject and object to form a sentence; thus *John likes milk* is an acceptable English sentence, where **John likes* and **likes milk* are not (this dissertation will follow the standard linguistics practice of indicating ungrammatical sentences with a preceding *). Many verbs can also produce sentences with only one argument as a subject (e.g. *John knows*). However, there are several verbs, such as the English *put*, which require three arguments: subject, direct object and indirect object: *John* [subject] *put the book* [direct object] *on the table* [indirect object]. **John put the book* and **John put on the table* are not considered complete as stand-alone utterances (although the first is an acceptable answer to the question *what did John put on the table?*). In addition, virtually all verbs that take two arguments can optionally take a third (e.g. *John saw Mary [in the bookshop]*). The two-argument sentence can therefore be seen as a special case of the more inclusive three-argument construct; and the components of language (subject, verb, object, indirect object; or instigator, action, recipient, context) form a similar set to the components of signalling (sender, message, receiver, referent). As we will see, this similarity is significant.

If correct, this approach to the origins of grammar has interesting implications for the study of grammar itself. If we view language grammar as an endogenous formal system of rules then we would expect certain preconditions to be present before language emerges: Hauser, Chomsky and Fitch argue that recursion (the ability of an algorithm to run itself as part of its process) leads to hierarchy and segmentation, and these are the conditions under which the complexity of grammar develops[20]. If, however, we view language as an exogenous response to a communicative need, then the logic is very different. Segmented signalling is a response to the complexity of the communication problem, hierarchy is an outcome of transferring two-dimensional cognitive constructs into one-dimensional speech constructs, and recursion is emergent from segmentation and hierarchy. The model proposed by Hauser, Chomsky and Fitch is turned exactly on its head.

[20] **Marc D Hauser, Noam Chomsky & W Tecumseh Fitch**, The Faculty of Language: what is it, who has it, and how did it evolve? In *Science* vol 298 22 November 2002, pp1569-1579

If recursion is seen as emergent from communicative necessities then formal structure, emergent from recursion, is a response to complexity and not a source of it. The structure of signalling, and the social need to produce signals about it, dictate the form of language[21]. This signalling structure requires no genetic or developmental explanation; it is merely a description of the physical necessities of signalling: like gravity, it imposes conditions on genetic and developmental explanations. In this model there is no need for the form of grammar to be explained by a sudden and massive change to the genetic form of the species – a macromutation[22]. Instead, the problem of recursion is replaced by the much more intriguing question: if we don't produce language because of an inherited need to babble at each other, why do we produce language? What problems does it solve, and what costs do we pay to have those problems solved?

1.3. Solving the Origins of Grammar: who benefits?

The problem to be solved in this dissertation is the origins of grammar: what did grammar emerge from, why, and what were the costs and benefits that it brought? However, there is another question behind this first one: what value does mapping the origins of grammar give us? This must be addressed if solving the first problem is to have any worth. To answer this, consideration will be given to three different disciplines, all of which are currently concerned with the origins of language: Linguistics, Anthropology and Psychology. As these three disciplines form the strongest strands in this dissertation, it is fitting that their needs be specifically addressed.

1.3.1. The Linguistics Question

From a Linguistics viewpoint the problem of language origins is textual: why does language have the form that it does? Language is a segmented and hierarchical system with a variety of components to play with. At the lowest level there is the dichotomy of object-action (or nomination-process, or noun-verb)[23]; which seems to be an innate cognitive distinction[24]; and at the combinatorial level there is the three-argument structure of relating three objects through an action (action with instigator, recipient and context; process with actor, recipient and goal; verb

[21] **James R Hurford**, Social Transmission Favours Linguistic Generalisation. In Chris Knight, Michael Studdert-Kennedy & James Hurford (eds), *The Evolutionary Emergence of Language: social function and the origins of form*
[22] **Noam Chomsky**, *On Nature and Language*, pp146-151
[23] **R L Trask**, *Key Concepts in Language and Linguistics*, p224
[24] **Kevin A Shapiro, Lauren R Moo and Alfonso Caramazza**, Cortical Signatures of Noun and Verb Production. In *PNAS* 2006 103, pp1644-1649

with subject, object and indirect object; finite/predicate with subject, complement and adjunct; and so on)[25]. While some human languages, like Pirahã[26], have been found to be deficient in features that have elsewhere been labelled the *sine qua non* of language, no language has yet been found that does not follow this minimal pair of syntactic rules.

It therefore becomes important to explain the origins of these two conditions in language: why do we differentiate action and object, and why do we use the three-argument structure in our utterances? The answers to these questions have to lie in cognitive principles which are wider than language. If language is part of general cognition then it must operate on the same principles; and if language is not an instantiation of general cognition then it must operate on similar principles, otherwise the semantic interface between general cognition and language would not be able to move meaningful values between the two. A slot-filling model like instigator-action-recipient-referent requires both a segmented signal and an analytic cognitive process, but where did the action-object differentiation and the instigator-action-recipient-referent form come from? The explanation of segmented signalling that will be presented here attempts to place these two conditions of language into a general cognitive context.

1.3.2. The Anthropology Question

For Anthropology, the problem of language origins is experiential: how did humans become able to habitually share knowledge, despite the costs that sharing entails? Selfish gene theory predicts that co-operation is an essentially unstable strategy, always vulnerable to freeloading. Individual sharing activities may become evolutionarily advantageous if each particular freeloading problem can be overcome[27]; but for a whole species-defining set of co-operative activities to appear, too many freeloading problems have to be overcome simultaneously. Yet we are a species defined by co-operation[28], we are committed to high-cost altruistic punishment[29] (we punish others who have broken our group rules regardless of the cost to ourselves), and we share information in a profligate way that is difficult to explain in evolutionary terms[30]. Humans in the past must have developed a series of strategies that enabled co-operation to be a stronger evolutionary force than direct self-promotion, and language must be intimately involved as a source or outcome (or both) of these strategies. This is fortunate

[25] **Michael A K Halliday & Christian M I M Matthiessen**, *An Introduction to Functional Grammar, third edition*, pp106-111
[26] **Peter Gordon**, Numerical Cognition Without Words: evidence from Amazonia. In *Science* vol 306 15 October 2004, pp496-499
[27] **Richard Dawkins**, *The Selfish Gene*, pp183-186
[28] **Wilhelm von Humboldt**, *Linguistic Variability and Intellectual Development*, ch3
[29] **James Moore**, The Evolution of Reciprocal Sharing. In *Ethology and Sociobiology* 5: pp5-14 (1984)
[30] **Jean-Louis Dessalles**, Altruism, status and the origin of relevance. In James R Hurford, Michael Studdert-Kennedy, Chris Knight (eds), *Approaches to the Evolution of Language*, pp130-147

because we have language with us today and, as far as we can tell, it is likely to have qualitative similarities to the language used in earlier human societies. Language is a living fossil that provides clues to the origins of human culture.

So discovering where grammar came from will help us to understand some of the social mechanisms that made us human. Segmentation as a feature of grammar is, therefore, part of the answer to the question of human origins; discovering the cognitive mechanisms which allowed us to see a signal as a set of separable components will also reveal the mechanism that allowed us to produce the complex signals of language. There may even be clues as to why we need such complexity in the first place. Segmentation is, after all, part of our ability to plan: our ancestors needed to be able to analyse a task into component steps in order to perform such complex activities as Acheulean handaxe production[31] and co-operative hunting[32] 1.5 million years ago. Could the segmented nature of language help us to understand when and how cognitive segmentation became so easy for us?

1.3.3. The Psychology Question

For Psychology, the emphasis in the language origins problem is interpersonal: what makes for a successful transfer of information, and why is language so effective in this role? Why do humans collude in constructing a shared meta-reality, and what role does language play in this? From a psychological viewpoint the mystery of language is in its symbolic nature. Is the symbolism we use in language a product of symbolic cognition, or vice versa? This is important because every human life starts with a pre-symbolic mind, but this situation changes radically during childhood[33]. For the infant there appears to be no element of speculation in their existence: they have problems understanding the minds of others[34], they cannot lie effectively[35], they have difficulties differentiating lifelike photographs from real objects[36], and they cannot use language in a fully segmented way[37]. Yet, by the age of five, most children have no problems with any of the above concepts. Additionally, they positively enjoy being told about fantastic worlds where dragons guard great treasures, wizards fly on broomsticks and mundane wardrobes open onto magical lands. In short, they have not just developed symbolic thought,

[31] **Marek Kohn**, *As We Know It: coming to terms with an evolved mind*, ch3
[32] **Peter J. Richerson & Robert Boyd**, Built for Speed: Pleistocene climate variation and the origin of Human culture. In F. Tonneau & N.S. Thompson (Eds.). *Perspectives in Ethology. 13. Evolution, culture and behavior*, pp1-45
[33] **Alison Gopnik, Andrew Meltzoff & Patricia Kuhl**, *How Babies Think*, pp143-164
[34] **Michael Tomasello**, *The Cultural Origins of Human Cognition*, pp56-61
[35] **Sarah Brewer**, *A Child's World: a unique insight into how children think*, ch2
[36] **Judy S DeLoache**, Mindful of Symbols. In *Scientific American*, volume 293 number 2, August 2005. pp60-65
[37] **Ray Cattell**, *Children's Language: consensus and controversy*, ch1

they have embraced it.

Segmentation is key to understanding symbolic thought. It is involved in the mental structures that govern the modelling of symbolic relationships. In order to make models of others interacting we have to be able to create models of those others separate to our models of the interaction. This is not a holistic process: first we need the modelled concepts of two other individuals, then we need to model the interaction between them. In the case of humans, this knowledge of others is enhanced by knowledge of the motivations of those others: we don't just read possible outcomes, we "mindread" others to identify the motivations behind those outcomes. How, as a species, did we get to be good at this?

1.4. Segmented Signalling: the forgotten solution?

While segmentation is important in language, and is a clear difference between language and most nonhuman signalling, it has taken second place in most theories of language origins. For many theorists, segmented signalling by itself is not a significant source of grammar[38] [39] [40]. The secret of language must lie in its ability to handle hierarchy, order and recursion – these are all features not found in nonhuman signalling, whereas segmented signalling has several instantiations outside of language. It is not the ability to analyse a signal into its components that is important, but the ability to build up those components in meaningful ways[41] [42].

Other approaches have looked at the symbolic nature of language, contrasting it with the indexical nature of nonhuman signals[43] [44] [45]. Or they have concentrated on the fact that language has a learned component, where most nonhuman signals are genetically innate[46] [47] [48]. Or they concentrate on the remarkable fact that language is channel-independent: the same sign can be

[38] **Derek Bickerton**, Catastrophic Evolution: the case for a single step from protolanguage to full human language. In James R Hurford, Michael Studdert-Kennedy & Chris Knight (eds), *Approaches to the Evolution of Language: social and cognitive bases*, ch21
[39] **Noam Chomsky**, *New Horizons in the Study of Language and Mind*, pp173-194
[40] **Michael C Corballis**, Did Language Evolve from Manual Gestures? In Alison Wray (ed), *The Transition to Language*, ch8
[41] **Marc D Hauser, Noam Chomsky & W Tecumseh Fitch**, The Faculty of Language: what is it, who has it, and how did it evolve? In *Science* vol 298 22 November 2002, pp1569-1579
[42] **James R Hurford**, The Language Mosaic and Its Evolution. In Morten H Christiansen & Simon Kirby (eds), *Language Evolution*, pp43-44
[43] **Daniel C Dennett**, *Kinds of Minds: towards an understanding of consciousness*, pp173-176
[44] **Herbert S Terrace**, Serial Expertise and the Evolution of Language. In Alison Wray (ed), *The Transition to Language*, pp82-84
[45] **Merlin Donald**, *A Mind So Rare: the evolution of human consciousness*, pp274-279
[46] **Terrence Deacon**, *The Symbolic Species: the co-evolution of language and the human brain*, ch4
[47] **Jean Aitchison**, *The Articulate Mammal: an introduction to psycholinguistics*, ch7
[48] **Geoffrey Sampson**, *The 'Language Instinct' Debate, revised edition*, ch1

given through different signalling media[49] [50] [51] – vocal, written, signed, and so on. Or they show that the primary channel, speech, may have imposed its own limitations on language form[52] [53] [54]. All of these theories look at the ways in which language differs from nonhuman signalling. Because the differences are substantial there is a tendency to emphasise them, sometimes to the point where language is seen as having no correspondences at all with nonhuman signalling[55]. Even where language is seen as continuous with nonhuman signalling, the nature of the continuity is usually underdefined[56] [57]. However, while examining discontinuities is useful in describing the differences between language and nonhuman signalling, it is unhelpful in relating language back to any pre-language state.

In fact, it seems impossible to close the gap between language and nonhuman signalling starting from the language end: to imagine *modern language less x* is difficult and artificial, and tends only to show that there are many ways in which modern language could have developed. Starting from nonhuman signalling, on the other hand, it is possible to build a consistent incremental model. However, such models always reach a stage where signalling is no longer evolutionarily viable – the signal becomes intrinsically untrustworthy, or the simultaneous appearance of encoding and decoding capacity is unlikely, or clarity is compromised by complexity[58]. Segmentation by itself does not help us to bridge this gap, and an alternative explanation is needed. Consideration is given to this problem in chapter 8, *From Nonhuman signalling to Language*.

1.5. Mapping the Dissertation

As well as the introduction, this dissertation is composed of three sections. The first section, chapters 2 to 8, sets out the main theory and shows how it fits with current knowledge in the areas of linguistics, anthropology and psychology. The second section, chapters 9 and 10, sets out some of the evidence in support of the theory; and chapter 11 provides a summary and conclusion.

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[49] **David F Armstrong, William C Stokoe & Sherman E Wilcox**, *Gesture and the Nature of Language*
[50] **Michael C Corballis**, *From Hand to Mouth: the origins of language*, ch3
[51] **Horst D Steklis & Stevan R Harnad**, From Hand to Mouth: some critical stages in the evolution of language. In Stevan Harnad, Horst D Steklis & Jane Lancaster (eds), *Origins and Evolution of Language and Speech*, pp445-455
[52] **Philip Lieberman**, *Eve Spoke: human language and human evolution*, pp118-132
[53] **Andrew Carstairs-McCarthy**, *The Origins of Complex Language: an inquiry into the evolutionary beginnings of sentences, syllables and truth*, ch5
[54] **April McMahon**, *Change, Chance and Optimality*, ch2
[55] **Noam Chomsky**, *The Architecture of Language*, pp3-4
[56] **Steven Pinker**, *The Language Instinct*, ch11
[57] **Derek Bickerton**, *Language and Species*, pp100-104
[58] **Chris Knight**, Language and Revolutionary Consciousness. In Alison Wray (ed), *The Transition to Language*, pp138-160

Within section 2, the first task is to clarify terms. Different disciplines use the same terms differently and, as this dissertation is trans-disciplinary, it is important to establish a common ground. Chapter 2 is therefore concerned primarily with building a common framework of terminology.

In chapter 3 the structure and process of signalling is examined. It is shown that the components identifiable in the signalling structure largely correspond to the functions of the signalling process. This is not a given, process does not always map so well onto structure. It is more common for structure to define the framework of the system while process defines the interrelationships within that framework. For instance, if we are describing an organisation as a structure then the components are both the individuals and the subunits into which those individuals are organised: the structural view is hierarchical. As a process, the organisation is goal-oriented: it is a series of functions organized serially or in parallel to achieve specific goals. The functions of the process cannot be described in terms of the components of the structure because there is no one-to-one mapping. Chapter 3 therefore looks at the particular features of signalling that, unusually, largely permit a one-to-one mapping between structural components and process functions.

In chapters 4 to 6, language is considered as a specific case of signalling, both as a structure and as a process. The traditional linguistic approaches of Formalism and Functionalism are identified with structure and process respectively; and it is shown that the two approaches are both productive descriptions of language, although very different. In language, the correspondence of structural components to process functions is less marked than in signalling. It is strong enough for the Formalist and Functionalist models to be compared, but weak enough for each to find the other wanting. Chapters 4 to 6 argue that both Formalist and Functionalist approaches are productive, but a synthesis provides a better understanding of language as signalling.

Chapter 7 moves away from signalling, and looks at the role of modelling in language. Consideration is given to the ways in which others can be modelled as intentional beings, and the ways in which we are able to make models of ourself. The necessary levels of awareness needed to make these models is explored, and it is argued that there is something very odd, in evolutionary terms, in having the ability to make mental models of the self. This oddity is so unDarwinian, and so central to the genesis of grammar, that self modelling can only be

explained if it is explicitly linked to strong evolutionary processes from which it can emerge. The chapter will attempt to describe these processes, rather than accept them as proved just because language is a current given.

Chapter 8 examines the evolutionary roots of grammar. It considers the questions of where and when grammar appeared. It will also look at the much thornier question of *how* grammar appeared. Any attempt to describe the origins of language or grammar is doomed to speculation, so the origins proposed here are linked closely to existing theories: the Female Kin Coalition model of Chris Knight, Camilla Power and Ian Watts[59], the Vigilant Sharing model of David Erdal and Andrew Whiten[60], and the Reverse Dominance theory of Christopher Boehm[61]. Because of the unproveability of the theory of the origins of grammar proposed here, it is presented as a *Just So* story to emphasise its speculative nature.

In chapters 9 and 10 the model proposed in this dissertation is tested against two important issues in linguistics. The first is a systemic issue: how are humans able to model time and express it in language? This is explored in chapter 9. The second issue is developmental: how do human children acquire the complexities of their native languages? This is the discussed in chapter 10. The arguments in both of these cases are informed by the assumptions that underlie the model of grammar origins proposed here. These are:

- That language is not a system generated directly from an innate and separable cognitive module. It is emergent from the cognitive systems of modelling others, self modelling and socialisation, and from the physical system of signalling.
- That language is essentially communicative, although not necessarily through its direct message (or denotation or ostension)[62]. Much of the information of an utterance is passed indirectly by metamessage (or connotation or inference), and this information can be within the utterance itself or within the context of the utterance.
- That the communicative aspect of language means that both sender and receiver have an interest in discovering the value of the message to the other, and both parties have an interest in satisfying the other's interest. This is different to nonhuman signalling, where the receiver does not need to know the value of the signal to the sender, and the sender has no need to know why the signal was produced.

[59] **Chris Knight, Camilla Power & Ian Watts**, The Human Symbolic Revolution: a Darwinian account. In *Cambridge Archaeological Journal* 5:1 1995, pp 75-114
[60] **David Erdal & Andrew Whiten**, On Human Egalitarianism: an evolutionary product of Machiavellian status escalation? In *Current Anthropology*, Vol 35 , no 2, (April 1994) pp175-183
[61] **Christopher Boehm**, *Hierarchy in the Forest: the evolution of egalitarian behavior*
[62] **Dan Sperber & Dierdre Wilson**, *Relevance: communication and cognition*, pp46-50

Finally, in chapter 11 the arguments in the dissertation are summarised and conclusions drawn. The chapter and the dissertation end with a consideration of future directions for the theory discussed.

By showing the correspondences between the process and structure of signalling, and the similarities between the processes of nonhuman signalling and language, this dissertation argues that language is continuous with other forms of signalling. Although it is significantly different to other signalling, and uses cognitive systems that are not needed in other signalling systems, language is nonetheless just a type of signalling and not an exotic with no precursors or comparators.

The dissertation builds a series of incremental models between nonhuman signalling and language to show that intermediate states are possible. These models reflect enhancements in segmentation, in social awareness and in social modelling – enhancements that occurred in the cognitive systems of our genetic lineage and not necessarily simultaneously in our signalling systems. Although an order of events is posited, the timing of these events is examined only on a very cursory basis. While certain features can be identified uncontroversially as part of present-day primate cognition, and other features can be identified as part of modern human cognition and communication, the appearance of intermediate features is not always specifically allocated to a particular forebear species.

It is hoped that this dissertation demonstrates that language grammar originated in the cognitive systems needed for socialisation. It is not an outcome of an improbable macromutation, nor is it a simple straight-line development out of nonhuman signalling. Instead, grammar is a response to a need for symbolic thinking and modelling, and its expression in language is a reflection of the need to communicate that symbolic thinking.

Part 2: Establishing the Theory

2. Signalling: Reconciling Definitions

2.1. The Problem of Terminology

"When *I* use a word," Humpty Dumpty said, in a rather scornful tone, "it means just what I choose it to mean – neither more nor less"[63]. This line from Lewis Carroll's *Alice Through the Looking Glass* illustrates the problem of terminology in scientific usage. Words have common meanings which are often at odds with specialist uses, and specialist uses are often themselves contradictory. We may believe that Humpty Dumpty's philosophy is deeply flawed, but we often behave as if it is the only game in town. We choose less common words, such as *syntax* or *cognition*, (or common words, such as *communication* or *language*) and define them in a way that is useful for our argument but which does not fully reflect their pre-established meanings. It is difficult to do otherwise, we have to build our argument from the word-bricks already baked, trimming to size where necessary; but it is therefore important to ensure that our readers recognize, and are content to collude in, the meanings that we are using.

The theory proposed in this dissertation draws on pre-established knowledge from several disciplines: Anthropology, Linguistics, Psychology, Semiotics and Communication Theory. These disciplines, like all others, have their own terminologies, but they often tread on each others' toes in terms of the words used. Particularly problematic are the following groups of terms: signalling, communication and language; selfhood; co-operation; and segmentation, sequentiality, hierarchy, recursion, grammar and syntax.

The model proposed here is also concerned with the origins of language grammar, both privately within individual minds and publicly in signalling between those minds; and, because it takes the view that language is itself a natural system, the model is expressed as both a functionally driven process and a structure composed of identifiable components. The importance of the process-structure dichotomy of language is examined more closely later; but first, the main terms are reviewed to fix their meaning within this dissertation.

2.1.1. Signalling, communication and language

What is a signal? Does it communicate? Is language a signal? These are not easy questions to answer without first deciding the semantic limits that each word has. If you say *[tə'ma:təu]* and I say *[tə'mei:təu]*, then we both know we are talking about the same red fruit; but if you say

[63] **Lewis Carroll**, *Alice through the Looking Glass*, ch6

"ape language"[64] and I say "language is a human construct"[65] then we have a serious definitional problem. One side has to provisionally accept the other's definition and abandon their own, or communication breaks down. In writing there can be no negotiation to an agreed compromise, so I have to ask my reader to accept the definitions I give. In return, I will use my defined terms only within the meaning-confines I have set.

Starting with the term **signalling**, we immediately face the problem of what constitutes a signal. Can there be a signal with no sender to create the signal – is a dark sky a signal for rain? On one level it would be odd to class natural events and cognitively produced signs as similar phenomena, but on another level it is reasonable: both are treated by the receiving organism as a secondary representation of a primary event which would otherwise be unknown to the receiver, and which enables the receiver to react to the secondary representation as if it was the primary event. Warning calls allow the receiver to flee threats they may otherwise be unaware of, and the dark sky allows the receiver to seek shelter before the rain begins.

We can see from this that the concepts of sender and message are not necessary in a definition of signalling: the producer of the signal (the sender) can be the signal itself, and there need be no product (message) which is separately identifiable from the signal. The only value in this type of signal is the value to the receiver, which means that the receiver and signal are the only components necessary. We can define these "minimal component" signals, where no sender is apparent, as *senderless signals*.

Senderless signals are sometimes referred to as *cues* to distinguish them from more complex signals. The definition of the word *cue* is, however, not rigorous: it can refer to an external stimulus (a *discriminable cue*), an internal response (a *discriminated cue*), or an external response to an internal response (a *cued signal*)[66]. The term *senderless signal* will therefore be used preferentially in this dissertation.

Senderless signals co-identify with the semiotic *sign*, as described by Charles Sanders Peirce[67]. However, Peirce's sign is essentially a cognitive event in the mind of the receiver, while the

[64] For instance, **Pär Segerdahl, William Fields & Sue Savage-Rumbaugh**, *Kanzi's Primal Language: the cultural initiation of primates into language*
[65] For instance, **Herbert S Terrace**, Serial Expertise and the Evolution of Language. In Alison Wray (ed), *The Transition to Language*, ch4
[66] **Kim Sterelny**, Folk Logic and Animal Rationality. In Susan Hurley & Matthew Nudds (eds), *Rational Animals?*, ch14
[67] **Charles Sanders Peirce**, Some Consequences of Four Incapacities. In *Selected Writings (values in a Universe of chance)*, pp51-72

term signal being used here is the stimulus for the receiver's cognition of sign, rather than the sign itself. Karl Bühler clarified this, using the word *signal* for all cognitive stimuli and reserving *sign* for stimuli which have a cognitive genesis as well as cognitive comprehension[68]; it is this terminology that will be used here.

The senderless signal is only one of several types of signalling. Where a signal has an identifiable sender we have a more complex signalling structure: a sender generates a message, and the message is interpreted by the receiver. However, there is no requirement for the sender to know the effect the message has on the receiver, nor for the receiver to know that the message has an originator. Signals don't work because they mean something, they work because the production costs are less than the benefits for the sender, and the apprehension costs are less than the benefits for the receiver[69]. There does not need to be a direct relationship between sender and receiver.

For the sender, the signal is a response to a stimulus: for instance, the stimulus of a predator plus the stimulus of conspecifics causes the sender to produce a predator warning call. For the receiver, the signal is a stimulus to a response: the stimulus of the predator warning call causes the responses of seeking safety and repeating the signal. It is only from the viewpoint of an external observer (which will here be called the fourth-person viewpoint) that this form of signalling can be seen as a single process. However, just because sender-message-receiver is not perceived as a single process by sender or receiver, it does not mean that it is not one: the fourth-person view of a signal is as valid as that of first or second person in the signal, although very different. It remains vital, however, to know which perspective is being taken in any signal description.

Signals with senders are qualitatively different from senderless signals; and, to differentiate this type of signal, they will be referred to here as *sender signals*.

There is an important subset of sender signals, where the receiver is aware of the other party in the signalling process (and they are, therefore, acting in the twin roles of receiver and external observer). The receiver is therefore aware both of the value of the signal to the receiver, and of the mitigation of that value created by this particular sender. The receiver cannot just accept the

[68] **Karl Bühler**, The Key Principle: the sign character of language. In Robert E Innis (ed) *Semiotics: an introductory anthology*, pp70-86
[69] **Stephen Budiansky**, *If a Lion Could Talk: how animals think*, pp135-139

signal by itself, they must judge the reliability of the sender in order to fully evaluate the signal. These types of signal will be identified as *receiver signals*.

The final type of signal, a subset of receiver signals, involves both parties in the signal being aware of the other. Both sender and receiver are able to adopt the role of external observer, and signalling becomes a matter of modelling both the motivations of the sender and the likely effects of the signal on the receiver. These types of signals will be known as *reciprocal signals*.

This leads on to the problem of **communication**. The common definition, of which Roman Jakobson provides one example[70], is that it is a process of exchanging information. This definition implies a transactional approach to signalling (signals are not just presented by the sender for the receiver to accept or ignore, there is a negotiation within the signal, with the sender anticipating the needs of the receiver and the receiver accommodating the needs of the sender). Yet we have seen that, in senderless and sender signals, there is no transaction between sender and receiver: information is extracted from the signal by the receiver without the need for a concept of – or even the existence of – a sender. These signals cannot be called communicative in any useful meaning of the word.

There is still no immediate transaction of information in receiver signals: the information that the receiver can extract from a signal event is more complex, but there is no immediate exchange in the signal event. In a social species, however, a receiver signal may determine later choices made by the receiver in relation to the sender: today's grooming must be reciprocated tomorrow[71]; today's warning call indicates a fit mate for next week[72]; and acceptance or refusal of a challenge becomes subject to assessment of alliance strengths, which are the products of earlier signalling exchanges[73]. There is, therefore, a level of information exchange in receiver signals which allows them to be labelled communication. They are part of, and help to define, the social structure in which they arise.

If receiver signals are communicative then reciprocal signals, as a subset of receiver signals, must also be so. However, there is much more to the exchange of information in reciprocal signals: both sender and receiver are aware of a communicative exchange on several levels. There is the externalised meaning of the signal itself – the message; but there is also the

[70] **Roman Jakobson**, *Language in Literature*, pp66-71
[71] **Robin I M Dunbar**, *Grooming, Gossip and the Evolution of Language*, pp18-22
[72] **Amotz Zahavi & Avishag Zahavi**, *The Handicap Principle: a missing piece of Darwin's puzzle*, ch12
[73] **Ronald Noë**, A Veto Game Played by Baboons: a challenge to the use of the Prisoners Dilemma as a paradigm for reciprocity and cooperation. In *Animal Behaviour*, 1990, 39, pp78-90

sender's model of the receiver's reaction, the receiver's model of the sender's intentions, and the iterative models within models that are an inevitable outcome of knowing that both *I* and *you* are making models.

This brings us to the definition of **language**. In this dissertation the view is taken that language relies on reciprocal signals, which largely limits it to a definition of what we humans do. However, there are two types of language to be explained here, comprehension and production, and there is an important difference between the two: comprehension gives value to the production data; but without production there are no data to be comprehended. Production without comprehension is meaningless; but, for individuals, the capacity to comprehend can occur without the capacity to produce if the environment includes other individuals who are willing to produce. Our pets, in responding to a range of sometimes quite complex signals, seem able to comprehend parts of human reciprocal communication without being able to produce language. Being able to react to signals that result in immediate or long-term rewards is an evolutionarily successful strategy; and, as our pets have been selectively bred in an environment of constant reward for many generations, it is not unlikely that innate traits that enhance their standing with their rewarders would be reinforced. The ability to understand some language would be an evolutionarily fit strategy for our domestic animals without any need for them to produce it.

This raises the question of where language begins. In this dissertation, the significant feature of language to be explored is the need for a high level of co-operation between the sender and receiver of a language message. While other defining features of language are clearly significant – such as the use of symbols, the need to express complex messages, segmentation, and vocal dexterity – it is the peculiarly co-operative nature of human signalling that is of interest here. For that reason, this dissertation differentiates between language and nonhuman signalling. All human signalling takes place in a co-operative social environment, so all volitional human signalling (gesturing, facial expression, posture etc) can be symbolic, complex, segmented and dextrous. It does not even need to be factually based – indeed, the entertainment industries rely both on actors able to simulate truthful signals, and on an audience able to treat these signals in a metaphorical language-like way.

For this dissertation, language is therefore a product of human socialisation; and it is both the outcome of production and the input to comprehension, so the capacity for language requires the capacities both to produce and to comprehend. This still leaves us with the key problem: how

did production and comprehension of reciprocal signals became part of being human? The implications of this question will become clearer as this dissertation progresses.

2.1.2. Selfhood

Part of the solution to human reciprocal signalling lies in the ability of humans to understand the signalling roles of sender and receiver in a personal way: I can comprehend *you* as the receiver of my signal, and *me* as the sender of it. There is, therefore, a meta-level to human signalling which appears to be missing from nonhuman signalling. Where nonhumans can largely ignore the self in signalling because they are in an environment of sender and receiver signals, humans operate in an environment of reciprocal signals where selfhood is paramount, particularly first-person selfhood.

The problem of who *I* am is a peculiarly human preoccupation, and a remarkably difficult one to solve. It is tied to the problem of consciousness, which has itself posed a dilemma for philosophers of selfhood for centuries: If there is an *I* that is aware of itself, what is it actually aware of?[74] The Cartesian solution, to deny evidence for the existence of anything, leads only to the circular argument that the self exists because the self thinks, and to the dualist solution that mind and matter must therefore be different things[75]. This tells us nothing useful about the nature of the self itself.

Modern analyses of the problem have highlighted three salient but mutually exclusive views of consciousness: that it is an illusion[76]; that it is essentially irreducible[77]; and that it is currently unknowable[78]. In all of these views the problem of consciousness is intractable – if not forever then certainly for now. This dissertation therefore largely avoids the issue of consciousness; it takes the view that the self is reifiable but unknown, and the features important for language grammar are the relationships of the self with models of itself and others.

There are two issues of selfhood that cannot be sidestepped by declaring it *terra incognita*: the ability to choose between options to maximize the interests of the self; and the ability to make models of the self. These are related to **second order intentionality** (the ability to see others as

[74] **William H Calvin**, *How Brains Think: evolving intelligence, then and now*, pp29-34
[75] **René Descartes**, Meditations on First Philosophy, Second Meditation. In Desmond M Clarke (tr), *René Descartes: Meditations and Other Metaphysical Writings*, pp23-27
[76] **Daniel C Dennett**, *Consciousness Explained*, ch14
[77] **John R Searle**, *Mind, Language and Society*, pp51-55
[78] **Merlin Donald**, *A Mind So Rare: the evolution of human consciousness*, pp8-9

making choices[79]), and **Theory of Mind** (the ability to see others as having their own view of the universe[80]). There seems to be a relationship between the knowledge we have about others and the knowledge we can have about ourselves. At the level of Theory of Mind this appears to create recursion between the two types of knowledge: self-knowledge and other-knowledge seem to be parameters in the definition of each other. The way we know ourselves is by identifying appropriate aspects of other selves, and the way we know other selves is by identifying appropriate traits within ourselves.

The issue of selfhood, or knowledge of self, is neither simple nor currently solved. It is important in this dissertation because it is at the heart of grammatical knowledge, and a full chapter is therefore devoted to the subject. However, it must be remembered that the selves of interest in this dissertation are the sender and receiver of signalling events, and the cognitive systems that allow these roles to be recognised. The philosophy of self and consciousness is not investigated deeply here.

2.1.3. Co-operation

It is generally accepted that you cannot have communicative language, complex socialization and culture without a high level of co-operation[81]. However, the advantages of co-operation (communicative language, complex socialization and culture) are so significant that it seems co-operation must be an evolutionary inevitability. This is an argument after the fact: evolution is not interested in what will work but what does work. The advantages of co-operation only accrue when genotypic co-operation (co-operation produced by a species-wide co-operation gene) is in place; but it is very difficult to posit an evolutionary scenario that allows phenotypic co-operation (co-operation produced by a co-operation gene in one individual) by itself to survive, let alone flourish; and, without phenotypic co-operation becoming an evolutionarily fit strategy, it cannot spread through a species.

The problem of co-operation has been addressed by Richard Dawkins, who shows that the physical nature of a DNA replicator is such that it can only propagate itself; and, in an environment of limited resources, the replicators that can appropriate those resources will out-compete those that cannot[82]. Co-operation is rare at the level of the replicator: the selfish replicator will always tend to outcompete the co-operative replicator because it will have the

[79] **Robin I M Dunbar**, *The Human Story: a new history of mankind's evolution*, pp45-51
[80] **Michael Tomasello**, *The Cultural Origins of Human Cognition*, pp178-179
[81] **Leslie C Aiello & Camilla Power**, Female Proto-Symbolic Strategies. In Lori Hager (ed), *Women in Human Evolution*
[82] **Richard Dawkins**, *The Selfish Gene*, pp18-20

advantage of the resources it can gain for itself, plus any it gains from the co-operative replicators.

There must have been some form of co-operation, however, otherwise complex organisms could not have evolved. A complex organism, such as an animal, is the product of interactive mechanisms at several levels: DNA strands work together to produce effective genes; genes work together to produce effective proteins; proteins work together to produce effective cells; and cells work together to produce effective phenotypes[83].

Co-operation does not end at the phenotype: many species on this planet are social (individuals co-operate to enhance each other's reproductive success), eusocial (individuals co-operate to enhance the reproductive success of a small number of relatives) or cultural-social (individuals co-operate to enhance the reproductive success of the group to which they belong, which may or may not enhance their own reproductive success). Co-operation is an emergent feature of complex phenotypic reproductive strategies; strategies which, as with the levels below the phenotype, must be more effective at propagating co-operating individuals over selfish ones. In the case of cultural-social humans, we have been able to exploit the reproductive advantages of co-operation to the point where our genetic density is becoming an environmental issue; and a major engine of that co-operation is our use of human language.

However, this poses a paradox: how could we co-operate before we had language to facilitate that co-operation; but how could we have language before we had the high level of co-operation needed to make language work? Primates are certainly capable of co-operative activity as long as there is an evolutionary fitness gain for the individual, but humans co-operate at a much higher level than this[84]. Language is cognitively high-cost and productively low-cost: it creates large ongoing cognitive overheads for the sender and receiver (fluent language needs relatively large brains[85]); but, once the articulatory modifications to the primate vocal tract are in place[86], its production is relatively low cost. Most importantly, language does not involve the high demonstrative costs needed in other primate signals to show honesty. To say that humans are not interested in the truthfulness of an utterance is an exaggeration, but we are certainly not

[83] **John Maynard Smith & Eörs Szathmáry**, *The Major Transitions in Evolution*
[84] **Joan B. Silk**, The Evolution of Cooperation in Primate Groups. In H. Gintis, S. Bowles, R. Boyd, and E. Fehr (eds), *Moral Sentiments and Material Interests: On the Foundations of Cooperation in Economic Life*, ch2
[85] **Robin I M Dunbar**, *Grooming, Gossip and the Evolution of Language*, ch4
[86] **William Tecumseh Fitch**, Comparative Vocal Production and the Evolution of Speech: reinterpreting the descent of the larynx. In Alison Wray (ed), *The Transition to Language*, ch2

fully reliant on the one-to-one correspondence between signal and referent that is paramount for effective signalling in other primates[87].

While we cannot know for certain the evolutionary development that created the will to co-operate in humans, it is likely to have been a gradual process involving the aggregation of several different co-operative behaviours. In this dissertation co-operation will be identified as a pre-language state that facilitated the development of grammatical language – language has to emerge from co-operation and not vice versa; but it will also be shown that language has significantly changed the co-operative landscape of human interaction[88]. The question of how co-operation and language bootstrapped each other is looked at in more detail in chapter 8.

2.1.4. Segmentation, sequentiality, hierarchy, recursion, grammar and syntax

We have already seen that **segmentation** is important in the definition of language. Without segmentation there are no components on which sequence, hierarchy, recursion, syntax and grammar can operate. segmentation divides a signal into identifiable units which usually have different roles within that signal. When a diana monkey (*Cercopithecus diana*) makes an eagle call preceded by a 'probably' boom it is creating a signal to which the receiver makes a different response than to the eagle call by itself[89]. The role of the eagle call remains nominal (or imperative if the call is seen as having the value of 'climb down' rather than 'eagle') while the boom has a mitigating role which could be viewed as modal in linguistics terminology.

All human languages have a primary segmentational distinction between an *object*, a component that has permanence outside of a particular utterance and often has a concrete reality, and an *action*, a process which the object initiates or undergoes. Several objects can be bound to a single action as instigator or actor, patient or recipient, and referent, context or goal of the action. These complex language constructs are described as one-argument (action plus object), two-argument (action plus two objects) and three-argument (action plus three objects) forms.

The repetition of component types within a message raises the problem of **sequentiality**. Sequence is an important feature of segmented calls. For instance, if the diana monkey 'probably' boom followed the eagle call rather than preceding it then it would be considerably less effective: the other dianas would be reacting to the eagle call before its mitigated nature was

[87] **Eduardo Giannetti**, *Lies We Live By: the art of self-deception*, ch4
[88] **John Maynard Smith & Eörs Szathmáry**, *The Major Transitions in Evolution*, pp271-278
[89] **Klaus Zuberbühler**, Referential labelling in Diana monkeys. In *Animal Behaviour*, 2000, 59, doi: 10.1006/anbe.1999.1317, pp917–927

known. The main channel for languages is speech and, because language is segmented and speech is one-dimensional, there is a need for conventionalised sequencing of the segments. In one-argument utterances (a verb phrase with one noun phrase, such as *John hid*) there is less need for a conventional sequence – the two segments of the call serve different roles. In two- or three- argument structures, however, (such as *John hid the book* and *John hid the book in the kitchen*) rules of sequence are vital. This sequentiality can be indicated by position in the construct or by markers of role (such as inflections in Latin): what has to indicated is the sequence of roles, not the sequence of words – although, in some languages, the two are synonymous.

Sequentiality leads on to **hierarchy**. The one-dimensionality of speech and the two-dimensionality of a three-argument form mean that there has to be a conversion process between the two. This conversion process can be seen as a hierarchy, linking a verb at top level to each of the three arguments below it. As we will see, this is not the only hierarchical way of envisaging this relationship, and several other models are used in linguistic analysis. This model does, however, emphasise the difference in roles between action and objects, placing them at different levels of the hierarchy.

In Formal Linguistics these hierarchical analyses are particularly significant. For instance, *John put the book on the table* can be analysed as in Figure 1[90]. The entire grammar used here consists of four equations: S→NP+VP, VP→V'+PP, V'→V+NP, and PP→P+NP. This is inadequate to describe all forms used in English, and misleading when applied to languages with other structures, but it illustrates well the hierarchical nature of language grammar.

<table>
<tr><th>John</th><th>put</th><th>the book</th><th>on</th><th>the table</th></tr>
<tr><td colspan="5">Sentence (S)</td></tr>
<tr><td rowspan="3">Noun Phrase (NP)</td><td colspan="4">Verb Phrase (VP)</td></tr>
<tr><td colspan="2">Verb form (V')</td><td colspan="2">Prepositional Phrase (PP)</td></tr>
<tr><td>Verb (V)</td><td>NP</td><td>Preposition (P)</td><td>NP</td></tr>
</table>

Figure 1 - A simple recursive language structure

It is possible in this hierarchical analysis for phrase types to be embedded within each other. For instance, the NP can also be a container for itself: *John of Gaunt* is an NP which consists of NP+PP; and the PP, as we have seen, consists of P+NP. The NP is embedded in PP, which can itself be embedded in NP. For this reason Marc Hauser, Noam Chomsky and William Tecumseh

[90] **Vivian J Cook & Mark Newson**, *Chomsky's Universal Grammar: an introduction* (2nd edition), ch4

Fitch identify **recursion** as the key difference between language and nonhuman signalling[91], although other linguists strongly dispute this claim[92]. Nonetheless, it is uncontroversial that recursion is an important feature of language grammar, even if it is not the whole story.

This brings us on to a definition of **grammar**, perhaps the slipperiest of the terms so far encountered. The definition used in this dissertation is somewhat idiosyncratic – although hopefully not so unusual that it is unrecognizable. What is of interest here is not the prescriptive grammars of grammar books, although this type of grammar provides many of the terms necessary to describe language as a structure or form. Neither is the model proposed here based solely on the formalized analysis of sentences into tree structures[93] – although, once again, this type of analysis is not unproductive. Nor is the emphasis here just on the functional nature of language, and in particular the metafunctional roles set out by Michael Halliday and others[94]. Instead, the model proposed here will attempt to merge the Formal and Functional approaches into a single grammar. This grammar is a system operating not just within the text itself, it is in the complex relationship of interpersonal markers between sender and receiver, and it is in the negotiation of ideas between sender and receiver. It governs the production and comprehension of an utterance as well as its structure. This grammar is, therefore, impossible to describe in a single dimension.

Of course, this interpretation of grammar is open to the accusation that it is everything and nothing. To counter this, three defining aspects of grammar must be emphasized.

- First, grammar is a response to segmentation in the signal. Not all grammatical utterances need to be segmented (the English words *yes* and *no* would be examples of this), but behind every utterance is the segmented concept that a sender is negotiating a meaning, or message, with a receiver about a context, or referent. This metagrammar of language signalling is always present, creating the structure within which language itself works.
- Second, grammar is hierarchical. It is a response to the need to break up complex ideas into simple, consistent, expressible forms. The three-argument form of *Instigator-Action-Recipient-Context* is a linking of three objects with a single action, which means that is essentially a two-dimensional structure. Speech, where this argument form is

[91] **Marc D Hauser, Noam Chomsky & W Tecumseh Fitch**, The Faculty of Language: what is it, who has it, and how did it evolve? In *Science* vol 298 22 November 2002, pp1569-1579
[92] **Steven Pinker & Ray Jackendoff**, The Faculty of Language: what's special about it? In *Cognition* 95 (2005) pp201–236
[93] **Andrew Radford**, *Syntax: a Minimalist introduction*
[94] **Michael A K Halliday & Christian M I M Matthiessen**, *An Introduction to Functional Grammar, third edition*

expressed, is one-dimensional: one sound follows another, one idea follows another. The complexity of converting multidimensional cognitive models into one-dimensional streams of speech requires a rule structure; and it is the structures and processes of the multidimensional cognitive models that govern the forms and functions of speech grammar.

- Third, some aspects of grammar are probably innate, in particular the object-action distinction and the Instigator-Action-Recipient-Context form. However, these innate features are imposed by universals which evolved before the human mind, they are outside of language, and definitely outside of grammar. There is no need to posit grammar as a reified organ of the brain to explain these innate universals.

It is also important to identify the difference between grammar and **syntax**. This term is largely avoided in this dissertation because it has two quite distinct meanings which straddle grammar. The first meaning of syntax is *order*, and this has been applied to any process that has a passing structural similarity to language. Thus we have the syntaxes of town planning, employee interactions, computer systems, and anything else that can be described as a cultural rule-based system. In this definition, language grammar is a subset of syntax.

At the other end, the term *syntax* in linguistics describes a subset of grammar. It is concerned with the relationships between words, and not with the meanings and structures expressed within the words, nor with the relationships between utterances. Syntax thus does not account for what Leonard Bloomfield refers to as morphology[95] nor does it account for what Halliday refers to as the logical metafunction[96]. It is of use when closely analysing structure or form, but cannot tell the whole story of language use. Because syntax has two different meanings, one too wide and the other too narrow, the term *grammar* is preferred over *syntax* in this dissertation.

2.2. Structure and Process

As well as the problem of definitions, a trans-disciplinary argument must address the issues of structure and process: are the models proposed in the argument about how the system works (process) or how it is organised (structure)? Or perhaps, as in this dissertation, is the argument trying to model both things at once?

[95] **Leonard Bloomfield**, *Language*, p184
[96] **Michael A K Halliday & Christian M I M Matthiessen**, *An Introduction to Functional Grammar, third edition*, ch7

When humans view systems in nature, they do so through the particular cognitive mapping that being human gives[97]. Part of this cognitive mapping is the habit or ability to see a system in two ways: as a structure composed of real components; and as a process consisting of productive functions[98]. The first view maps a system as a fixed entity, it identifies hierarchies within the system, and it treats the system as an isolate from the rest of the universe; in Saussurean terms this is a synchronic view (a "static" snapshot in time)[99]. The second view maps the system as a conversion of inputs to outputs, it identifies the information flows within the system, and it is concerned with the integration of the system with the rest of the universe; in Saussurean terms this is a diachronic view (the way things change over time)[100]. The two viewpoints would seem to be irreconcilable, but a system cannot be fully described without both views being accounted for. Ferdinand de Saussure describes these views as the axes of simultaneity and succession, and states: "the more complex and rigorously organised a system of values is, the more essential it becomes, on account of this very complexity, to study it separately in terms of the two axes"[101].

However, instead of separately studying both structure and process, there seems to be a tendency in human analyses of systems to ignore one view in favour of the other. This is identifiable in the names used to describe opposing schools of thought in many areas. For example, the structural anthropology of Claude Levi-Strauss[102] and Marcel Mauss[103] lines up against the post-structuralism of Jacques Derrida[104] and Michel Foucault[105]; and in psychoanalysis, Sigmund Freud's structural model of the mind[106] contrasts with the analytical psychology of Carl Jung[107]. In some areas, such as computer science, successful integration of structure and process has altered the paradigm of the subject, as anyone with experience of computers before and after Windows™ can attest; but these cases of integration remain notably rare.

A structure can be broken down into components, each of which has the potential to be described as a structure itself. However, the nature of structural analysis requires that, at some point, one type or level of component is considered to be an indivisible base component. Often we accept these base components without demur, they form a natural differentiation between

[97] **Rita Carter**, *Consciousness*, ch2
[98] **William H Calvin**, *How Brains Think: evolving intelligence, then and now*, pp113-114
[99] **Ferdinand de Saussure**, *Course in General Linguistics, translated & annotated by Roy Harris*, Part II
[100] ***Ibid***., Part III
[101] ***Ibid***., p81, original p116
[102] **Claude Lévi-Strauss**, *Structural Anthropology*
[103] **Marcel Mauss**, *The Gift*, Conclusion, III
[104] **Jacques Derrida**, *Of Grammatology*
[105] **Michel Foucault**, *Language, Counter-memory, Practice: selected essays and interviews*
[106] **Sigmund Freud**, The Structure of the Unconscious. In *New Introductory Lectures on Psychoanalysis*
[107] **C G Jung & C Kerényi**, *The Science of Mythology*, ch2, The Psychology of the Child Archetype

levels of structure. Thus a business organization is composed of departments, which are composed of teams, which are composed of individuals as the base component. It is certainly possible to subdivide an individual into capacities or roles, but we tend to see this division as part of a separate structural description: the subdivision of the individual is not relevant to the structural model of the organization. In reality, the fact that an individual can undertake several roles within an organization, and therefore can appear at multiple positions in the structure, poses a major problem for organizational mapmakers. No single "magic bullet" solution has yet been found[108].

A process, in contrast, is composed of functions, which are not miniature processes in the same way that components are miniature structures. Functions are reliant on each other to make a process work: the input to one function is the output of another. Additionally, processes tend to be task-specific and do not have the general applicability of structures. The process of a business, for instance, is divisible into the functions of purchasing, manufacturing, selling, and management of various resources (stock, money, people, etc). Not every business has all of these functions, and each of these functions involves a different way of satisfying a different purpose. For example, while purchasing and selling are both involved in the conversion between internal and external resources, their directions of flow are very different.

In linguistics, the ongoing debate between Formalism, which sees language as a form composed of rules governing components, and Functionalism, which views language as a process transferring meanings between individuals, continues to divide the community. The Formalist approach produces analyses which are hierarchical, component-bound and stable; the Functionalist approach produces models which involve multiple flows of functions between sender and receiver, and which are essentially conditional. Both models accurately describe language, but in very different ways.

Both signalling and language can be described simultaneously as processes and structures, but the distance between their respective process and structure models is quite different. In signalling we see an unusual situation, where the components of structure largely map to the functions of process: parallels can be drawn between the structure and process models, and it is

[108] This is my personal experience from 20 years in the Human Resources support industry. The major suppliers of Human Resources software have a range of solutions to the problems of describing *ad hoc* teams, multitasked individuals, job shares and multiple managers. Administrators adopt a subset of these solutions to describe their own organisations, often with different solutions being adopted at different levels of the organisation. This can impact on the understanding by different individuals of how the organisation works.

possible to envisage the two models working together in a way that gives a clear understanding of what a signalling system actually is and does.

The close mapping of components and functions is not the case in language, which is surprising because language is apparently just a specific form of signalling. The fact that language operates on several levels (Halliday's metafunctions[109]) means that information flows through the process in three simultaneous strands. The ideational strand carries what we traditionally call the message: it identifies how the information in the signal is related to the universe. The interpersonal strand negotiates a common meaning between sender and receiver: language signals are not indexes of meaning, and their contexts are seldom verifiably here-and-now; instead, contexts have to be modelled and agreed by sender and receiver. Finally, the textual strand establishes the tools used to convey the message. In nonhuman signalling the signal is its own text; in contrast, the textual tools of language are words, grammar and prosody (stress, intonation and tone), which are together referred to as the lexicogrammar continuum[110]. The language signal is therefore a convention-determined outcome of the combination of these textual tools.

In contrast to process, the structure of language is seen as a unitary form. In Chomsky's Minimalist model the form of language consists of just two transformations, *Merge* and *Move*. Structures are embedded into each other using Merge, which allows language to produce rich and complex messages by recursion[111]. As we will see, this is not the only way to divide language structure into components; but, even in traditional grammar, the components used in language (verb, noun, adverb, adjective, etc.) form a small, closed set. Different linguists find it necessary to divide up the component landscape in different ways, which indicates that language structure may be a matter of viewpoint. For instance, in traditional grammar the word *train* in *train ticket* would be described as adjectival[112]; in many modern linguistic models, such as Word Grammar, it is a noun[113].

The separation of structure and process in the description of language is institutional: for Formalist linguists, the process of language use is a distraction. As Chomsky says:

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[109] **Michael A K Halliday & Christian M I M Matthiessen**, *An Introduction to Functional Grammar, third edition*
[110] **Thomas Bloor & Meriel Bloor**, *The Functional Analysis of English: a Hallidayan approach*, pp228-229
[111] **Noam Chomsky**, *The Minimalist Program*, pp241-249
[112] **Gordon Jarvie**, *Bloomsbury Grammar Guide: the way the English language works*, pp17-24
[113] **Richard Hudson**, *English Grammar*, p14

> If you take a standard Functionalist point of view, you would ask: is the system designed for its use? So, is it going to be well designed for the uses to which people put it? And the answer there is "apparently not"; … But a totally separate question is: forgetting the use to which the object is put, is it well designed from the perspective of internal structure? That's a different kind of question, and actually a new one. The natural approach has always been: is it well designed for use, understood typically as use for communication? I think that's the wrong question. The use of language for communication might turn out to be a kind of epiphenomenon.[114]

For Functionalists, the structure of language is of interest only in terms of what it reveals about process:

> If we have a functional viewpoint, we may be able to suggest why it is that the child builds up the system in the particular way he does: why, for example, there comes a point where he has to take over the adult language, and to build certain of its features, such as structure and vocabulary, into his total potential. The second reason for looking at the process from a functional point of view is that it also gives us some insight into why the adult language has evolved in the way it has. The human brain would have been capable of constructing a hundred and one different types of semiotic system; why is it that language evolved in this particular way as a semiotic system with the particular properties that it has?[115]

The reconciliation of structure and process in language is an important issue that remains largely unvisited. In this dissertation, however, structure and process must be reconciled if we are to understand the relationships between language and other forms of signalling.

2.3. Why Signalling Needs an Evolutionary Explanation

The main task for a trans-disciplinary argument is to make it fit with the dominant theories of the time in each discipline. For any origins story this means reconciling it with current thinking in neo-Darwinian evolution theory. In 1963, Niko Tinbergen set out the four questions that any evolutionary theory must pursue if a behaviour is to be understood. These are:

1. How does the behaviour contribute to the survival or reproduction of the individual? What is the function of the behaviour?
2. What are the external stimuli and internal interpretations that produce the behaviour as a response? What is the cause of the behaviour?
3. How does this behaviour become part of the repertoire of the individual? How does it develop?
4. How did this behaviour evolve in the species? What selective forces are at work?[116]

[114] **Noam Chomsky**, An Interview on Minimalism. In *On Nature and Language*, pp106-107
[115] **Michael A K Halliday**, *Learning How to Mean: explorations in the development of language*, ch2
[116] **Niko Tinbergen**, On Aims and Methods. In Ethology. *Zeitschrift für Tierpsychologie*, 20, 1963, pp410-433

Signalling, as a behaviour subject to evolutionary pressure, must be explained in these terms; and these questions will underlie the evolutionary investigation made in this dissertation.

Information is power: this is a cliché of our time[117]; and power is the currency of any Darwinian social structure. It is not at all clear, using a selfish gene model, why any individual should be willing to give information to another individual: true information is valuable to the sender, and there is no obvious reason why the sender should give that value to a conspecific. If the conspecific is a sexual rival (same sex) then to do so is anti-Darwinian – the individuals that give away valuable information to rivals will be outbred by those that don't. If the conspecific is a prospective sexual partner (different sex) then there is no reason why the receiver should believe a signal which cannot be immediately verified as honest.

Yet signalling is ubiquitous in nature: how can this have come about? There are three main evolutionary theories that have helped us to explain signalling. The first is William Hamilton's theory of Kin Selection[118]: helping a conspecific related to the helper advantages the common genes held by the helper and helped, so it is an evolutionarily fit strategy. For instance, if signalling the presence of a predator helps a relative (who has some of your genes) to survive and breed, it is a behaviour that will survive and spread. The problem with this is that it also enhances the non-common genes. There is, therefore, always a trade-off between honesty and genetic self-interest: the greater the genetic distance between individuals the fewer honest signals should be used, and only perfectly related individuals (i.e. clones) should always signal honestly. While Kin Selection can explain communication in species or groups that are genetically highly related, it cannot explain warning behaviours in groups of marginally related individuals, or mixed species groups[119].

The second evolutionary theory which has helped to explain signalling is Robert Trivers' Reciprocal Altruism[120]: helping an unrelated individual is a fit strategy if there is the expectation that you will be helped in turn at some later date. This spreads the burden of short-term hardship and increases the fitness of both individuals over time, in circumstances where non-co-operation would decrease the fitness of both individuals separately. Honest signalling between conspecifics is maintained by a time-delayed *quid pro quo* social structure. The sender signals

[117] A search on Alta Vista found 334,000 references to the phrase
[118] **William D Hamilton**, The Genetical Evolution of Social Behaviour II. In *The Journal of Theoretical Biology*, 1964, 7, pp17-52
[119] **Charles A Munn**, Birds that 'Cry Wolf'. In *Nature*, 319, 9 Jan 1986, pp143-145
[120] **Robert Trivers**, The Evolution of Reciprocal Altruism. In *The Quarterly Review of Biology*, vol 46, 1971, pp35-57

honestly in order to maintain a social compact between sender and receiver. The social compact is always conditional on current honesty, and being discovered in a lie impacts negatively on the liar[121]. However, in this model there has to be altruistic punishment of cheats. Altruistic punishment is common among humans[122]; but, although it does happen in the rest of nature[123], our current knowledge indicates that it is not common[124].

Both Kin Selection and Reciprocal Altruism have problems explaining reproductive signalling. They both tend to take the view that reproduction is a special case, where converging interests of sender and receiver make it worthwhile to co-operate in the signal. Kin Selection obviously cannot apply to reproductive co-operation – mating with very close relatives is not an evolutionarily good idea; and Reciprocal Altruism cannot apply, because dishonesty cannot be punished until it is too late. This is a major problem for Kin Selection and Reciprocal Altruism: a significant part of signalling in nature is mating-related.

The Handicap Principle of Amotz and Avishag Zahavi[125] provides a theory to explain honesty in mating signals. In this model, honesty in a signal is maintained by the cost. Because the signalling costs have to be paid up-front (the signal has to be costly to the sender) the honesty of the signal is guaranteed by the fact the signal has been made[126]. The receiver's scepticism about the signal, and the value to the sender of overcoming that scepticism, maintain the signal at its most costly. Yet, while the Handicap Principle is an excellent model for mating signals, it has difficulty with signalling systems that have been reduced in cost because of kin or reciprocation advantages[127].

It is probable that no single one of these theories can explain all signalling events. The purpose of a signal varies between events, and each purpose is likely to have a separate evolutionary explanation. Yet, even with a multiplicity of signalling purposes, it seems that the structure and process of signalling can be seen as unitary and independent of signal purpose; all signals can be described as a *sender* producing a *message* about a *referent* for a *receiver*. This is a description

[121] **Arnon Lotem, Michael A Fishman & Lewi Stone**, From Reciprocity to Unconditional Altruism through Signalling Benefits. In *Proc R Soc Lond B* (2003) 270, DOI 10.1098, pp199-205
[122] **Ernst Fehr & Simon Gächter**, Altruistic Punishment in Humans. In *Nature*, vol 415, 10 January 2002, pp137-140
[123] **Elizabeth A Tibbetts & James Dale**, A Socially Enforced Signal of Quality in a Paper Wasp. In *Nature*, vol 432 11 November 2004, pp218-222
[124] **Ernst Fehr & Simon Gachter**, Altruistic Punishment in Humans. In *Nature*, vol 415, 10 January 2002, pp137-140
[125] **Amotz Zahavi & Avishag Zahavi**, *The Handicap Principle: a missing piece of Darwin's puzzle*
[126] **Thomas E Dickins**, On the Origin of Symbols. In *Connexions: current research in cognitive science*. Issue 5, March 2001
[127] **Carl T Bergstrom & Michael Lachmann**, Signalling among relatives. I. Is costly signalling *too* costly? In *Phil Trans R Soc Lond B* (1997), pp609-617

not of how the signal came about but what it is and how it works. It is in many ways a model after the fact of signal production, a reflection of what that fourth-person observer sees of the signalling event. This model emphasises both the components and the functions of signalling over its generation; it does not need to be concerned with what motivated the signal production in the first place, only with the structures and processes that allow it to work. This model will be examined in more detail in chapter 3.

2.4. Terms Defined?

In this chapter we encountered the problem of defining terms. This problem is a product of terminological differences between different disciplines, and it has to be solved if a consistent trans-disciplinary argument is to be made. To this end, definitions have been given for key terms necessary to understand both the process and structure of signalling – and signalling, process and structure have themselves been defined.

Some of the definitions given here are directive rather than explanatory: the meaning of the term has been set out, but the implications of this meaning are explored later in the dissertation. Using this definitional base, however, it should now be possible to set out the argumentation for the origins of grammar in more detail.

3. The Structure and Process of Signalling

In chapter 2 we saw the importance of analysing systems as both structures and processes. The two viewpoints answer different questions, and both are needed to fully understand a system. This chapter looks particularly at signalling, and will show that structure and process can co-identify in ways that make the two views of this system easy to integrate. This co-identity has not stopped some from investigating structure[128] or process[129] separately, and these single-viewpoint approaches have been particularly useful as pointers to what the system of signalling entails. In this chapter the two viewpoints are examined both separately and jointly.

First, some signalling theories are considered to establish their common ground. This will help to identify functions and components that are commonly seen as important in signalling, and will place approaches to signalling into context. The roles of meaning and value are then reviewed, and it will be proposed that signals must have value, but that meaning is optional. The fourth-person viewpoint will also be considered to show what it is, how it differs from a third-person viewpoint, and why it is important.

Finally, the nature of transactional signalling is examined, and it is shown that the apparent transactionality in many signals can be explained just as well by a non-transactional model. The apparent transaction, the transfer of information from sender to receiver, is an outcome that is clear to a fourth-person observer, but need not be part of the signalling intentions of either sender or receiver. Neither sender nor receiver needs to understand – or even know – the whole process of signalling for it to work. At the end of this chapter it should be clear that the structure and process models provide complementary views of signalling, and that both approaches are needed to provide a comprehensive model.

3.1. Signalling Theories

Signalling has been studied in several different ways: as a mechanical phenomenon between infinitely co-operative machines[130]; as a semiotic phenomenon, mapping the relationship

[128] **Terence Hawkes**, *Structuralism and Semiotics*, ch1
[129] **Deb Roy**, Semiotic Schemas: a framework for grounding language in action and perception. In *Artificial Intelligence*, Volume 167, Number 1-2, September 2005, pp170-205.
[130] **Luc Steels**, The Evolution of Communication Systems by Adaptive Agents. In E. Alonso, D. Kudenko & D. Kazakov, (eds), *Adaptive Agents and Multi-Agent Systems, Lecture Notes in AI* (vol. 2636), pp125-140. Springer Verlag, Berlin, 2004.

between the signal and the sign or signs it conveys[131]; and as a communicative phenomenon, involving negotiation to meaning between a sender and a receiver who are aware of each other[132]. These approaches are not necessarily appropriate for nonhuman signalling. As Stephen Budiansky says, signals are not made because they mean something but because they work[133]; it is not the signal-as-information, the signal-as-sign, or the signal-as-message that makes them work but the signal-as-stimulus.

If we look at models of signalling we can see that it is usually viewed as a simple system. For instance, Charles Sanders Peirce's basic semiotic description consists of only three functions: the sign or representamen, which is both the act of attention and the particular features attended to; the object, which is the brute reality of what has caused the attention; and the interpretant, which is the perceived meaning of what is attended to[134]. Every semiotic act involves a movement from attention through perception to interpretation – a process of *becoming to mean*. Attention and interpretation are internal functions of cognition, but the perceived semiotic object grounds the sign in reality and gives it value.

Peirce shows that the nature of the interpretant is such that, in a symbolic signalling environment such as language, it can act as a sign for a further interpretive process. So, for instance, attention to a "no entry" road sign, perceived as a relevant item of street furniture, can produce an interpretant of an invisible virtual barrier across the road; but this virtual barrier, reinterpreted as a sign of legal sanction, can produce the interpretant of social prohibition. The road sign is not a barrier, but it stands in place of the barrier, which in turn stands in place of the social prohibition. In interpreting a road sign we understand, among other things, its purpose, its validity and its authority. This movement from interpretation back to attention is what gives language the power of metaphor and symbolic representation.

We can thus see that the movement from sign to interpretant is a process of apprehension, but the movement from interpretant to sign is a process of comprehension. For humans (and possibly for no other animal) the semiotic process is continuous rather than episodic: signals are not compartmentalised by their internal definition, they are part of a network of meaning which

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[131] **Angelo Loula, Ricardo Gudwin, Charbel Niño El-Hani, & João Queiroz**, The Emergence of Symbol-Based Communication in a Complex System of Artificial Creatures. In *Proceedings 5th International Conference Integration of Knowledge Intensive Multi-Agent Systems KIMAS '05: Modeling, Evolution and Engineering*. Waltham, Massachusetts. 2005.
[132] **Yannis Labrou, Tim Finin & Yun Peng**, The current landscape of Agent Communication Languages. In *IEEE Intelligent Systems*, volume 14, number 2, March/April, 1999.
[133] **Stephen Budiansky**, *If a Lion Could Talk: how animals think*, p137
[134] **Charles Sanders Peirce**, Logic as Semiotic: the theory of signs. In Robert E Innis (ed), *Semiotics: an introductory anthology*

extends both vertically through the life of an individual and horizontally through social groups. For nonhumans the compartmentalisation of signal definitions means that there need be no horizontal web of meanings, only a set of values – which accrue to the signal rather than to the signaller.

Peirce's trinary semiotic model of object, sign and interpretant[135] was extended by Charles Morris. Peirce's model (which is more process than structure) helps to explain metaphor (interpretant becomes sign), collocation (sign becomes interpretant), synonymy (sign becomes interpretant becomes sign) and a series of other grammatical forms. However, it is not necessarily a communicative process: these interpretations of sign to interpretant to sign can happen inside one brain with no need for sharing.

By extending the number of components involved, Morris converted Peirce's cognitive model into a model of language signalling[136]. For Morris, the interpretant implied an interpreter to make the interpretation, and the interpreted object could be analysed into denotata (the features of the object that are actually being represented) and significata (what is being treated as significant about the object). The interpretant is, therefore, the outcome of a relationship between a sign and an object as perceived by the interpreter; but what is perceived might not be all that the object is. This is a model of comprehension rather than production, and it is a more complex and hierarchical model than that of Peirce. The object component consists of two sub-components, and the interpretant is a complex product of the sign and interpreter components. It is also largely a structural view of signalling.

In contrast to Peirce and Morris, Roman Jakobson's view of language as a signalling phenomenon encompassed both structure and process. He identified six "constitutive factors in any speech act". Essentially, the **addresser** (sender) produces a **message** for the **addressee** (receiver). The message has a **context** (or referent), and requires a **code** and **contact** shared between addresser and addressee. Jakobson also saw that the components of this structural model identified closely with functions of process. The addresser brings an **emotive** function to the signal, while the addressee's function is **conative** (comprehending and reacting to the message). The function of the context is, unsurprisingly, **referential**, while that of the message is **poetic** (the lexicogrammatical choices made for this particular message). For code the

[135] **Charles Sanders Peirce**, A Letter to Lady Welby, October 12 1904. In *Selected Writings (values in a Universe of chance)*, pp381-393
[136] **Charles Morris**, Signs and the Act. In Robert Innis (ed), *Semiotics: an introductory anthology*, pp178-189

function is **metalingual** (the rules of language), and for contact it is **phatic** ("serving to establish, to prolong, or to discontinue communication")[137]. Although Jakobson's model is essentially linguistic it does emphasise the signalling system around a language utterance, and it does examine the relationship between structure and process.

Umberto Eco provides another semiotic view of the process of signalling. He is concerned with the transformation of information from an output to an input, which appears to occur in the space between minds rather than in the minds themselves. Eco shows that this is an illusion, the meaning of the information lies in the common convention that exists between sender and receiver, but it is a convention that both sender and receiver have separately acquired. The simple tripartite analysis of Peirce is insufficient to explain this transfer of meaning, which is reliant on two separate processes: the acquisition of a common code by sender and receiver, and the utilisation of that code to express and extend meanings[138].

Eco is interested in the process by which information becomes a sign, concentrating on the *becoming* part of *becoming to mean*. In his Watergate model he attempts to understand a communication process without cultural signification, and proposes a way in which two mechanical devices can exchange information. He sees a source of **information** – which largely co-identifies with Peirce's object – being perceived by a **transmitter** which produces a **signal**. The signal is transmitted through a **channel**, which can introduce **noise** into the signal such that the signal at the start of transmission may not be the signal at the end. The final signal, whether accurate or not, is received by a **receiver** (a detection device) which extracts the **message** from it, and creates a meaning at the **destination**. A common **code** between transmitter and destination ensures the integrity of meaning, excluding noise[139]. Eco emphasises that this code is not in the channel, receiver or message, it is in a convention between transmitter and destination and has to be established separately from the signal.

The Watergate model described by Eco emphasises two important features of non-linguistic signalling: it is essentially sequential – or, as Eco describes it, a classical labyrinth[140] (a twisting path with no branchings); and the value of the signal relies on information outside of the signal. Eco's model identifies the transmission between the mechanical devices as a process, involving a flow through a series of functions. The functions carry the signal rather than defining the

[137] **Roman Jakobson**, *Language in Literature*, pp66-71
[138] **Umberto Eco**, *Kant and the Platypus: essays on language and cognition*, ch2, Kant, Peirce, and the Platypus
[139] **Umberto Eco**, *A Theory of Semiotics*, ch1, Signification and Communication
[140] **Umberto Eco**, *Semiotics and the Philosophy of Language*, p80

signalling system. Of course, if we were to describe this process as a structure it would look very similar: Eco's approach, like that of Jakobson, can easily produce an integrated model of signalling as a system.

Paul Grice's model of language as dialogue must also be considered here because it offers an important link to nonhuman signalling. Paul Grice approached the issue of language communication as a series of conversational maxims that the utterer (sender) must follow to ensure commitment to reception by the receiver[141]. Of these, the primary maxim for Grice was *be co-operative*, but he also identified the maxim *be relevant* as a significant indicator of successful language messaging. The need for co-operation is important for language, but less so for nonhuman signalling; there does not need to be any negotiation in nonhuman signalling. The need for relevance, however, is vital for every signal, both language and nonhuman signals: if a signal has no value to the receiver it will be ignored and is therefore not worth making.

The importance of relevance in language signalling was further explored by Dan Sperber and Deirdre Wilson[142]. Relevance Theory treats language as a negotiation to a common meaning between sender and receiver. The sender must be able to decide what is of importance to the receiver so that they can tailor their message, and the receiver must be able to provide back-channel information (indicators of continued acceptance of their role as receiver) to encourage sender relevance. Sperber and Wilson ask in their first sentence, "How do human beings communicate with one another?" Jean Louis Dessalles answers this question as follows:

> The honour for having recognized the significance of relevance goes to Sperber & Wilson (1986). In their Relevance Theory, they show that relevance is an automatic feature of any intended communication: the emitter is expected to be relevant as soon as he shows his intention to communicate. Actual relevance is achieved if the hearer is able to draw inferences from what he heard. The more inferences, the greater the relevance.[143]

Here we see both sender and receiver implicated in the communicative act, with relevance as the object negotiated between them. The referent (the context or cause of the message) defines the intention to communicate, and the message determines the scope of inference available. The model is similar to that of Jakobson, although Relevance Theory is concerned more with the *why* of communication, while Jakobson is concerned with the *how*. The relevance model is not

[141] **Paul Grice**, Logic and Conversation. In *Studies in the Way of Words*, pp24-31
[142] **Dan Sperber & Deirdre Wilson**, *Relevance: communication and cognition*
[143] **Jean-Louis Dessalles**, Altruism, status and the origin of relevance. In James R Hurford, Michael Studdert-Kennedy, Chris Knight (eds), *Approaches to the Evolution of Language*, p132

itself a model of general signalling, but it nonetheless contains sufficient components to provide the basis for such a model.

Relevance Theory is particularly interested in the interpersonal nature of signalling, and it is not concerned solely with either the sender's or receiver's viewpoints. It shows how relevance is maintained by oblique reference, which permits metaphor, synonymy and the other rhetorical features of human language. The basic Relevance Theory model is of a sender producing a message for a receiver about a referent or context, but it is the back-channel relevance of the referent to the receiver through the message that drives the signal.

Relevance Theory identifies two important sender intentions: the informative intention, whereby the sender makes "manifest or more manifest to the audience a set of assumptions **I**"[144]; and the communicative intention, whereby it is "mutually manifest to audience and communicator that the communicator has this informative intention"[145]. Communication consists of two transfers from sender to receiver, as in Eco's model; but whereas for Eco the transfers are the message and a pre-existing code that permits the message, for Sperber and Wilson the division is between the information of the signal and the intention of the sender.

Sperber and Wilson emphasise throughout their book that their model of communication is a language model, and has limited application in a non-linguistic environment. Nonetheless, it is possible to draw conclusions which apply to signalling in general. For instance, in Relevance Theory it is the anticipation of the needs of the receiver by the sender that drives language signalling. The sender is not concerned with what the signal means to the sender but the likely meaning it has for the receiver – the sender has to be aware that there is a receiver. If we try to apply this back to nonhuman signalling then we encounter a difficulty: if the sender is aware of the receiver and able to modulate a signal to accommodate that receiver, then the sender is also able to manipulate the signal for personal advantage. The value of the signal to the receiver has become uncertain. The important question in nonhuman signalling is not, therefore, "what causes the signal to be made?" but "why does the signal work?"

For example, it is possible to see how interspecies warning signals can arise out of reliable responses to referents (e.g. barking at them as an aggressive posture), if these responses are then noticed by others and treated as signifiers for the presence of the referent. Increasingly refined

[144] **Dan Sperber & Deirdre Wilson**, *Relevance: communication and cognition*, p58
[145] **Dan Sperber & Deirdre Wilson**, *Relevance: communication and cognition*, p61

attention to the signal over generations instantiates the response to the referent by the sender as a valuable indicator of the presence of the referent for the receiver. In this model, the signalling process is concerned with the receiver's attention to the sender's sign, even though the sender's sign was not originally directed at the receiver; and what makes the signal reliable for the receiver is the fact that the sender is *not* anticipating their needs. Seeking relevance and value in the signs of others can be a fit strategy, but only if those signs are reliable.

Rudi Keller offers yet another view of language which offers further insights into the process of signalling. For Keller, it is the process of language *change* that is of interest: his is a diachronic model of language, in contrast to the synchronic approaches of other commentators. He takes the view that two important features of being human are the need to be identified by others as an in-group member, and the need for the group to identify its members. Conventions of language arise and are adopted because the demands of socialisation create an "invisible hand" effect. Language change occurs not because it is consciously sought by individual parties, but because there is a constant process of compromise between the needs of sender and receiver, which creates a dynamic between simplification of production and simplification of comprehension[146].

Keller uses this dynamic to review the problem of meaning in language. He poses the question, are words representations or instruments? If words are representational signs then they work because of the shared meaning they represent. We would expect correspondences between sound and meaning to be represented in the same physical way in different brains, and consonance, or common understanding, between brains is then achieved by shared innate mechanisms or by deliberate ostension (saying *I mean x*). If, however, words are instrumental signs then they work because of their symbolic value in communication. We would expect correspondences between sound and meaning to be *ad hoc*, and controlled by cultural or socialisation processes, or by negotiation in each dialogue. Consonance can be achieved either by recognition of the joint cultural environment (*I've got Friday on my mind*), by ostension (*let your yes be yes and your no be no*), or by negotiating to an agreed meaning (*how do you solve a problem like Maria?*).

Of the two, the instrumental model corresponds most closely to how we see language working in the real world, so it makes sense to prefer this model over the representational one[147]. This means that language and words work not because they mean something but because they

[146] **Rudi Keller**, *On Language Change: the invisible hand in language*
[147] **Rudi Keller**, *A Theory of Linguistic Signs*

facilitate meaning between the sender and receiver. Language is not a mind made manifest, it is a negotiation between minds – *becoming to mean* rather than *meaning*.

What is the significance of this for nonhuman signalling? The main conclusion must be that the features identified by Keller (change through socialisation and meaning through socialisation) are peculiar to language. They are features that separate language from the rest of signalling. For language, as a social construct, the changes of meaning and usage are central; but for nonhuman signalling, which is a genetically coded construct, change is inimical to signal comprehension. Keller sees this as the central problem of language origins. In what he calls "something like a fairy tale, not the reconstruction of a past reality"[148], he proposes a series of steps in the co-option of a nonhuman signal to a language-like role.

First a "flee!" warning signal is mistakenly used, resulting in the signaller being inadvertently advantaged. Next, the signaller begins to use the signal inappropriately, and not in its warning function, to further advantage itself. Next, others begin to use the signal in its non-warning function, and the signal loses its value as a warning. Finally, the signal is used by an alpha in a situation where it is demanding advantage. The signal that started with a value for both sender and receiver of "flee!" becomes a signal with a receiver value of "flee!" but a sender value of "go away!"; and finally it becomes, for both sender and receiver, a signal demanding that the receiver "go away!"

All Keller is trying to do here is show that signal change is a logical possibility, and his story demonstrates this is so. However, it is also clear that this sort of change in the value of a signal requires both a level of volition in the sender and a level of co-operation in the receiver. Without volition the sender cannot begin to use the signal out of context, and without co-operation the signal cannot pass through a period of cognitive dissonance (when it has value to the sender but not the receiver) before the new value takes hold. This process of meaning change is clearly continuous in language, but it would seem to be unusual, if not impossible, in nonhuman signalling.

Keller's model once again emphasises the importance of the sender-message-receiver-referent process in nonhuman signalling, but he gives us another important insight on that process. The code that ensures apparent cognitive consonance between sender and receiver is pre-existent within sender and receiver, even when it is volitional and not genetically inspired: the signal

[148] **Rudi Keller**, *On Language Change: the invisible hand in language*, p19

does not work because meanings are shunted around but because there is a conventional correspondence between referent and message for the sender, and another conventional correspondence between message and reaction for the receiver. It is these correspondences that make a signal work; there does not necessarily need to be any convention between sender and receiver.

The models of signalling discussed here display common features which form the base of the signalling system: a **sender** creates a **message** about a **referent** which has value to a **receiver**. This system around the message is clearly applicable to both nonhuman signalling and language, and it is this system which provides the components of structure and the functions of process in the signalling model to be proposed here. However, before we review the system of signalling the viewpoint of the fourth person must be examined, and the terms *meaning* and *value* must be reviewed.

3.2. The Fourth Person Model of Signalling

The fourth-person view has been mentioned in this dissertation in relation to signalling, but no definition has yet been given. What is this fourth person view, why is it different to the other persons, and why is it important to signalling? There are three candidates to fill this fourth-person role in signalling: the interested third party (the referent); interested observers (such as one species of bird being able to understand and react to another species' warning calls[149]); and disinterested observers (probably limited to curious humans). As will be shown, however, the absence of a fourth-person view of the signal does not alter the signal in any way, unlike the absence of the first person (sender) or second person (receiver), or even third person (referent). The fourth-person view is, therefore, an emergent feature of signalling, not a definitional feature. A description of signalling does not include the fourth-person view, but the very act of describing takes place from the fourth-person view.

How do the three candidates for the fourth-person view fit with the role? If the fourth-person candidate is the referent (the third person) we do not see the beginnings of meaning in the signal. The referent, like the sender and receiver, is not interested in the value of the signal to others but in the information it holds for itself. The referent is an unintended receiver of the signal, but just a receiver nonetheless; and, like the intended receiver, the unintended receiver needs no concept of the sender's intentions. For instance, the vervet eagle call does not indicate

[149] **Russell P Balda, Gary C Bateman & Gene F Foster**, Flocking Associates of the Piñon Jay. In *The Wilson Bulletin*, March 1972, vol 84 no 1, pp60-76

to the eagle that the vervets know it is there, it indicates that the vervets are going to be difficult to catch. The source of the signal is not important, it is the fact that the signal has been made that creates the problem for the eagle.

The same applies for interested observers: they are really just another type of receiver. Additionally, they have no control over the honesty of the signal, and can be subjected to calls which are dishonest to them but not to the signaller's conspecifics. For instance, the ant shrike (*Thamnomanes schistogynus*) forms joint flocks with the shrike tanager (*Lanio versicolor*). Both species make accurate predator warning calls which benefit all birds, but they also make deceptive calls, and these calls are used to win interspecies food competitions[150]. Presumably the advantages to both species in co-flocking currently outweigh the disadvantages of deception, but there remains a trade-off for interested observers between reacting to a false signal and ignoring a true one.

Because the referent and the interested observer are just types of receiver, only the curious human has a true fourth-person view: we can view a signalling event not in terms of its value to us but in terms of its value to others. Yet this view is so natural to our species that we often assume that other animals are able to adopt it, too; and it is so taken for granted that we often fail to consider this fourth-person view as significant in our model-building – even though most of our models of reality, both formal and informal, rely on it. It therefore becomes a given of our models of language signalling, and its absence in nonhuman signalling creates an apparently inexplicable dislocation between the two signalling structures.

Yet it is the fourth-person model of signalling, and the human ability to model the whole of signalling structure by adopting the role of disinterested observer, that makes many of the unique features of language signalling explicable. First, how do we negotiate to common meanings through language? We are able to model how others are going to receive our signals, so we are able to tailor our output; and by modelling the intentions behind the signals of others we are able to judge the likely truthfulness and intended meaning of any messages we receive. Second, why is language such a complex signalling structure? Complexity comes from the fact that language is involved not just with the denotation (or ostension) of a signal, but with layers of interpersonal and ideational connotation (or inference) that negotiating to a common meaning creates. Third, why is there so much redundancy (semantic and grammatical) in language? Because every negotiation to meaning is unique, and the connotative load of each message has

[150] **Charles A Munn**, Birds that 'Cry Wolf'. In *Nature*, 319, 9 Jan 1986, pp143-145

to be adjustable to circumstance. And finally, why don't nonhuman signals have a fourth-person dimension? Because, for nonhuman receivers, if there is no direct personal value in the signal then it is just white noise; and there is therefore no value in adopting the role of disinterested observer.

The fourth-person view sees signalling from the outside: the sender, receiver and referent are themselves just components in the model. This view allows the process of signalling to be examined not just in terms of what is exchanged between sender and receiver but in terms of what validates that exchange. As we will see, this creates a powerful description of signalling in terms of both structure and process.

3.3. Meaning and Value

The problem of what constitutes a signal has often been parsed as "what does the signal mean?" A signal without a meaning would appear to be worthless, or even impossible; but it is not meaning that makes a signal valuable.

When we use the word *meaning* we are adopting a fourth-person view of signalling. The assumption is that the value to the sender of making the signal and the value to the receiver of apprehending the signal are instantiated in the signal itself, and that the message therefore acts as an "exchange rate" between those sender and receiver values. For the nonhuman sender, however, a signal is an index of the sender's own emotional state: unease produces warning signals, happiness produces pleasure-grunts, sexual desire produces sexual display, and so on. To the receiver, on the other hand, it is not the sender's emotional state that is of interest, it is the relevance of the reactions that the signal produces in the receiver. The value of the signal to the sender is not in what it means but in its effects, and the value for the receiver is in the relevance of those effects to the receiver. The signal does not have to *mean* anything in the way that human language *means* (as in, the word *chair* encompasses a series of ideas which are both mutual to sender and receiver and determined directly by neither). A signal does not have to have *meaning* in order to have *value*.

A signal without value to the sender is a signal that will not be produced. The value may be in what it does for the sender's survival, or for the sender's social ranking, or for the sender's kin, but there has to be an identifiable Darwinian return for making the signal. Likewise, the receiver has to gain value from the signal, or it will not be apprehended and it will become pointless for

the sender to produce it. Without both of these values a signal has no evolutionary fitness advantages, so no survival potential.

In sender signals, as we will see, the signal can be viewed as two stimulus-response pairs: for the sender, the signal is a response to an external stimulus, and for the receiver it is a stimulus to a particular response. There is no need for a common value in these signals – in fact, their strength lies in the fact that production and apprehension of the signal are very different events. If a vervet monkey makes a leopard alarm, it is not the shared concept of leopard that is useful to its conspecifics, nor is it the shared sense of panic[151]. It is the fact that apprehending the signal causes the conspecifics to climb upward that makes the signal valuable to them. So we can see within this signal two different values: the value to the sender is that the signal marks the appearance of a referent (the leopard), but the value to the receiver is the receiver-action (climbing upwards).

With receiver signals the value of the signal to the sender is of interest to the receiver also, creating – in the mind of the receiver – a co-identification of the referent and the receiver-action. This co-identification has to have an iterative nature: the receiver must be aware of the "usual" receiver value of the signal, the likely value of the signal to this particular sender, and the "true" value of the signal as a product of the other two values. This has not simplified the signal, the receiver now has to comprehend three values to interpret it. Additionally, the receiver must be able to understand the intentions of the sender in making the signal – which means that they must see the sender as an object with intentions.

The problem here, however, is that all this cognizing by the receiver is being done in a selfish-gene environment: if the receiver sees the sender as a being with intentions then the intentions it must see are those of a self-serving and deceptive object. It is safer for the receiver to think the worst of any signals received in this environment: no signal is trustworthy unless it is demonstrably trustworthy[152]. The receiver should accept signals only if their trustworthiness is inherent – that is, if they are non-volitional or costly to produce[153] – or if deception

[151] **Dorothy M Cheney & Robert L Seyfarth**, *How Monkeys See the World: inside the mind of another species*, pp139-144
[152] **Amotz Zahavi & Avishag Zahavi**, *The Handicap Principle: a missing piece of Darwin's puzzle*, pp55-60
[153] **Amotz Zahavi**, Indirect Selection and Individual Selection in Sociobiology: my personal views on theories of social behaviour. In *Animal Behavior* 2003, 65, pp859-863

demonstrably disadvantages the sender. This latter case allows reduced-cost signals in some adult-child dyads[154], but in very few other circumstances outside of human society[155].

So we can see that value is necessary for a signal to survive in a Darwinian environment, and that there must be value in the signal for both sender and receiver. A common understanding by sender and receiver of the signal's meaning is, however, not necessary; and it may render the signal ineffective by introducing Machiavellian calculation into the signalling environment.

3.4. Signalling as Structure

We have already seen that the structure of signalling can, at the very least, be divided into the components of signal and receiver; this is the minimal pair required for senderless signalling. We have also seen that sender signalling requires three components: sender, message and receiver. The receiver is a base component common to both models, which means that the signal component of senderless signals can be equated in some way to the message and sender components of sender signals; and if we treat them as directly equivalent we can create a single signalling model. This allows us to view the message and sender as an evolutionary expansion of the signal.

With receiver signals we saw that the message is also divisible, consisting of two values: the referent, the context or cause of the message and therefore the value that the signal has to the sender; and the receiver-action, the value the signal has to the receiver. The values within the message are reliant on real-world objects and events: if the object or event is missing then the signal value is empty. It is the reliability of the correspondence between the signal and its real-world equivalents that keeps the signal in existence: a signal produced in the absence of its referent is not worth receiver-action; and a signal that does not invoke some form of receiver-action is not worth producing.

We thus have a signalling structure of two divisible components (signal and message) and four base components (receiver, sender, referent and receiver-action). The components in this signalling model are discrete and the structure they create is finite. The model is illustrated in figure 2, and it informs the structural analysis of signalling throughout this dissertation.

[154] **Dorothy M Cheney & Robert L Seyfarth**, *How Monkeys See the World: inside the mind of another species*, pp230-235
[155] **John Maynard Smith & Eörs Szathmáry**, *The Major Transitions in Evolution*, pp271-276

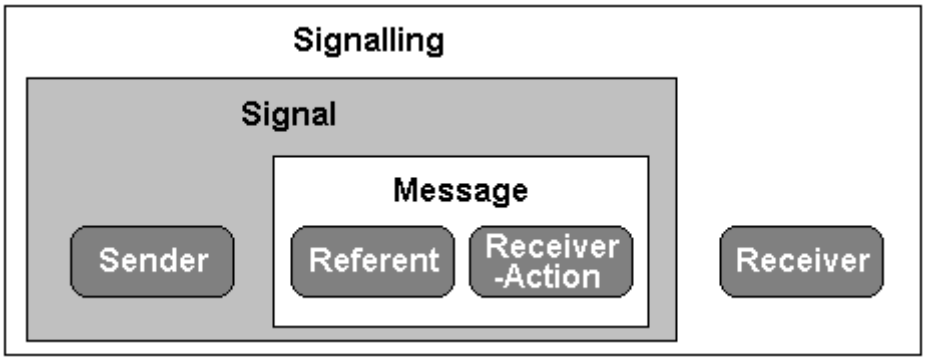

Figure 2 - The Structure of Signalling
Signalling consists of a Signal and a Receiver – the form of the Senderless Signal;
the Signal consists of a Sender and a Message – the form of the Sender Signal;
and the Message consists of a Referent and a Receiver-Action – the form of the Receiver Signal.

As we will see next, the sender, referent, receiver, receiver-action and message are functions of process as well as being components of structure. The components and functions identify closely, allowing signalling to be easily viewed as a system.

3.5. Signalling as Process

The process of signalling is simple compared to other types of process flows: with no milestones and no decision functions, it is truly sequential. The fact that individual instances of signalling are largely similar is also significant, and allows a simple common model to be derived. This model can be described as: *a context or referent acts as a stimulus to the sender to produce a message, and the message acts as a stimulus to the receiver to produce an action or reaction.* This is, in large part, the reason why signalling process and structure match so well: the simplicity of both the sequential process and of the three-level binary structure allow parallels to be easily identified.

In structure we looked for components and hierarchy. In process we look for functions and flow. The flow in signalling is easy to identify, there is a natural gradient from sender to receiver: the sender is the active generator of the message, while the receiver is the passive interpreter. But what are the functions?

The functions of most signalling are, at base, stimulus-response pairs: the referent is noticed by the sender, who produces a call. The call is noticed by the receiver, who produces an action. There are two different stimuli and two different responses: it looks more like two processes than one. Yet from the fourth-person viewpoint the two processes form a single continuity, and the second process is a dependent of the first. What is being passed between sender and receiver

is not knowledge or information or signs, but attention – or relevance. Leonard Bloomfield says, "Language enables one person to make a reaction (R) when another person has the stimulus (S)"[156]. This statement has equal validity in any signalling environment.

In nonhuman signalling the sender stimulus does not come from the referent, it *is* the referent; and the response does not produce the message, it *is* the message. Similarly, the receiver stimulus *is* the message, and the response *is* the receiver-action. There is no level of signification within stimulus and response – the sender and receiver are not decoding stimuli or encoding responses. The sender acts as the conduit of flow between referent and message, and the receiver is the conduit between message and receiver-action. Additionally, the message acts as the conduit between sender and receiver, which allows the signal to be seen from a fourth-person viewpoint as a flow from referent to sender to message to receiver to receiver-action.

All of the conduits of flow in the signalling process – sender, receiver and message – are functions with both an input and an output. The referent is a function with output only, and the receiver-action is a function with input only. This gives us the five functions of a signal process: **sender**, **receiver** and **message** as the conduits, **referent** as the source and **receiver-action** as the destination. The flow can be described diagrammatically as in figure 3.

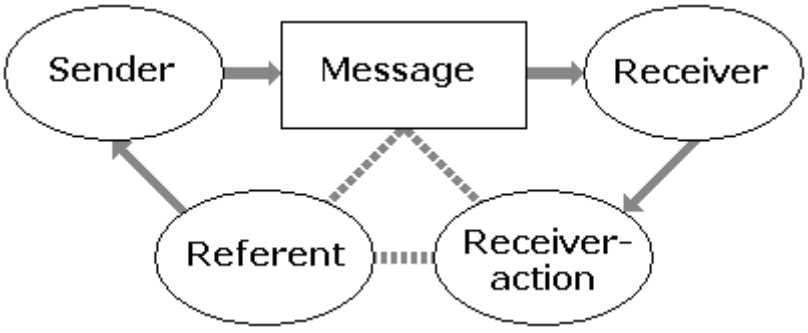

Figure 3 - The process of signalling
The Referent is the stimulus to the Sender to produce the Message
The Message is the stimulus to the Receiver to produce the Receiver-Action

The flow in this diagram is shown by the solid grey lines. It is sequential and unbranching and therefore represents the simplest type of flow. However, the sender flow (referent → sender → message) and the receiver flow (message → receiver → receiver-action) both exhibit features that mark them as "Peircean triangles". For the sender flow, the representamen or sign is the **referent**, which becomes the interpretant of the **message** through the object of the **sender**. The

[156] **Leonard Bloomfield**, *Language*, p24

sender may not identify themself as an object, but the fourth-person view does place them in that role: the sender is the hard fact that causes the referent sign to be perceived and interpreted.

For the receiver flow, the **receiver** is the object and the **message** is the sign; and, less obviously, the **receiver-action** is the interpretant. Treating the receiver-action as an interpretant is not as counter-intuitive as it first appears. Peirce says of the interpretant:

> I define a Sign as anything which is so determined by something else, called its Object, and so determines an effect upon a person, which effect I call its Interpretant, that the latter is thereby mediately determined by the former. My insertion of "upon a person" is a sop to Cerberus, because I despair of making my own broader conception understood.[157]

Peirce's "broader conception" is that his model is not a model of processes of mentation within individual minds, but of the conceptual process of mentation itself. For Peirce, the semiotic process is not cognitive but metacognitive, not a process of *meaning* but one of *becoming to mean*. In this view of the interpretant, the receiver-action is, from the fourth-person viewpoint, a clear effect caused by the sign of the message and determined by the receiver as object.

The two triangles of sender and receiver flow are linked in the standard Peircean way, with the interpretant of the first triangle becoming the sign of the next: the message acts in this dual role, providing the link between the two triangles. There is, however, a third triangle in figure 3, represented by the broken grey lines, and which is only available to a fourth-person view of the signalling process. The sign of the **referent** becomes the interpretant of the **receiver-action** through the object of the **message**. This means that the message acts in the roles of interpretant, sign and object separately in the three triangles. From the fourth-person viewpoint the message has the potential of representing the whole signification process – and this is a potential that is realised in language.

It must be re-emphasised that being able to adopt this fourth-person viewpoint is limited to disinterested human observers. The potential of segmentation in the message can only be achieved if the sender and receiver can also adopt this fourth-person viewpoint and see the message as more than just a response or stimulus to their own cognitive process – in effect, they have to be humans, able to adopt the disinterested stance.

[157] **Charles Sanders Peirce**, A letter to Lady Welby, December 23 1908. In *Selected Writings (values in a Universe of chance)*, p404

The Peircean semiotic triangle offers two ways of looking at signalling flows: first, the sign becomes the interpretant through the agency or perception of the object; and second, the firstness of the sign is motivated through the secondness of the object into the thirdness of the interpretant[158]. This has correspondences with other triads of process functions. For instance, Leonard Bloomfield describes the language message as a conduit between the referent (the stimulus to the sender) and the receiver-action (the reaction of the receiver), which corresponds with the third signalling triangle described above[159]. Ferdinand de Saussure describes Peirce's sign and interpretant functions as *signifier* and *signified*; each function triggers the other, a relationship he illustrates as two arrows[160]. Merlin Donald describes a mimetic process in which practice makes perfect: actions are mentally rehearsed, physically enacted and then mentally reviewed, creating a relationship of firstness (the signification involved in rehearsal), secondness (the hard fact of enaction) and thirdness (the review of the outcome) in mimesis[161].

All of these triads show that the process of conversion from one representation to another is key to understanding human cognition. Whether it is semiotic processing, comprehending the process of intention, analysing symbolic association, dialogic communication, or systematic planning, there is a relationship between first function and third function mediated by second function. Human cognition is a process of interpretation, or strategic thinking[162], or metamind[163], which seems to be rare in the rest of nature.

Charles Sanders Peirce	Sign Firstness	Object Secondness	Interpretant Thirdness
Leonard Bloomfield	Stimulus	Conduit	Response
Ferdinand de Saussure	Signifier	↑↓	Signified
Merlin Donald	Rehearsal	Enactment	Review
Signal – Sender relationship	Referent	Sender	Message
Signal – Receiver relationship	Message	Receiver	Receiver-action
Signal – Message relationship	Referent	Message	Receiver-action

Figure 4 - Triadic relationships in various models of human cognition and signalling

[158] **Charles Sanders Peirce**, The Architecture of Theories. In *Chance, Love, and Logic: philosophical essays*, pp176-178
[159] **Leonard Bloomfield**, *Language*, ch2
[160] **Ferdinand de Saussure**, *Course in General Linguistics*, translated & annotated by Roy Harris, pt1, ch1
[161] **Merlin Donald**, *A Mind So Rare: the evolution of human consciousness*, pp269-271
[162] **Adam Morton**, The Evolution of Strategic Thinking. In Peter Carruthers & Andrew Chamberlain, *Evolution and the Human Mind: modularity, language and meta-cognition*
[163] **Thomas Suddendorf**, The Rise of the Metamind. In Michael C Corballis & Stephen E G Lea, *The Descent of Mind: psychological perspectives on hominid evolution*

3.6. Signalling as System

In the system of signalling set out in this dissertation we can see that the components of structure largely map to the functions of flow. The base components of *sender*, *receiver*, *referent* and *receiver-action* are also functions in the signalling process. The sender and receiver are both conduits in the process of signalling, and non-divisible components paired with divisible components in structure; and the referent and receiver-action are both terminators of flow, and base components paired in the divisible component of the message.

This has an important effect on signalling as a system. Normally, the flow through a system carries the mutative effect of the system (how the system converts inputs to outputs), while the structure creates the constant rules (what the system is, regardless of the presence of flows). For instance, in a computer program the program itself provides the rules, and the data follows the rules to produce outcomes. The range of outcomes is predefined, but the particular outcome is determined by the datum. In theory, in a system where components and flows co-identify, it is possible for the data flowing through the system to change the structure of the system itself.

This mutation of structure by process is precisely what we see happening in language, but in nonhuman signalling it is constrained by the need to retain a one-to-one correspondence between referent and receiver-action: the flow cannot significantly affect structure without this correspondence being threatened. The conduits of flow (the sender and receiver) cannot be allowed to affect the values of the signal – hence the need for signals to be costly or non-volitional.

Referent and receiver-action co-identify with the message in the models above: the referent is the value of the signal to the sender, and the receiver-action is the value of the signal to the receiver. There is a problem, however: on one side, the referent is a primary stimulus for the sender but only secondary for the receiver. On the other side, there is no need for the receiver-action to be part of the sender's world-view – even though, in terms of outcome, it is the reason why the message works.

For instance, in the bee waggle dance, is the bee performing in order to directly recruit sisters to her food source, or is the dance a response to arriving back at the hive which incidentally results in recruitment? The dancing bee cannot possibly know whether other bees are going to respond to the dance by becoming foragers because there is no dialogue in the exchange. All she can

know (and this knowledge is at the genetic level) is that the dance attracts the attention of sisters, some of which process the food she is carrying. Indeed, if insufficient sisters are paying attention, the bee changes its behaviour to food processing, and performs another type of dance to recruit other processors[164]. The bees perform their dances not because they have meaning to either sender or receiver, but because they work. The value of the dance is not in the minds of the bees, it is in the genetic stimulus-response imperatives around the message; and, as we have seen, the message is a response by the sender but a stimulus for the receiver.

So where do referent and receiver-action co-identify? If the message is viewed by the sender then only the referent is significant, if viewed by the receiver then only the receiver-action is significant; but if it is viewed by a fourth person then the fact that the message is a response to the referent and a stimulus to the receiver-action, and the fact that these are one-to-one relationships, *is* significant. The message, referent and receiver-action all co-identify.

However, this means that the message of structure is a hierarchical component, while the message of process cannot have hierarchy, only flow. The message of structure and the message of process would therefore seem to be different things.

In fact, both types of message are composites, although the composition is expressed in different ways. The structural description of the message is as a hierarchical container, while the process description is as a series of functions which depend on the process view adopted. The process message is the response, or terminating function, of the sender process; and it is the stimulus, or initiating function, of the receiver process. In both of these cases the message function has a single role and no hierarchy. From the fourth-person viewpoint the message has a linking function between the stimulus for the sender and the receiver response: once again it has a single role and no hierarchy. The objective event and the message itself are the same in each case, but the subjective event depends on the viewpoint taken.

The co-identification of message, referent and receiver-action does not work in language because referent and receiver-action no longer reliably co-identify, and the action inside the message is no longer the receiver-action outside the message. In language, the single word *leopard* can be a warning, an invitation to look, a comment, an identification of something that has some attributes in common with a leopard, and so on, determined by context. The language

[164] **Carl Anderson & Francis L W Ratnieks**, Worker Allocation in Insect Societies: coordination of nectar foragers and nectar receivers in honey bee (*Apis mellifera*) colonies. In *Behav Ecol Sociobiol*, (1999) 46, pp73-81

message is a container for conventional meaning, sender meaning and receiver meaning, so it is not an indivisible function.

However, as a functional container, the language message is itself a process: it involves a translation of sender's intention into receiver's comprehension. Because the receiver has a role in comprehending the message, and the sender has an agenda in creating the message, the language signal is a negotiated transaction between sender and receiver. Without this understanding of the other's role in the signalling process there would be no need to accommodate the other in the exchange of the signal.

It is in the message that we see the difference between language and nonhuman signalling, as well as the difference between the components of language structure and the functions of process. These differences will be further explored in chapters 4 to 6. In nonhuman signalling, however, the co-identification of the referent and receiver-action with the message allows the message of process and the message of structure to be viewed as semantically equivalent.

3.7. Two Views, One Signal

In this chapter we have seen that a signal does not need to have 'meaning' to either sender or receiver. What gives it value is the fact that it reliably allows a receiver to react to a situation of which they are unaware; but the receiver's reaction is to the signal and not to the situation, and the sender and receiver do not need to be aware of each other for the signal to work.

We have also seen that signalling looks different depending on the viewpoint taken: first, second, or fourth person. The fact that the first-person sender and second-person receiver viewpoints each reveal only part of the structure of signalling is predictable from the fact that sender and receiver are themselves components within the model; it is only when signalling is viewed from the outside, from a fourth person standpoint, that the full system is revealed.

When we look at signalling as a structure we see a series of nested binary relationships, and these binary relationships reflect different levels of sophistication in the ability to model the intentions of others. From the two components of senderless signals to the six components of reciprocal signals we see an increasingly complex hierarchical structure with primary, secondary and tertiary components. At the primary and secondary levels there are indivisible and divisible components; at the tertiary level there are necessarily only indivisible components. The four indivisible components are the receiver-action and the three entities in the structure

(receiver, sender and referent); the divisible components are the signal and the message. The divisible components are therefore emergent entities, while the indivisible are source entities; but all the components are necessary to fully model the structure of signalling from the fourth-person viewpoint.

The components of the model set out here correspond to the components given or implied in other models of signalling. There is a sender or addresser, a receiver or addressee, a sign or message, and a signal (which may or may not be co-identified with the message). The model acknowledges that there is a referent or context or cause of the signal, but it also identifies the product of the signal (the receiver-action) as part of the signalling process. Many models do not include this final component, but it is the reason why the signal was made and why it works. It has to be accounted for if the purpose of any signal is to be discovered.

We have also seen that the process of signalling is productively a sequential flow: the stimulus of the referent incites the sender to produce the message, and the message incites the receiver to produce the receiver-action. However, there is a second, interpretive, flow – identifiable by a fourth-person viewer – converting a referent to a receiver-action via a message. This creates two types of flow through the process: the productive flow involving sender and receiver, and the interpretive flow, where sender and receiver are less significant.

The message is the key to signalling, uniting the referent and receiver-action functions into a process involving both productive and interpretive flows. Although the process of signalling is not hierarchical, it cannot be understood from a single perspective. The three perspectives – sender, receiver and fourth-person – show that it is not at all necessary to view signals as part of a communication transaction. This is perhaps the hardest part of signalling to comprehend: signals are not made because the sender wishes to communicate, they are made because the animals who signalled – or their close relatives – survived better than those that did not. Production and comprehension would seem to be two functions in a single process, but it is a process that does not need to be understood by either sender or receiver. The evolutionary "invisible hand"[165] in signalling allows it to work without "meaning" anything to sender or receiver.

Finally, it must be emphasised that the model given here is not *the* solution to the problem of the structure of signalling, it is *a* solution; but it is a coherent solution and, as we will see, provides

[165] **Rudi Keller**, *On Language Change: the invisible hand in language*

important and informative links between the structure and process of signalling. In the next chapter we will see that, because it relies on an internalised fourth-person viewpoint, language is very different to other forms of signalling.

4. Grammar: Formalism and Theories of Structure

The last chapter showed that the structure and process of signalling provide a unified model in which the components and functions co-identify, even though the hierarchies and flows tell rather different stories. This co-identification of structure and process in signalling applies outside and around the message; and human language, as a signalling system, is subject to it.

However, human language has features that separate it from other forms of signalling. It is segmented, not just exceptionally but by nature: the noun-verb distinction and subject-verb-object-indirect object form seem to be universal[166]. It is symbolic: the meaning of a language utterance is not just a product of the sounds of which it is composed, it is a product of the sender's intentions in making the utterance, the receiver's comprehension of those intentions, and the double-guessing produced by both sender and receiver knowing the other has intentions[167]. Language is also transactional: meanings are not the outcome of a single understanding imposed by one party on another, there is a constant negotiation of meaning between sender and receiver, a *becoming to mean*[168]. And language is cultural: it is used to do things[169], it is used to lie productively[170] and by agreement[171], and every utterance is part of a continuing discourse – no word or utterance is an island[172].

Emphasis on different features separating language from other signalling produces different models of how language evolved, but any successful model must explain all of the differences at some level. In this thesis the emphasis is on segmentation, and this chapter considers the way that segmentation – the basis of grammar – is understood to work in the structure of language.

In this chapter the traditional theories of language structure are examined to identify how language is formally described. The dominant models in this area are largely the inspiration of one man, Noam Chomsky; but the range of theories he has created and inspired, some of which are mutually exclusive, offer several alternative views of how language could be constructed

[166] **R L Trask**, *Key Concepts in Language and Linguistics*, p224 & pp35-36
[167] **Robin I M Dunbar**, *The Human Story: a new history of mankind's evolution*, ch3
[168] **Michael A K Halliday**, *Learning How to Mean: explorations in the development of language*
[169] **J L Austin**, *How to Do Things with Words*
[170] **Eduardo Giannetti**, *Lies We Live By: the art of self-deception*
[171] **Kerstin Dautenhahn**, Stories of Lemurs and Robots – the social origin of storytelling. In *Narrative Intelligence*, eds Michael Mateus & Phoebe Sengers, 2003, pp59-66, John Benjamins Publishing Company
[172] **George Yule**, *Pragmatics*, ch1

and deconstructed. Due to space constraints the trajectory of Chomsky's theories will be used in this dissertation as an exemplar of developments in Formalist linguistics over the past 50 years. This should not be taken as a denial of the wide range of productive work being done by other Formalist researchers outside of this trajectory.

4.1. Formalism – a Short History

The linguistic theories of Noam Chomsky have revolutionised the subject of linguistics over the past fifty years. His theories has provided bases for others to build on, and a rich and wide range of effective language models have been produced as a consequence. He has also initiated an active and sometimes acrimonious debate in the linguistics community[173].

Chomsky first began to set out the theories of Formalist language structure in 1957 in *Syntactic Structures*[174]. He dismissed a prescriptive approach to language, and showed the problems associated with traditional finite-state and phrase structure grammars: finite state grammars are inflexible and can only model a subset of possible sentences; phrase structure grammar is more complete and able to model most sentences, but it is clumsy and possibly incomplete when modelling complex, recursive forms. Chomsky's solution, Transformational Grammar, was an attempt to offer a complete and simple engine which would be able to model all possible languages, past, present and future. Unlike a descriptive grammar, which explains existing utterances but cannot predict new ones, Chomsky's generative grammar predicts possible future forms from a limited set of examples. It is this predictive nature of language which implies that children must be born with some kind of linguistic fore-knowledge, but Chomsky did not explore this theme until later. Also, while he provided examples of how the syntactic rules could be arrived at, Chomsky did not initially describe the rules themselves. *Syntactic Structures* was a promissory note for a solution still to come.

In *Aspects of the Theory of Syntax*, Chomsky set out the theory of Deep and Surface structures in language[175]. The deep structure can be equated with the conceptual level of language, the level at which the relationships between objects are assembled into a cognitive model. The surface structure consists of the utterance produced, where the meaning produced may or may not correspond to the intended meaning, depending on the way deep structure was converted to surface structure. The deep structure rules are transformed to surface structure sentences via a

[173] **Randy Allen Harris**, *The Linguistics Wars*
[174] **Noam Chomsky**, *Syntactic Structures*
[175] **Noam Chomsky**, *Aspects of the Theory of Syntax*

set of transformational rules, which convert the context-free deep structure to a context-specific surface form. Chomsky's *Aspects* model became known as the Standard Theory.

Standard Theory is about language structure in the mind: there are cognitive resources which interpret (or generate) the deep structure, and which moderate the surface structure into (or from) an acoustic signal. The acoustic signal is the only external part of the process, the visible tip of the iceberg. Chomsky identified three resources that generate deep structure: the lexicon, which provides the words, or "atoms" of work; the rules or syntax, which determine the structure of phrasing; and the semantic values to be encoded or decoded. In the Standard Theory these resources are independent of any actual language; they are resources available to all humans who use language.

Although Chomsky once again promised that a Universal Grammar engine would emerge from this theory, he provided only examples of how this engine might work. It was left to others to find the mechanisms of the engine. Unfortunately, different people found different solutions. Charles J Fillmore proposed *Case Grammar*[176], in which deep structure was based around the effects of the verb on other sentence components; *Relational Grammar* (P M Postal[177] among others) was almost the mirror image, being concerned with the hierarchical relations of subject, object and indirect object; and George Lakoff's *Generative Semantics*[178] concentrated on the semantic content of deep structure.

Chomsky realised that there was a problem with the Standard Theory model, in that the Semantic Interpretation did not appear to be correctly defined. As he stated in *Language and Responsibility* in 1977:

> The first person who offered a substantial critique of the Standard Theory, and the best, as far as I can recall, was Ray Jackendoff – that must have been in 1964 or 1965. He showed that surface structure played a much more important role in semantic interpretation than had been supposed; if so, then the Standard hypothesis, according to which it was the deep structure that completely determined this interpretation, is false. For example, by studying the interaction of negation and quantification within a sentence, Jackendoff showed that their relative position in the surface structure of the sentence was crucial for interpretation. Many other such examples were worked out by Ray Dougherty and others.[179]

[176] **Charles J Fillmore**, Types of Lexical Information, in *Semantics: an interdisciplinary reader in Philosophy, Linguistics and Psychology*, pp370-392
[177] **P M Postal**, Underlying and Superficial Linguistic Structure, in *Language*, pp179-201
[178] **George Lakoff**, On Generative Semantics. In *Semantics: an interdisciplinary reader in Philosophy, Linguistics and Psychology*, pp232-296
[179] **Noam Chomsky**, *Language and Responsibility*, pp151-152

The semantic interpretation had to change from being a moderator of deep grammar to being a moderator of surface grammar. This, in turn, meant that surface grammar no longer had a one-to-one relationship with the phonological interpretation, so conversion rules were needed between surface structure and both the phonological and the semantic interpretations.

This model, however, introduced a new problem. The lexicon is divorced from phonological and semantic interpretations; but then, what is a mental lexicon if not a cross-referencing of meanings with sounds, and with the muscular processes required to produce those sounds? The only other feature which could occupy the role of the lexicon is the class value of words (verb, noun, adjective, etc), but Chomsky places this firmly in the phrase structure rules. Of course, it is possible to remove lexicon as a moderator of deep structure, as was done for the semantic interpretation; but this leaves deep structure even further impoverished. The model would then show a set of rules (phrase structure) producing a deep structure which is not directly linguistically applicable. A second set of rules (transformational) must then be applied to produce an applicable surface structure. This seems somewhat baroque and difficult to justify in terms of what seems to happen in real humans[180].

Chomsky clarified in *Language and Responsibility* that deep structure is not Universal Grammar. Universal Grammar is a metatheory[181], it is concerned with the conditions under which language can appear – the bounds of what we can do with linguistic communication. Deep structure is the rules under which a linguistic utterance is generated, the structure generated by the base component of the linguistic system. It does not produce phrase structure, semantic structure or phonological structure, and it has only an indirect role in the production of surface structure[182].

This definition of deep structure is understandable in light of the revision of the model between *Aspects of the Theory of Syntax* and *Language and Responsibility*. In the first, deep structure followed a Wittgensteinian definition as the parts of language which are hidden from view, the mental language engine which powers language utterance[183]; in the second it is the structure that converts the initial element or base component into a surface structure.

[180] **Geoffrey Sampson**, *Empirical Linguistics*, pp132-139
[181] **Noam Chomsky**, *Language and Responsibility*, p183
[182] ***Ibid***., p165 & pp169-179
[183] **Ludwig Wittgenstein**, *Philosophical Investigations*, remarks 269-280

By the time *Language and Responsibility* was published, Chomsky had adopted the concept of the linguistic "trace". This is an element of the structure that is not expressed – a phonological zero element. Chomsky took the view that handling traces was a function of the phonological rules. So, for example, the surface structure of:

*Who did you see **t**?*

Is rendered to the phonological form:

Who did you see?

The formants of the surface structure would have needed to add the trace as a marker of transitivity for the verb *see*. Of course, this begs the question of why a deep structure that is also satisfied by the acceptable English form *you saw whom?* should be transformed to the complex surface structure *who did you see?* This is either a permissive transformation process which is capable of producing multiple outputs from one input, or the inputs to *you saw whom?* and *who did you see?* are different.

By 1982 Chomsky was developing the Principles and Parameters model. In this model there are certain features of Universal Grammar which are explicit in the language product. These features are passed through all the transformations of the Extended Standard Theory without excessive change because they are a product of parameterisation in Universal Grammar. For instance, the location of a complement to the left or right of its specifier seems to be universal, with each language parameterised to left or right; so knowing the location of one complement in a language is, because of the universal rule, enough to know them all. At this stage, Chomsky saw Universal Grammar as a physical instantiation in the human mind which can generate a large but finite set of real languages:

> We observed that it is a task for the brain sciences to explain the properties and principles discovered in the study of mind. More accurately, the interdependency of the brain sciences and the study of mind is reciprocal. The theory of mind aims to determine the properties of the initial state S_0 and each attainable state S_L of the language faculty, and the brain sciences seek to discover the mechanisms of the brain that are the physical realizations of these states. There is a common enterprise: to discover the correct characterization of the language faculty in its initial and attained states, to discover the truth about the language faculty. This enterprise is conducted at several levels: an abstract characterization in the theory of mind, and an inquiry into mechanisms in the brain sciences. In principle, discoveries about the brain should influence the theory of mind, and at the same time the abstract study of states of the language faculty should formulate properties to be explained by the theory of the brain and is likely to be indispensable in the search for mechanisms. To the extent that such connections can be established, the study of the mind – in particular, of I-language – will be assimilated to the mainstream of the natural sciences.[184]

[184] **Noam Chomsky**, *Knowledge of Language: its nature, origin, and use*, pp38-39

Here we see a series of concepts formalised into the Extended Standard Theory. The initial state of language, S_0, is identified with Universal Grammar, and the attainable state, S_L, is identifiable with an instantiated grammar. There is also I-language, or internal language, which is contrasted with E-language, or external language. This I-language/E-language distinction is not a novel description. It has a long pedigree, and is effectively identifiable with Wilhelm von Humboldt's *Language* and *Languages* distinction[185]: language is instantiated both as a personal cognitive engine and as a shared community phenomenon.

The concept of government, introduced in the Principles and Parameters model, formalises the linguistic hierarchy into a phrase structure, with certain elements being subordinate to, or *bound to*, others[186]. A verb or preposition governs its object noun phrase, a noun governs its adjective, and so on. Binding is the semantic process by which lexical items refer back to previously defined items[187]. Pronouns are the most obvious example, but adjectives like *same* (as in *the same idea*) or adverbs like *again* (*it's happened again*) can also have wider binding properties.

Chomsky described the new model (often called the Revised Extended Standard Theory, or REST) as consisting of:

a. X-bar theory
b. θ theory
c. Case theory
d. Binding theory
e. Bounding theory
f. Control theory
g. Government theory[188]

X-bar theory is an attempt to identify the phrase structure rules which are universal rather than language specific. θ-theory states that there is a formal structure determined by thematic roles (e.g. *Agent*, *Patient* and *Goal*), and each item must be expressed in the deep structure. Case theory is concerned with the assignment of case where it is needed (for agreement or tense), but in deep structure, not surface structure. Bounding theory covers the conditions of separation operating on items subject to binding. Finally, control theory is concerned with the phonological zero element, formerly called *t* but now called PRO. From this collection of theories Chomsky attempted to build a comprehensive set of Universal Grammar features. However, despite

[185] **Wilhelm von Humboldt**, *On Language: on the diversity of human language construction and its influence on the mental development of the human species*, pp74-76
[186] **Vivian J Cook & Mark Newson**, *Chomsky's Universal Grammar : an introduction (2nd edition)*, p51
[187] **Noam Chomsky**, *Language and Problems of Knowledge: the Managua lectures*, p52
[188] **Noam Chomsky**, *Some Concepts and Consequences of the Theory of Government and Binding*, p6

considerable work on REST by many linguists, the definition of Universal Grammar remained more promissory than real.

Chomsky was still dissatisfied with the REST model, and in 1995 he produced *The Minimalist Program*. In chapter 4 he drops a bombshell:

> A linguistic expression of L is at least a pair (π, λ) meeting this condition [capable of Full Interpretation] – and under minimalist assumptions, at most such a pair, meaning that there are no levels of linguistic structure apart from the two interface levels PF and LF [Phonetic Form and Logical Form]; specifically, no levels of D-Structure or S-Structure.[189]

Suddenly, the differentiation between deep and surface structures is swept away. This new approach has not endeared Chomsky to many in the American linguistics community, who have spent a large part of their lives identifying the rules of deep and surface structure and mapping the transformational rules between the two.

The Minimalist approach to grammar has recently been set out in some detail by Norbert Hornstein. He shows that the seven theories of REST (X-bar, θ, Case, Binding, Bounding, Control and Government theories) can all be reduced to a single theory, that of movement[190]. In doing so he argues against Chomsky's own theory of attraction, or *attract/move* (grammatical forms attract semantically linked items, moving them according to a fixed set of rules), which replaced the old doctrine of *merge and move*[191]. It has to be said that Hornstein's theory satisfies the Minimalist requirement of being simpler than Chomsky's, and it may be a sign of even greater simplification to come in the Minimalist Program.

4.2. Formalism – The Minimalist Program

With each new Formalist Grammar theory there have been some theorists who have continued working on the old model. However, in the case of the Minimalist Program, Chomsky has not carried many adherents with him. As Frederick Newmeyer says:

> If I were to write this book several years from now, I would opt for the MP [Minimalist Program]. However, at the present time, I find the concrete claims of the MP so vague and the total set of mechanisms that it requires (where I have been able to understand them) so *unminimalist* that I see no reason to encumber the exposition with my interpretation of how the phenomenon in question might be dealt with within that approach. It is also worth pointing out that even leading

[189] **Noam Chomsky**, *The Minimalist Program*, p219
[190] **Norbert Hornstein**, *Move! A Minimalist theory of construal*
[191] **Noam Chomsky**, *The Minimalist Program*, pp297-312

> developers of the MP typically appeal to strictly GB [Government and Binding] principles in presentations to general audiences of linguists.[192]

One of the most powerful promises of the initial *Syntactic Structures* theory was the identification of a mechanism by which an instantiated grammar could be generated from Universal Grammar. With the Minimalist program Chomsky is saying that Universal Grammar allows not just the set of learnable human languages; it may also permit unlearnable possibilities[193]. UG is therefore more powerful and more general than required by the sum of all languages, more powerful even than required by the sum of all possible languages. This means that the relationship between Universal Grammar and languages is not bi-directional: a language can only exist if it is permitted by the universal constraints, but the universal constraints do not by themselves predict a language – learnability must also be present. Universal Grammar has ceased to be an engine generating language and has become something more abstract.

There remain problems with the Minimalist Program, which can be illustrated by looking at two claims made in chapter 1 of *New Horizons in the Study of Language and Mind*. First, Chomsky considers the importance of the recursive nature of language:

> Human language is based on an elementary property that also seems to be biologically isolated: the property of discrete infinity, which is exhibited in its purest form by the natural numbers 1,2,3, ... [194]

However, the property of "discrete infinity" is actually two properties: discreteness, and recursion. The term *infinity* is particularly mischosen: humans have no concept of infinity except through linguistic metaphor. There is no instantiation of language which is infinite because it has to be held inside a human mind. It is true to say, in a trivial way, that language constructs can be strung together without ever reaching an end of sentence – although, if your definition of a well-formed language construct is a sentence, this does not produce well-formed grammatical constructs. It is also true to say that the full range of possible sentences in a language can never be uttered; but this also is trivial, and reduces language to chatter: it fails to fully recognise that language is a method of transferring meaning around a community, and it is not what *can* be done with language but what *is* done that matters. Language is an incredibly rich and complex system, and is clearly highly extensible, but the question of whether human language is really based on discrete infinity continues to remain unproved.

[192] **Frederick J Newmeyer**, *Language Form and Language Function*, pp12-13
[193] **Noam Chomsky**, *The Minimalist Program*, pp17-18
[194] **Noam Chomsky**, *New Horizons in the Study of Language and Mind*, p3

On the faculty of language, Chomsky says:

> The faculty of language can reasonably be regarded as a "language organ" in the sense in which scientists speak of the visual system... [195]

The term *organ* is not much used nowadays by biological scientists, and has been replaced by the word *system*. There is recognition that systems, like seeing, are interactions between several specialised and non-specialised functions which work together in an integrated way. Some structural damage (e.g. loss of an eyeball) causes system degradation; other damage (e.g. a lesion in the visual cortex) can cause unrelated components to be pressed into service to repair the system damage, even though the component damaged is itself irreparable. If Chomsky's language organ is like the eyeball then there would be a danger that damage would degrade it. If, however, it is like the visual cortex then it would be difficult to degrade. This seems to be the case for language, and it is reasonable to consider it a function of the cortex. However, the cortex is a highly plastic area of the brain, and variations between different brains are common[196]. If the language "organ" is located in the cortex then it will be hard to isolate. Additionally, most cortical systems are support mechanisms for pre-existing limbic or brain stem functions; but Chomsky does not accept the existence of pre-language functions which dictate the nature of language. Unusually, therefore, language would be a cortical system without a sub-cortical function. For this reason the discrete, organic nature of language has to be considered uncertain.

Chomsky's basic theory, that something about language is species-invariant, is supported by the facts: people appear to be able to learn any language, either as a first or subsequent language, at least to the point where they can communicate with other speakers. This is something that most (Chomsky would say all) other animals cannot do. However, if language is emergent from evolutionarily earlier systems, the thing that is invariant need not be language itself. The sources of language, located in pre-human systems, can still be species-invariant (because they are pre-species-invariant), but the principles of language would then be determined by non-linguistic necessities, and language could not be a discrete organ.

On the other hand, just because language is a product of an unconscious process does not mean that it has to be genetically inspired. Driving a car is an unconscious process, after the initial learning has been completed, but it is not genetically innate. However, the paradigm of driving

[195] ***Ibid.***, p4
[196] **Susan Greenfield**, *Brain Story: unlocking our inner world of emotions, memories, ideas and desires*, ch3

has been refined so that it closely matches and uses other innate abilities. The modern car is a human artefact which is not a product of a genetic driving instinct, nor even a genetic need to drive. It is a device emergent from a social desire for rapid movement and ownership of personal space, and it is a compromise between these desires, the physical limitations imposed on the device, and the human abilities to control such a device.

Language, like driving, is an unconscious process after the initial learning has been completed. Does it require a Universal Grammar – an innate genetic component – or has language been refined so that it closely matches and uses other human abilities?[197] Is Universal Grammar the base on which language is developed, as Chomsky maintains, or is it an emergent feature of the common demands that we make of language?

There are also problems with the concept of how Universal Grammar produces I-language. For Chomsky, Universal Grammar produces instantiations of I-language through the setting of "switches", which determine the rules of the I-language. I-language is therefore an emergent effect of genetically enforced Universal Grammar. Because the I-language can have any of the states allowed by the Universal Grammar, the switch choices have to be statistically neutral. If they were not then all languages would tend towards a single model, rather than the range of models we see in the real world.

However, this merely carries the problem of language acquisition to another level. What are the switches, what sets them, and how can they be statistically neutral? When looking at genetic processes which produce emergent effects we see overwhelming evidence of single solutions coming from those processes. The genes which produce the proteins which control the growth of the body and brain all produce very much the same design every time. Variants are seen as aberrations and are mostly not successful in evolutionary terms – there is little statistical neutrality in body design. The design of *Homo sapiens* has remained largely unchanged for at least 150,000 years, which amounts to about 7,500 generations. If there is a species-invariant structure behind I-language (Universal Grammar) then why does it allow statistically neutral variance in I-language?

[197] **Terrence Deacon**, *The Symbolic Species: the co-evolution of language and the human brain*, offers a full argument

4.3. Formalism and the Origins of Language

One of the major problems for Chomsky's theories is, how did language come to exist as a species-wide capacity? It is not an issue that Chomsky really tackles, although he has consistently maintained that language has no precursors: language is a perfect, or near optimal and minimal device, it cannot be subdivided or impoverished to demonstrate a pre-language state[198]. This has led to the belief that Chomsky supports a sudden and catastrophic appearance of language in humans. However, while "sudden appearance" best typifies Chomsky's approach to language genesis, Chomsky himself displays only a cursory curiosity about the subject. He is interested in the current structure of language only, and he makes little comment on language origins. By assuming sudden appearance he is able to treat Universal Grammar as an ideal structure: it may not be the most elegant engine for language production, but it is the only game in town. There is no reason to look for variation in the Universal Grammar engine, inherent in its name is the fact that there is no variation to be found.

The Formalists who do take an interest in language genesis have to deal with this Chomskyan assumption. Steven Pinker's solution is to posit a steady, incremental evolutionary transition from nonhuman signalling to language throughout the human lineage:

> Though we know few details about how the language instinct evolved, there is no reason to doubt that the principal explanation is the same as for any other complex instinct or organ, Darwin's theory of natural selection.[199]

Another solution is to posit a series of intermediate language-types between pre-lingual signalling and full language. Derek Bickerton sees only one step, which he refers to as protolanguage. He believes that this is still used in pidgins, child language and aphasic language; but he recognises that this single step may be insufficient:

> Granted, this assumption still does not smooth the path, for the gulf between protolanguage and language remains an enormous one. But at least it makes the task possible, especially since the level of representational systems achieved by some social mammals amounts to a stage of readiness, if not for language, at least for some intermediate system such as protolanguage.[200]

Pinker, on the other hand, sees the use of pidgins, child language and aphasic language as proof of the vast range of different communicative solutions under the heading of language. The same data seems to prove two mutually exclusive things:

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[198] **Noam Chomsky**, *The Architecture of Language*, pp18-24
[199] **Steven Pinker**, *The Language Instinct*, p333
[200] **Derek Bickerton**, *Language and Species*, p 128

> The languages of children, pidgin speakers, immigrants, tourists, aphasics, telegrams, and headlines show that there is a vast continuum of viable language systems varying in efficiency and expressive power, exactly what the theory of natural selection requires.[201]

However, if Universal Grammar exists, then Bickerton's position is more tenable. Universal Grammar is an "organ" which is present in humans and absent from all other animals. It is species-invariant; and it does not assist language, it permits it. Most importantly, it is indivisible: the rules do not relate to specific language constructs or forms, they determine the whole structure of language[202]. There is no partial development with Universal Grammar: it is either present, and full language can be generated; or it is absent and full language is impossible. Universal Grammar is a principle that both Bickerton and Pinker appear to support, but it is not necessarily compatible with either evolutionary theory or protolanguage.

Bickerton's protolanguage cannot be dismissed out of hand. It is indeed likely that full language was preceded by a functional signalling system which had aspects of segmentation. For Alison Wray, protolanguage solves the problem of continuity: it forms an intermediate state between the holistic signalling of other primates and the analytical (or segmented) language used by humans. Wray points out that all modern languages contain a holistic element[203]. This corresponds with the simple grammar constructs given in Edwardes 2001[204], and is represented by such things as idiom and those difficult little adverbial interjections like *yes*, *no* and *thanks*. Wray also presents evidence of holism in modern morphemic segmented language use: segmented constructs can be analysed both as morphemic and as holistic, and the speech outcomes of these mutually exclusive analyses are indistinguishable. For instance, is the construct *I/you/she did it my/your/her way* a fully analysed sentence, or a slot-filling exercise? Wray describes the use of apparently grammatical holistic utterances as "performance without competence"[205].

This still leaves an important issue to address: how did the analytic content of language evolve? Wray considers two routes. The first is a slow increase in the number, range and use of analytic constructs throughout the history of protolanguage; the second is a slow evolution of the

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[201] **Steven Pinker**, *The Language Instinct*, p366
[202] **Derek Bickerton**, How Protolanguage Became Language. In *The Evolutionary Emergence of Language: social function and the origins of linguistic form*
[203] **Alison Wray**, Holistic Utterances in Protolanguage: the link from primates to humans. In Chris Knight, Michael Studdert-Kennedy & James R Hurford (eds), *The Evolutionary Emergence of Language: social function and the origins of linguistic form*
[204] Available at http://www.btinternet.com/~martin.edwardes/ma_thesis.doc, ch6
[205] **Alison Wray**, Dual Processing in Protolanguage: performance without competence. In Alison Wray (ed), *The Transition to Language*

features which created the environment in which analytic language could emerge, but with the actual emergence being a single event. As the use of analytical signalling itself imposes limitations on the analytical structures possible, Wray favours the second solution: this would allow the features enabling segmented language to evolve unrestrained by the limits of other types of signal.

Wray's analysis gives one solution to the problem of complexity: why language is so clearly over-engineered for signalling purposes and why it can be used so easily to produce lies. Her theory offers a middle path between the catastrophic events of Chomsky and Bickerton, and Pinker's optimistic incremental evolution.

4.4. Formalism and the Real World

When looking at Formalist theories as an explanation of real language cases, there are issues to be addressed. Chomsky has always adopted the view that language should be studied as an ideal object, and that cases only confuse the issue[206]; but, at some stage, any theory has to be lined up against the facts to check its validity. Formalism works well with many outcomes of observational linguistic analysis, but it does have its problem areas.

One problem for Formalist linguistics is that of synonymous construction. *At this point we diverged* has a similar meaning to: *we diverged at this point*; *this is the point at which we diverged*; *our divergence occurred at this point*; and even *we diverged here*. The same message can be expressed in different ways, with different surface grammar constructs; but there is a semantic relationship which cannot be explained just in grammatical terms. While Generative Semantics[207] would seek to describe a deep semantic structure, and REST would posit a series of transformations from a standard deep form to each of the surface forms, Minimalist theory is largely silent on this matter. Indeed, the interpretation seems to be that they are different constructs, and cannot be easily co-analysed. This is counter-intuitive, and it would seem reasonable that there is a relationship here that a theory of linguistics should be able to address. The primary (some would say only) purpose of language would seem to be to transfer meaning from one person to another. Semantic significance is central to the function of language, and it would appear that it should be placed at the centre of any linguistic theory. Chomsky disagrees with this approach, but he recognises that he is ploughing a lonely furrow.[208]

[206] **Noam Chomsky**, *New Horizons in the Study of Language and Mind*, pp98-100
[207] **George Lakoff**, *Women, Fire, and Dangerous Things - what categories reveal about the mind*
[208] **Noam Chomsky**, *On Nature and Language*, pp110-111

Another question that remains to be addressed is whether grammar is always needed for the transfer of meaning. Words and phrases encapsulate meaning, and they can work holistically without a grammatical overlay. Indeed, some of our commonest utterances (*yes* and *no*) live in a strange grammatical limbo; and an utterance like *You! Here! Now!* demonstrates that messages can be clear yet agrammatical. It could be argued that these utterances demonstrate the fact that their surface structure must have a deep structure for them to be understood, but it sounds a little like the argument for phlogiston in early physics: things that burn must contain something to make them burn. Deep structure could be the phlogiston of linguistics, a position not incompatible with Chomsky's Minimalist Program.

One final problem for the Formalist approach lies in Chomsky's initial assumption that there has to be a genetic component to language because language is an unlearnable system. There has been much debate on this subject, and even Chomsky acknowledges that there has to be a learned component – and that component appears to be getting more significant with each incarnation of theory. The argument against Chomsky is no longer that language is wholly learned; very few now take this position. The dispute now centres on how much and what needs to be innate, and whether these innate features are language-specific or more general. Human capacities long thought to be innate are being found, on closer examination, to have large learned components. For instance, a recent study has shown that mathematics is not a human universal[209], despite Hauser, Chomsky and Fitch's claim that a recursive counting ability is implicated in the universals of language[210]. Recursion as a requirement for language itself has also recently been challenged[211].

By placing Universal Grammar and language parameters at the genetic level, Formalists are able to state that language rules are universal. However, a description of the genetic process that creates a human universal grammar engine remains elusive. This may well be, as Mark Baker suggests, due to insufficient time to study the area: the science may just be too young to provide the answers[212]. However, by its nature the parameterised view of language (internal language) has a finite structure, and many believe the set of parameters to be small. It is not a moving

[209] **Peter Gordon**, Numerical Cognition without Words: evidence from Amazonia. In *Science*, Vol 306, 15 October 2004, pp496-499
[210] **Marc D Hauser, Noam Chomsky & W. Tecumseh Fitch**, The Faculty of Language: what is it, who has it, and how did it evolve? In *Science*, vol 298 22 November 2002, pp1569-1579
[211] **Daniel L Everett**, Cultural Constraints on Grammar and Cognition in Pirahã: another look at the design features of human language. In *Current Anthropology* vol 46 no 4, August-October 2005, pp621-646
[212] **Mark C Baker**, *The Atoms of Language*, ch7

target, and it does not involve elusive components. True, it has to be studied through instances of external language, which show the internal language "through a glass, darkly". But the number of instances of external language is enormous, much greater than any single linguist could analyse in a lifetime. If internal language remains mysterious, it is not for want of data; and if language parameters are universal and simple, it seems odd that they remain so elusive.

Formalist linguistics is an attempt to describe language as a structure of rules. Intuitively this should be a feasible exercise – language is clearly rule-driven; but the practicalities of the exercise have not yet identified a universal set of rules. In order to understand better why this is the case, the theories of Formalism will be revisited in more detail next.

4.5. Formalist Theories

As we have seen, Chomsky's Formalist theories have gone through many changes; and, in order to fully understand the changes between instantiations of Formalist theory, they have to be studied as a trajectory through time. For this reason the individual instantiations of Formalism are examined in more detail here.

4.5.1. Before Minimalism

The Formalist approach to language is hierarchical: it analyses language at a series of levels, analysing from the sentence level through phrases down to the level of words. Some work has been done on formal analysis above the sentence level and below the word level but, for traditional phrase structure analysis, these are the limits. A simple analysis of the regular English sentence, *John put the book on the table*, would divide the sentence into a noun phrase, *John*, and a verb phrase, *put the book on the table*. This verb phrase then breaks down into a verb form, *put the book*, and an adpositional phrase *on the table*. The verb form further analyses into a verb, *put*, and a noun phrase, *the book*; and the adpositional phrase further analyses into an adposition, *on*, and a noun phrase, *the table*. There are thus three levels of analysis in this sentence, and seven component types. In one of several Formalist notations this would be expressed as:

S ⇨ [NP + [VP ⇨ [V'⇨V + NP] + [PP ⇨ P + NP]]].

(this notation is an alternative to that used in figure 1, but it expresses the same analysis.)

Phrase structure analysis takes the view that sentences are analysable as nested or tree structures, with certain parts of the sentence governing other parts. For instance, the structure of the sentence itself governs the placement of the subject, verb and direct object; the placement of

the verb governs the placement of the direct object; the adposition governs the inflection and case of the adpositional noun (*to her* and not **to she*); and so on.

Unfortunately for this simple model, some parts of a sentence appear to be detached from their governors (such as English adverbs), so rules of binding must apply, too. These rules of binding place constraints on the position that a bound item can occupy. The range of these positions is called the bounds of the binding. For example, if we wish to add an adverb, *usually*, into the sentence *he was moving furniture*, it can be bound in three of the five possible positions: *usually he was moving furniture, he was usually moving furniture, he was moving furniture usually*. The two forms **he usually was moving furniture* and **he was moving usually furniture* are excluded from grammaticality because they violate the bounding rules, although the first is occasionally used in some regional dialects.

Together, these three rules – government, binding and bounding – form the basic rules of **Government and Binding**, the name for the Formalist theoretical structure of the late 1970s and early 1980s. Added to these are the rules for trace words. For instance, if we take the sentence *I want to go*, a Formalist will ask the question "what do I want to go?", and give the answer "I want me to go". They then explain the missing word by inserting the trace word, **PRO**, making *I want PRO to go*. This big PRO should not be confused with little pro, which is a feature of languages like Spanish: *quiero dejar* requires no explicit subject because the verb carries inflection, so it can be expressed as *[pro] quiero dejar*. It is little pro because it is a surface structure feature: only in some languages must subjects be explicit; languages that do not require an explicit subject are called pro-drop. Traces, pro and PRO demonstrate the importance of reconciling actual forms to ideal or standard forms in Formalism.

Another important feature of Formalist theories is **θ theory**. This identifies the thematic roles required by a particular verb to form a sentence. Thus *put* has three roles: *I put the book on the table*; **I put the book* and **I put on the table* are not valid forms for the verb *put*. In contrast, *drink* can take only two roles: *I drink beer* or *I drink to the King*, but not **I drink beer to the King*[213]. **θ theory** is tied up with semantics, however, and therefore not easily analysable in a purely grammatical way: is the first *drink* in the examples given the same word as the second, or just a homonym?

[213] **Vivian J Cook & Mark Newson**, *Chomsky's Universal Grammar: an introduction (2nd edition)*, p49

X-bar theory attempts to describe the structure of phrases in terms of deep structure, establishing the common basis behind every language. One product of X-bar theory is **projection**, whereby the characteristics of a root element projects up through the tree structure. So the characteristics of a verb form project through the verb phrase and into the sentence, giving both of these composite forms the characteristics of a free verb; similarly, the noun projects into the noun phrase, giving it the characteristics of a free noun. Although projection is not expressed in terms of deep and surface structure in Minimalism, it remains a tool of Minimalist analysis.

Another feature that has survived into Minimalism is **Move**: items can change position in a construct in order to express the same construct with a changed meaning. The first and main example of this is the question form, often referred to as WH-movement. The question *where is John?* can be seen as a movement of items from the less correct (but still valid) form, *John is where?*, which is in the standard English order for simple declaratives – Subject-Verb-Object. WH-movement involves the movement of items from their standard positions, leaving traces behind, such as *where$_1$ is$_2$ John t_2 t_1*. Here, t_2 represents the standard "trace" position of *is*, and t_1 represents the standard trace position of *where*.

Another example of movement is the passive form, where *John makes cakes* converts to *cakes are made by John* – the change of active verb to the auxiliary *be*, and the introduction of the adposition *by* are the markers that tell us of the reordering. N_1, V_2, N_3 has become N_3, V_2, P, N_1, t_2, t_3.

However, this raises the question of which is a trace of what. Movement theory, like many linguistics theories, reasonably makes an appeal to the standard or base form of a language[214] [215] [216]; this is usually based on statistical frequency, and there remains a level of uncertainty whether this is a true base form or just the most common form. Either way, assuming a base form does impose a limitation on a model that should be explicitly recognised.

Assuming there has to be a base form is not the only way to view the English active/passive problem. If we visualise a single structure that weights both active and passive forms equally then we would end up with the form t_{1x}, t_{2x}, N_3, "be"$_y$, t_{2y}, P_y, t_{1y}, where x components operate in

[214] **David Crystal**, *The Cambridge Encyclopedia of Language, 2nd edition*, pp94-99
[215] **Leonard Bloomfield**, *Language*, ch11
[216] **Andrew Carnie & Eithne Guilfoyle**, Introduction. In Andrew Carnie & Eithne Guilfoyle (eds) *The Syntax of Verb Initial Languages*, ch1

an active sentence and y components in a passive sentence; either the x or y components should be operating, but not both. This is not the only possible general form, because it assumes N_3 to be the fixed pivot of the description; it is equally possible to make N_1 the pivot.

There are unspoken assumptions in *Move* which determine the way it is viewed. These assumptions make sense, or they make sense within the ethos of Formalism, but there remains the problem that, while they may be the most economical expressions of sentence structure, they are not the only solution possible; and the standard forms on which they are reliant may be more the product of convention than proof.

4.5.2. Minimalism

Chomsky realised that the Principles and Parameters model (which had developed out of the Government and Binding model) may have been a descriptive model of language at work, but it could not possibly be a model of language acquisition; it was just too… formal. He therefore inaugurated the Minimalist Program in 1995 to persuade people to slim down their theories and build a new model of language. Out went the surface and deep structure dichotomy, which disposed of much of the Principles and Parameters model. Out went X-bar theory in favour of a simplified binary tree structure: each node on the tree is either a terminator or a link; if it is a link it consists of no more than two branches; and branching occurs in one direction all the way down the tree. PRO becomes a way of explaining branches that had not happened; and θ theory becomes a natural product of the binary tree structure, ceasing to be significant in its own right. Minimalism represented a move by Chomsky away from linguistic structure and into language origins; and, in part, it was a tacit recognition that language in use may be both more varied and less rule-bound than Formalist grammar was permitting.

However, to date, no single theory of structure has emerged to support the Minimalist Program. At least four threads of theory have emerged, which will be identified here as Merge Minimalism, Maximal Minimalism, Move Minimalism and Recursive Minimalism (these are my own terms and should not be taken as canonical.). These four models will be looked at as indicators of the way the Program is proceeding – or, at least, fragmenting. There are more than these four threads identifiable currently in Minimalism; what is most minimal at present is the amount of agreement between interpreters of the Program.

4.5.2.1. Merge Minimalism

This was the original Minimalist model, supported by Chomsky, and can be summed up in the two rules[217]:

- V' ⇨ V, (VP or ZP)
- VP ⇨ NP, V'

Or, in English:

- The verb form consists of a verb plus: a verb phrase or a terminating phrase
- The verb phrase consists of a noun phrase plus a verb form

These two rules can be merged in a recursive way to generate infinite linguistic constructs, hence the term Merge Minimalism used here. Chomsky describes this model as *attract/move*: each rule *attracts* the other and *moves* its own components to accommodate the other. Thus, *John took Mary to the shops* can be analysed as in figure 5 below[218].

<table>
<tr><th>John</th><th>[e]</th><th>the book</th><th>put</th><th>on</th><th>the shelf</th></tr>
<tr><td colspan="6">VP_1</td></tr>
<tr><td rowspan="3">NP_1</td><td colspan="5">V'_1</td></tr>
<tr><td rowspan="2">V_1</td><td colspan="4">VP_2</td></tr>
<tr><td rowspan="2">NP_2</td><td colspan="3">V'_2</td></tr>
<tr><td>V_2</td><td colspan="2">ZP</td></tr>
</table>

Figure 5 – An Attract/Move Minimalist sentence interpretation

An empty category, *[e]*, has been introduced to allow the minimal rules to work, but this seems rather an explanation after the event. As we have seen, the generation of empty categories or traces is heavily dependant for its justification on the stance adopted to describe the structure. Is the empty category in the above analysis an existent feature of innate grammar, or is it an artefact of the *attract/move* theory used to make the analysis?

Merge Minimalism is an interesting and coherent way of analysing language, but it does not necessarily illustrate how language is generated. While the rules are simple, the constructs they produce are complex, and it is doubtful that they truly reflect the process of construction that occurs in a language-generating human brain. The imputation of empty categories is particularly perplexing: why would a machine (the human language faculty) perform steps that are non-productive? There is something distinctly unminimal about empty categories.

[217] **Noam Chomsky**, *The Minimalist Program*, pp177-181
[218] ***Ibid***., p180

4.5.2.2. Maximal Minimalism

This branch of Minimalism is a product of those who were committed to Formalism before the Minimalist Program appeared. It represents the effort to incorporate the new way of thinking into the old framework with the minimum of disruption. However, as Minimalism is so radically different to Principles and Parameters, this is an approach with problems. Where Principles and Parameters is concerned with well-formedness and simplicity as an outcome of structure, Minimalism is concerned with the simplicity of the system; form is dictated by the system's simplicity.

Andrew Radford has done a lot of work in extending the Minimalist model to allow for greater coverage of forms of linguistic usage. Where Chomsky's Merge Minimalism is, in terms of rule structure, truly minimal, Radford's model is more inclusive and more explanatory, but it is some distance from Chomsky's Minimalist philosophy[219].

Radford sees a trichotomy of components as the minimal structure in language: Categories, Structure and Movement. The concept of Categories gives language the five types of word: noun, verb, adposition, adverb and adjective; it also allows for the language-specific functional categories, such as determiners and pronouns, so Categories can be seen as the lexical components of language. The concept of Structure covers the binary tree analysis of language constructs in Minimalism. However, where Chomsky's model uses only five terms (V', V, VP, NP, ZP), Radford introduces the infinitive (IP, and I), the finitive (Ī), the determiner/pronominal determiner (D), and the complementizer (C and CP). For instance, the phrase *that we are trying to help you* is analysed as follows[220]:

<table>
<tr><th>That</th><th>we</th><th>are</th><th>trying</th><th>to</th><th>help</th><th>you</th></tr>
<tr><td colspan="7">CP</td></tr>
<tr><td rowspan="6">C</td><td colspan="6">IP</td></tr>
<tr><td rowspan="5">D</td><td colspan="5">Ī</td></tr>
<tr><td rowspan="4">I</td><td colspan="4">VP</td></tr>
<tr><td rowspan="3">V</td><td colspan="3">IP</td></tr>
<tr><td rowspan="2">I</td><td colspan="2">VP</td></tr>
<tr><td>V</td><td>D</td></tr>
</table>

Figure 6 - A Maximal Minimalist phrase interpretation

Radford's general rules can be summarised as follows:

- CP ⇨ C, IP

[219] **Andrew Radford**, *Syntax: a Minimalist introduction*
[220] ***Ibid***., p66

- IP ⇨ (DP or D), Ī or ⇨ I, VP
- DP ⇨ D, N
- Ī ⇨ I, VP
- VP ⇨ V, (IP or D or A)

There are six bases (C, D, I and V, N (noun) and A (adjective)) and five transforms (CP, IP, Ī and VP), which is more than Chomsky's three bases (V, NP and ZP) and two transforms (V' and VP). Radford retains empty categories to allow the set of rules to be relatively minimal, but they remain more complex and less universal than Chomsky's rules.

Movement for Radford involves extension of the tree upwards and downwards, so the construct *I will love thee* has a trace before the *I* and another after *will*, making $[t_2]\ I_1\ will\ [t_1]\ love\ thee_2$. It is then possible to move *thee* to the first trace, and *I* to the second trace to make $[t_1]\ thee_2\ will\ I_1\ love\ [t_2]$[221]. Movement in this model becomes a change from an acceptable but arbitrary starting structure to another acceptable form, thus addressing the assumption made by basing analysis on a standard form.

However, Radford may be on shaky ground here, mixing diachronic structures into a single synchronic analysis. As well as the forms offered there are the related poetic forms of *I will thee love*, *I thee will love*, *love thee I will*, *love thee will I*, *love will I thee* and *thee I will love*. To try to produce a single structure to accommodate all eight expressions would create an extremely complex formula which could still say nothing about how we choose the construct we do.

Maximal Minimalism therefore falls between two stools: the complexity required by complete description and the simplicity required by minimalist description. For Maximal Minimalism the main question to be answered is whether this is a useful map of language, or an explanation after the event of production which does not really clarify how the production occurs.

4.5.2.3. Move Minimalism

This is the model proposed by Norbert Hornstein, and looks to be the most minimal of all the syntactic models. One point of interest in Hornstein's theory is that tree structure analysis has disappeared. Another is the idea that attraction is just a form of movement, so Chomsky's *move/attract* is actually just *move*[222].

[221] ***Ibid***., p173
[222] **Norbert Hornstein**, *Move! A Minimalist theory of construal*

Hornstein's approach relies heavily on empty categories and traces, into which sentence components can move. For instance, he sees the sentence *John hopes to win the race* as *John [John [hopes [John to [John win the race]]]]*. In verbal terms, John is the John who hopes, John is the John who is to do something, and John is the John to win the race[223].

Hornstein looks at the relative "costs" of different syntactic transformations, and his approach is revealing about structural dependencies; but it has the same problem as all Minimalist (and some other Formalist) solutions of language structure: sometimes an utterance is not generated by what is syntactically easy, but by what is semantically clear. For instance, there is no obvious reason why (1) *John will win the race, he hopes* cannot be formed as (2) **John will win the race, hopes*, nor why the simple movement to (3) *he hopes John will win the race* changes the meaning. Construct (1) has ambiguity which should be resolvable by removing the ambiguous *he* and allowing John to move to the position as a PRO, as in the construct *John comes home, puts on the kettle and makes tea*; but construct (2) is not acceptable English. Construct (3) has no ambiguity, but it has a different meaning to (1): *he* is no longer *John*; but all that has happened is that the verb phrase has moved – how has this affected the semantic values?

There would seem to be grammatical issues which are not easily solved by appeal to a single grammatical rule, and there is then the question of whether one rule, simple in form but complex in application, is truly simpler than several rules, complex in form but simple in application.

4.5.2.4. Recursive Minimalism

This last model represents Chomsky's latest view on what constitutes the key to Universal Grammar. It is not yet a syntactic theory in the same way as the other three, but it has some similarities to the Movement function in Maximal Minimalism. Essentially, Chomsky sees language constructs as containing their own structure embedded within them. In this respect, the model is part of a long and uncontroversial tradition in linguistics[224]. However, the idea that recursion is the only feature of language not present in animal communicative systems is new.

Recursion creates language by establishing hierarchy, enabling iteration and allowing movement to take place. In this way, Recursive Minimalism incorporates Movement while extending it into a more general principle. Movement works by extending a structure tree

[223] ***Ibid***., p27
[224] **Wilhelm Von Humboldt**, *On Language: on the diversity of human language construction and its influence on the mental development of the human species*, p91

upwards and downwards – in other words, it uses the recursive features of language to create variation of form. In this model, Movement is just a special case of Chomskyan Recursion. Move Minimalism uses a similar mechanism to extend constructs even though it does not directly use the tree structure; so it, too, can be seen as a special case of recursion.

Merge is part of Move, Move is part of Recursion, and Recursion is unique to humans. Recursive Minimalism, therefore, incorporates all the theories (and all of the models) of the other types of Minimalism. In principle, it can call on the other theories for its syntactic theory, but in practice there are contradictions to be addressed. Currently, no coherent linguistics theory has emerged from this approach to language form. Additionally, a human language has been identified which does not appear to use recursion[225], and recursion has been identified in the signalling systems of European starlings[226]. If recursion is neither universal to humans nor exclusive to them, it may indicate that the capacities of language grammar based on recursion are also neither universal nor exclusive[227].

4.6. Language as Structure

What conclusions can we draw from these several models of the structure of language? The first is that language demonstrates the features of a classic structure: it is hierarchical; it is composed of a range of components each representing a range of cases (e.g. verb and noun phrases); and the cases are not interchangeable, although most components within each case are. The formal models are also synchronous: each language utterance is wholly composed before it is migrated into a phonological form. And the models are self-contained: the language organ is, for Chomsky, a true organ which is unprecedented in nature and has precursors in no other cognitive systems[228].

There is also an unusual structural feature in the Formalist approach to language: the view is taken that language is potentially infinite in range. The recursive use of components within components creates an infinite nesting which means the set of sentences is unbounded. In practice, both production and comprehension greatly mitigate this infinity. The production of

[225] **Daniel L Everett**, Cultural Constraints on Grammar and Cognition in Pirahã: another look at the design features of human language. In *Current Anthropology* vol 46 no 4, August-October 2005, pp621-646
[226] **Timothy Q Gentner, Kimberley M Fenn, Danial Margoliash & Howard C Nusbaum**, Recursive Syntax Pattern Learning by Songbirds. In *Nature*, vol 440, issue 7088, 27 April 2006, pp1204-1207
[227] **James R Hurford**, Human uniqueness, learned symbols and recursive thought. In *European Review*, vol 12, issue 4, October 2004, pp551-565
[228] **Noam Chomsky**, *New Horizons in the Study of Language and Mind*, p4

complex utterances conflicts with Gricean maxims[229], especially the maxims of relevance and co-operation. They also prevent negotiation to meaning, because one person "filibustering" a complex utterance precludes back-channel communication and impedes comprehension. What is produced in these sentential perorations is likely to be "a tale told by an idiot, full of sound and fury, signifying nothing"[230]. In practice, therefore, we can say that language has a very large – and constantly growing – but in practice finite set of sentences.

If language is a classic structure then we should be able to identify its components. Here, different Formalist models pose a problem: there is no single trans-theory set of components. At minimum we have the noun phrase and the verb phrase (corresponding to the noun-verb or object-action distinction, a hopeful sign); at most we have noun, verb, adpositional, qualifying and pronominal phrases, trace elements, and rules of hierarchy, combination and meaning. In θ theory we also have identification of the subject-verb-object-indirect object form, which is another hopeful sign; but, over all, we do not have a single coherent theory of structure to work with. This is perhaps the most disappointing aspect of Formalism: after fifty years there is still no agreed form.

The definition of form used in this dissertation will therefore be a simplistic interpretation. It will concentrate on only the noun phrase and verb phrase as the components of structure, and it will use four simple rules of language structure as follows:

- The minimal form of an utterance is a single noun phrase or verb phrase.
- The minimal combinatorial form is a verb phrase plus a noun phrase – the one-argument form. This is the only combinatorial pair.
- The minimal two-argument form is a verb phrase plus two noun phrases. One noun phrase acts as an instigator of an action represented by the verb phrase, and the second noun phrase acts as a recipient of the action. This is the only combinatorial triad.
- The minimal three-argument form is a two-argument form plus an adpositional form. The adpositional consists of a noun phrase in the role of context: it qualifies the instigator (*I saw a house with Mary*), the action (*I saw a house with binoculars*), the recipient (*I saw a house with chimneys*), or the whole two-argument form (*I saw a house with surprise*).

Theoretically, with these two components and four rules, plus limited recursion, it should be possible to form any language construct. In practice language structure is nowhere near this

[229] **Paul Grice**, *Studies in the Way of Words*, ch5
[230] **William Shakespeare**, *Macbeth*, Act V Scene 5

simple; but this structural model provides a basis for comparison with a process model of language, and this comparison should help us to gain a better understanding of language as a system.

5. Grammar: Functionalism and Theories of Process

We have seen that the structure of language is in some ways different from the structure of signalling. For instance, signalling structure has no reuse of components, each component has a single structural role. Language structure, on the other hand, does have reuse: the noun phrase serves in the role of instigator, recipient and context. Language also has recursion: the noun phrase can be replaced by a one-argument, two-argument or three-argument form, which means that a noun phrase can contain other noun phrases. Signalling, the environment surrounding language utterances, is not as elastic as language utterances themselves. Language and signalling, however, do share the common features of any structure: hierarchy, a range of component types and self-containment. They are also (at least, under Minimalist theories) both binary hierarchies, with each level consisting of a base component and a composite. This means that the structural model of the signalling system around the language utterance bears a clear resemblance to a structural model proposed for the language utterance itself.

We have also seen that the structure and process of signalling can be co-modelled, because the components and functions co-identify. It would therefore seem that, if the structure and process of signalling are close, and the structures of signalling and language are close, the structure and process of language should also be close. As we will see in this chapter, this is not the case. This raises the inevitable question: why are the structure and process of language so different?

In this chapter the theories of language function are reviewed. Like the theories of form, they are also largely the inspiration of one man, in this case Michael Halliday. However, the theories of function are more coherent and less contradictory than theories of form, which allows them to be described largely as a single theory. This single functional model provides important information about the differences between language and other signalling processes, and also provides useful clues to the origins of grammar.

5.1. Functionalism – a Short History

While the theories of both formal and functional linguistics can be traced to single inspirational figures, the theoretical base of formal linguistics has changed several times over the years, while that of functional linguistics has remained largely constant. The seminal text remains *An*

Introduction to Functional Grammar, first published in 1985 (and now in its third edition[231]). However, Halliday and several others were teaching the principles of Functionalism for twenty years before this. The ideology of functional grammar can be summed up as follows:

> For Halliday, the only approach to the construction of grammars that is likely to be successful will be one that recognizes meaning and use as central features of language and tackles the grammar from this point of view. It follows from this that Halliday's grammar is semantic (concerned with meaning) and functional (concerned with how the language is used).[232]

This obviously has correspondences with Generative Semantics, but in Generative Semantics the emphasis is on universal deep semantic structures. As Paul Ziff said:

> … I am inclined to suppose that meaning is essentially a matter of nonsyntactic semantic regularities. This is not to say that meaning is simply a matter of such regularities but it does seem reasonable to suppose that an element's having meaning in the language can be explicated primarily in terms of the nonsyntactic semantic regularities to be found pertaining (directly or indirectly) to the element.[233]

In contrast, for Functional Grammarians the emphasis is on the systems which give function to meaning: meaning is not a product of the language system, it is a reason for the system to exist. It may not be the only reason, but it is a significant one. The emphasis on meaning places Functionalism in the tradition of David Hume and John Locke: if Formalism is Descartes without the homunculus then Functionalism is Locke without the *tabula rasa*.

Placing meaning at the centre of language theory has a long tradition. Edward Sapir described it as follows:

> It is well to remember that speech consists of a series of propositions. There must be something to talk about and something must be said about this subject of discourse once it is selected. This distinction is of such fundamental importance that the vast majority of languages have emphasized it by creating some sort of formal barrier between the two terms of the proposition. The subject of discourse is a noun. As the most common subject of discourse is either a person or a thing, the noun clusters about concrete concepts of that order. As the thing predicated of a subject is generally an activity in the widest sense of the word, a passage from one moment of existence to another, the form which has been set aside for the business of predicating, in other words, the verb, clusters about concepts of activity. No language wholly fails to distinguish noun and verb, though in particular cases the nature of the distinction may be an elusive one. It is different with the other parts of speech. Not one of them is imperatively required for the life of language.[234]

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[231] **Michael A K Halliday & Christian M I M Matthiessen**, *An Introduction to Functional Grammar, third edition*
[232] **Thomas Bloor & Meriel Bloor**, *The Functional Analysis of English: a Hallidayan approach*, p2
[233] **Paul Ziff**, *Semantic Analysis*, p42
[234] **Edward Sapir**, *Language*, p119

Benjamin Whorf also took this view, saying "… linguistics is essentially the quest for MEANING" (his capitals)[235]. Whorf took the view that ways of meaning affect language structure itself, and even the thought processes behind the structure; language affects the ways in which a person could think. While this view went out of fashion with the growth of Chomskyan Formalism in the sixties and seventies, there have been recent indications that there may be substance to the idea[236].

Halliday's model of language is more universal than that of Whorf: he sees language as a set of systems which offer the speaker/writer a choice of ways of expressing a meaning. For instance, the constructs *please may I have a drink*, *give me a drink*, *please* and *I would like a drink* are all ways in which a drink can be requested. On a semantic level their meanings are similar, but on a structural level they are very different. Similarly, the constructs *so I went upstairs and got my hat* and *so I goes up the apples and gets mi titfa* have the same meaning, although the register, lexis and tenses differ. What the speaker/writer is doing is not transforming internal language into external language, but expressing internal meaning in a convenient, clear and appropriate manner for their audience. This is a major difference between formal and functional analysis:

> It may well be possible, and intellectually productive, to view language, as the TG [Transformational-Generative] approach does, as a system of abstract rules which are applied in order to end up with a grammatically correct sentence; but there are doubts about whether this view captures to any useful extent the psychological processes involved when users actually produce or understand language. More importantly, there is little doubt that it does not reflect how the users themselves view language. They respond above all to the meanings that are expressed and the ways in which those meanings are expressed.[237]

This concentration on the sender and receiver in language utterances has created a very different model of language to that of Formalism. The message cannot be viewed as a self-contained unit because it is part of a process moving from sender to receiver, and from intention to production to apprehension to comprehension. In this respect, the functional model of language does not assume a pre-existing signalling environment which can be taken as a given and ignored: the signalling environment is itself part of the Functionalist model of language.

[235] **Benjamin Lee Whorf**, *Language, Thought and Reality*, p73
[236] **Daniel L Everett**, Cultural Constraints on Grammar and Cognition in Pirahã: another look at the design features of human language. In *Current Anthropology* vol 46 no 4, August-October 2005, pp621-646
[237] **Geoff Thompson**, *Introducing Functional Grammar*, p6

5.2. Functionalism – an Overview and Comparison

For Functionalists, the transfer and encoding of meaning occurs at the clause level and cannot be a direct product of words (or lexemes). For instance, by itself the word *cold* implies a temperature which is less than ideal. But in the construct *this isn't a cold fish* the meaning is mitigated in several ways. First, the term *isn't* implies that the actual temperature is not less than ideal and may be greater than ideal. Second, there is an ambiguity in the construct, which can only be resolved by a comparator not contained in the sentence: is a *cold fish* being compared with an uncold fish, or is it being compared with something completely different (e.g. a beefsteak)? Third, is *cold fish* being used in its idiomatic meaning of an unemotional person? The meaning of the construct is not the sum of its parts.

Hallidayan Systemic-Functional linguistics analyses language into four metafunctions: Textual, Interpersonal, Experiential and Logical. These four metafunctions represent different methods of analysing a clause, related to the different ways of analysing a discourse. The Textual metafunction is concerned with the clause as a message, The Interpersonal is concerned with the clause as an exchange, and the Experiential is concerned with the clause as a representation. As Halliday expresses it:

> These three headings – clause as a message, clause as an exchange, clause as a representation – refer to the three distinct kinds of meaning that are embodied in the structure of a clause. Each of these three strands of meaning is construed by configurations of certain particular functions. Theme, Subject and Actor do not occur as isolates; each occurs in association with other functions from the same strand of meaning.[238]

Of course, this explains only three of the metafunctions, but functional grammarians have traditionally divided them into "three plus one". The first three metafunctions are all concerned with analysis of the clause, but the Logical metafunction is an analysis of discourse – how the clauses work together. The logical metafunction is perhaps Halliday's greatest gift to the linguistics community: while he formalised the three metafunctions of clause, he was not the first to attempt to do so. In 1968, Gilbert Harman said:

> Philosophers approach the theory of meaning in three different ways. (1) Carnap, Ayer, Lewis, Firth, Hempel, Sellars, Quine, etc. take meaning to be connected with evidence and inference, a function of the place an expression has in one's 'conceptual scheme' or of its role in some inferential 'language game'. (2) Morris, Stevenson, Grice, Katz, etc. take meaning to be a matter of the idea, thought, feeling, or motion that an expression can be used to communicate. (3) Wittgenstein

[238] **Michael A K Halliday**, *An Introduction to Functional Grammar*, 2nd edition, p34

> (?), Austin, Hare, Nowell-Smith, Searle, Alston, etc. take meaning to have something to do with the speech acts the expression can be used to perform.[239]

He went on to say:

> Theories of meaning may attempt to do any of three different things. One theory might attempt to explain what it is for a thought to be the thought that so-and-so, etc. Another might attempt to explain what it takes to communicate certain information. A third might offer an account of speech acts. As theories of language, the first would offer an account of the use of language in thinking; the second, an account of the use of language in signalling; the third, an account of the use of language in certain institutions, rituals, or practices of a group of speakers.[240]

In Harman's definition we have a very close correspondence to Halliday's Textual, Experiential and Interpersonal metafunctions.

Halliday's four-strand analysis of language may appear unwieldy, but it has proven very productive. It has brought back into linguistics the study of prosodics and melodics (intonation, loudness, tone, etc) which are largely ignored by Formalists; it has placed emphasis back on the discourse rather than the sentence; and it has allowed issues of idiosyncratic language use to be addressed. For instance, the Logical metafunction allowed Halliday to identify a difference between parataxis and hypotaxis in discourse. A paratactical discourse is one where the clausal elements are linked at the same level by simple connection (e.g. *I went upstairs and got my hat, and then I went to the shops*); a hypotactical discourse consists of clausal elements linked hierarchically (e.g. *I went upstairs to get my hat so that I could go to the shops*). Deborah Tannen has shown that this difference in discourse choice is significant in cross-cultural misunderstandings, and even in cross-gender misunderstandings[241]. To say that men are hypotactic while women are paratactic is an exaggeration, but men tend to use and be more comfortable with hypotaxis than parataxis, and women *vice versa*. This is a discovery that could not have been made in a strict Formalist tradition.

One problem for grammaticians of all kinds is that of cognitive dissonance. If grammar is the engine by which messages are correctly transferred from sender to receiver, what happens when there is an incorrect transfer? This is not a case of the sender wishing to deceive the receiver, it is a case of the communicative engine breaking down. If language is a formal structure whereby internal representations are converted to external signals, then the only way dissonance can

[239] **Gilbert H Harman**, Three Levels of Meaning. In *Semantics: an interdisciplinary reader in philosophy, linguistics and psychology*, p66
[240] ***Ibid***., p68
[241] **Deborah Tannen**, *Gender & Discourse*, chs 3-5

occur is if there are differences between the I-languages of sender and receiver. If, however, language is seen as a functional structure then it is possible for dissonance to enter in at the coding or decoding of the message: functional problems of lexis or grammar can mean that the message (the form of words) as uttered may not match the sender's intention, or that the receiver might not successfully decode the sender's intention from the signal.

Systemic-Functional grammar is younger than Transformational-Generative grammar, but it has already produced some interesting offshoots. William Croft used SF grammar as a jumping-off point for Radical Construction grammar[242], which places itself in direct opposition to Formalist theories. Far from seeing universal syntactic structures, Croft sees only variation: grammar comes from agreed structure, and not structure from innate grammar.

Another approach, adopted by Sandor Hervey and Jan Mulder in 1980, was Axiomatic Functionalism[243]. This attempted to reconcile functional theories with the axiomatic approach of the Formalists. The intention was to give Functionalism the same "scientific" basis as Formalism, but it proved to be both functionally too restrictive and an inadequate model of natural language. This model has, however, shown that natural language is not necessarily amenable to a one-dimensional description predicated on a logical, axiomatic model.

While functional grammar remains a phenomenon of British and Australian linguistics, some interesting work is also being done in America, notably in Toronto University (Michael Gregory), Rice University (Sydney Lamb) and the Michigan universities (Peter Fries and David Lockwood). Once again, there is a trend to try to reconcile Functionalism with Formalism (e.g. David Lockwood's Stratificational-Cognitive linguistics[244]), but the main emphasis of Functionalism in the USA is on the way information flows and mutates through a discourse.

Functional grammar is providing answers where Formalism is silent. Part of the reason for this is that speculation and discovery are encouraged by the inclusive nature of Functionalism: it is open-ended and there are no heresies. Compare this to Formalism, where each level of the theory has generated metatheories, most of which have been directly condemned or forced into apostasy by a change in the main theory[245]. This has meant that many of the debateable issues in

[242] **William Croft**, *Radical Construction Grammar: syntactic theory in typological perspective*
[243] **Jan W F Mulder & Sandor G J Hervey**, *The Strategy of Linguistics*; and **Sandor G J Hervey**, *Axiomatic Semantics*
[244] **David G Lockwood**, Highlighting in Stratificational-Cognitive Linguistics. In *Relations and Functions Within and Around Language*, pp225-255
[245] **Randy Allen Harris**, *The Linguistics Wars*

Formalism have not been fully debated. For instance, while Chomsky admits that Formalist models have problems with certain complex or idiosyncratic language constructs, he does not address the main problem with Formalism: it is a good description of language structure but a poor description of language production. If language production proceeded according to Formalist models then the lower-most constructs would have to be evaluated before the higher constructs could be formed. But then *This is the dog that chased the cat that caught the rat that ate the malt that lay in the house that Jack built* would have to be "reverse-engineered" both for production and comprehension, and that begs the question why we say it in the order we do. Halliday's theme and rheme structure in the Textual metafunction explains it better:

Theme	**Rheme**
This is the dog	That chased the cat
… The cat	That caught the rat
… The rat	That ate the malt
… The malt	That lay in the house
… The house	That Jack built

Figure 7 - The house that Jack built as a Hallidayan Theme and Rheme construct

Functional linguistics covers a wider range of linguistic phenomena than do formal linguistics; in fact, most formal models refer only to the textual metafunction. If we look at the other metafunctions we see features that have no correlates in Formalism: because Formalism is concerned with grammaticality within sentences and not between sentences, the logical metafunction is functionless; because Formalism is concerned with the ideal speaker/listener, interpersonal features are trivial; and because language is a discrete organ or system, insulated from the effects of other cognition, the experiential metafunction has only a highly constrained role. Formalist and Functionalist linguistics seem to be descriptions of different phenomena, so great is the distance between them.

5.3. Functionalism and Language Evolution

One problem for functional grammar is that it makes few predictions concerning language innateness or the origins of language. As we will see in chapter 9, however, it does have a lot to tell us about language acquisition by children. On the subject of innateness, Functionalism is agnostic or sceptical about the existence of a Universal Grammar, although the existence of some linguistic universalism is accepted relatively uncontroversially. This universalism need not be specifically linguistic, however, it could be a product of other, nonlinguistic cognitive processes which have been co-opted into a linguistic role; and, because of the width of the

Functionalist model, these cognitive processes could be interpersonal, organisational, relational, definitional – any type of cognitive process could be involved.

There seem to be three main Functionalist approaches to the origins of language. The first is to support the edict of the *Academie Francaise*: in 1865 the *Academie* questioned the value of speculation on how language began, and banned all further discussion on the subject[246]. Even today, this ban is defensible: despite enormous advances in our understanding of humans, and vast improvements in our knowledge of pre-humans, there remains a gap between what we need language for and what we use it for. Language is under-engineered as a truthful information channel and over-engineered as a communication solution: the complexity is not where it is needed. It is possible that this gap between need and use will never be explained, and speculation on origins is indeed futile, as the *Academie* believed.

The second Functionalist approach is to treat language as an inevitable outcome of being human[247]. This is similar to Chomsky's macromutation in that it precludes discussion about origins; but, unlike the macromutation, it requires no specialist language module in the brain. The brain was the major organ reorganised on our route to becoming human, and it was one of these reorganisations that created the cognitive and social environment in which language could appear. Language is clearly useful, so any reorganisation that enhanced the ability to communicate would automatically alter the way we communicated; and individuals who were able to communicate more effectively would have an advantage that would enable them to out-reproduce the less effective communicators.

The problem with this approach is that it may be a triumph of optimism over reality. While language is clearly useful, each step along the way may not be. Indeed, the problem of giving away free, useful information remains a major obstacle in this model: useful information is valuable, valuable information increases the fitness of the receiver (and may reduce the fitness of the sender), so why give it away for free? And, for the receiver, why trust cheap, free information?

The third Functionalist approach to language origins is to treat phylogeny as a recapitulation of ontogeny: the way human children acquire language nowadays must mirror the way the species

[246] **Noam Chomsky**, *On Nature and Language*, pp83-84
[247] **R M W Dixon**, *The Rise and Fall of Languages*, pp63-66

acquired language[248]. This leads to the view that the interpersonal metafunction must have been acquired first, because it seems to be the first one activated in prelinguistic children[249]. There are, though, two problems with this approach. First, children come to language in a cultural environment rich with symbols; but language itself could not have evolved in this environment – you need language before you have a symbol-rich environment. Second, the approach assumes there was no metafunction or function active in cognition before the path to language began. Yet, as we have seen, ideation is an important feature of nonhuman cognition, even if it is not used directly for signalling.

The lack of a solid functional theory of language origins may be because there is no philosophy in Functionalism which requires an explanation of language origins, unlike the Universal Grammar of Formalism. Yet the lack of a Functionalist origins theory is also odd: the open-ended theories of Functionalism would seem to fit more happily with a theory of language origins than the more limited and closed theories of Formalism. Theories of language origins tend to be pragmatic and evidential, which would seem to better match a Functionalist theoretical framework rather than a Formalist; so why is so little work being done on a Functionalist approach to language origins?

5.4. Language as Process

If we were to build a Functionalist process model of language, where would we start? The obvious first stage would be to review the process model of signalling and see whether it still works for language. We still have a sender, a receiver, a message, the referent-stimulus and the receiver-action response, although the stimulus and response are more likely to be instances of cognition than events in the real world. We also have the fourth-person view of signalling, but in a much more complex way: both sender and receiver, as humans, are capable of adopting the fourth-person view, which means that they approach each signal from at least three vantage-points: that of their own role, that of the other role, and that of the fourth person. The sender viewpoint is one of creating relevance in the message; the receiver viewpoint is one of construing the message into a model of experience; and the fourth-person viewpoint enacts the social relationships between the sender and receiver. These three descriptions correspond to the

[248] **W D Whitney**, Nature and Origin of Language (1875). In Roy Harris (ed), *The Origin of Language*
[249] **Clare Painter**, The 'Interpersonal First' Principle in Child Language Development. In Geoff Williams & Annabelle Lukin (eds), *The Development of Language: functional perspectives on species and individuals*

definitions given by Michael Halliday and Christian Matthiessen for the textual, experiential and interpersonal metafunctions respectively[250].

Here we see an important difference between language and nonhuman signalling: in language the roles of sender, receiver and fourth person in signalling do not co-identify in a simple one-to-one equation with the viewpoints; every role can adopt every viewpoint simultaneously. We see this at work in everyday language. For example, the sender mitigates a message because they are aware of how the receiver will interpret it, or they adjust their message to indicate that third parties are included or excluded; the receiver adjusts their interpretation of the message based on their understanding of the sender, or based on shared knowledge; and both sender and receiver can switch to the fourth-person viewpoint and back again merely by changing attentional stance. All parties to the language signalling process are able to understand the intentions of others through Theory of Mind and awareness of self and others; and they use these abilities to build complex, co-operative models of their own and the other parties' relationships to the message and to each other. The question of language origins is no longer "how did communicational complexity arise?" but "how did social modelling complexity – and the willingness to communicate it – arise?"

In this chapter we have looked at language as a process, and grammar as the engine of that process. We have seen that language grammar is complex, involving several strands of functional activity simultaneously. A language message is therefore different to a nonhuman signalling message, which has only one strand. We have also seen that the language message is not just a vocalisation, not just a cue to a pre-existent genetic response; it contains meaning which is sometimes not dependent on the receiver's pre-existing knowledge and sometimes not dependent on the form of the message itself. In language, unlike nonhuman signalling, we create meanings in the message, some of which can be novel for the receiver: we can exchange new knowledge – and we do so freely.

This still leaves the question of what came first, the willingness to share or the ability to exchange knowledge. In Darwinian terms we can see that the willingness to share is the greater mystery – even if we had the ability to share there would be no evidence of it unless we actually shared, and we could not do that unless a willingness was there. So, if ability preceded willingness there is the problem of why it developed if not for sharing. In evolutionary terms,

[250] **Michael A K Halliday & Christian M I M Matthiessen**, *An Introduction to Functional Grammar*, third edition, p61

there has to be a need for an ability to allow it to develop, and there has to be a phylogeny that can mutate towards a needed adaptation. An ability to share without actual sharing taking place is unlikely because it fulfils no evolutionary need. It is likely, therefore, that the willingness – or the need – to share evolved before the sharing itself. This will be explored further in chapters 7 and 8.

There is another paradox to be resolved here: on one hand, signal structure and process are co-identifiable; on the other, language structure is signal structure plus something, and language process is signal process plus something; but language structure and process remain difficult to reconcile. The solution lies in what is considered as the plus part: for Formalism it is recursion, and for Functionalism it is metafunctionality. These are two very different things with different effects on the nature of the message; but they need to be reconciled if a unified theory of language as a system is to be proposed. This is the task undertaken in the next chapter.

6. Grammar as Structure and Process

The paradox of modern linguistics is that almost every human is an expert in at least one language, yet few would class themselves as experts in how language works. We have made great progress in our understanding of how individual languages work and what language in general is used for – we have even made some progress in understanding language as a conceptual entity – but the grand theory of linguistics still eludes us. This dissertation cannot hope to provide the missing grand theory, but by the end of this chapter we should have a simple unified model of language structure and process which should assist in identifying the origins of grammar.

The structural model proposed in this dissertation consists of four forms and two components. However, all of the first three forms – single words, one-argument and two-argument forms – are features of the final, three-argument form; which means that the three-argument form encompasses the other forms. The three-argument form can be summarised as: the complete language construct consists of one instance of the action-verb component in combination with three instances of the object-noun component in three roles, one as instigator, one as recipient and one as context of the action. This model of three-argument structure within the message reflects the signalling structure around the message, where the message component is in combination with a sender, a receiver and a referent of the message. This is not a coincidence: if one of the uses of language is to talk about our mental models of our social interactions then it must have a structure capable of expressing those interactions.

The three-argument form is, however, not the minimal requirement for a grammatical language; a syntactic language is certainly possible using just the two-argument form. In this language, *John sees the book on the table* would be represented by *John sees the book; the book is on the table*. Traditionally the two-argument form has been assumed to be an exemplar sentence, expressed as the subject-verb-object sentence or the simple sentence[251]; but the existence of, among others, three-argument forms, one-argument verb-object imperative forms (e.g. *do it!*), first-person pro-drop forms (*done it*) subject-verb intransitives (*I do*), and single-word utterances like *yes* and *no*, means that the two-argument form is not a sufficient model to explain all language utterances.

[251] **Gordon Jarvie**, *Bloomsbury Grammar Guide: the way the English language works*, pp66-70

Whether we adopt the two-argument form or the three-argument form as the base form of language, the systemic model of language presented here involves on one side a structure with hierarchy and, on the other side, a process with multiple flows. Hierarchy and multiple flows, however, pose a problem in terms of language use: speech is sequential, one sound follows another. This may initially appear as a constraint of the medium of sound; but when we converted our speech to written form we retained the sequential model, despite having the two-dimensional freedom of a flat surface. It would seem, therefore, that we should seek an explanation of this phenomenon if we are to understand the system of language as a conjunction of structure and process.

6.1. Sequential Grammars

Speech is essentially sequential in nature: it demands the organisation of utterances with reference not to their structure but their order. For instance, the sentence *John saw Mary on the train* would, in the canon of Formal grammar, consist of ordered relationships in a multi-level hierarchy. Functional grammar would analyse the clause on three levels, corresponding to the intraclausal metafunctions; but, although each metafunction is essentially sequential, they together form a multi-dimensional description of the utterance. So both formal and functional approaches produce descriptions with more than one dimension. What happens in speech, however is a series of sounds conveying hierarchies and flows in a single-dimensional carrier wave.

In contrast to standard Formal and Functional approaches, a sequential grammar looks at the relationship between neighbouring segments of the utterance: what is the relationship between *John* and *saw*, between *saw* and *Mary*, between *Mary* and *on*, and between *on* and *the train*? Only as a secondary step is the relationship between non-contiguous sequential segments analysed. This means that analysis can differ between languages: for instance *Johan hat Marie im zug gesehen* produces a different analytical solution to that of its English equivalent. Sequential grammars tend to use features from both Formalist and Functionalist models. For instance, where hierarchical grammars often reanalyse different word orders into a single structural template, sequential grammars tend to be less didactic about the need for universal templates. As William Croft says, having argued against all other forms of grammatical analysis: "Coded dependencies, including constituency and sequential order, are therefore the only proper types of evidence for syntactic relations that remain".[252]

[252] **William Croft**, *Radical Construction Grammar: syntactic theory in typological perspective*, p202

Sequential grammars do not set out to solve the entire problem of language in a single model. For instance, Andreas Kathol takes a constructionist view of language and builds a sequential adjunct to Hierarchical Phrase Structure Grammar (HPSG), using the Head-driven model as his starting point[253]. He argues that HPSG is a good representation of English grammar, but it is less effective at describing German sentence formation. In order to overcome this inadequacy he analyses sentences in both HPSG tree structure form and in sequential Functionalist domains of meaning, and shows that a hybrid approach both informs the HPSG analysis and solves some of the more intractable issues of detecting unacceptable syntax. Kathol's approach is to drill down through the tree structure to the semantic units and then apply a sequential analysis to the units; he also applies a sequential analysis at the clausal level, linking the two semantically. He is particularly interested in the causes and cases involved in sentential coherence and incoherence: what combinations and orders are allowed and in which circumstances.

For instance, he shows that the permitted ordering of a sentence in an emphatic construct varies between different German dialects. This seems to be the product of a difference in the "leftness" of the topicality – although the words and much of the grammar are similar, the dialects do work at a certain level as different languages. This is also a feature of some of the major dialects of English, a feature which is often glossed over because of the much more self-contained nature of English words; but, as statistical groups, different English-speakers may see their unmarked grammatical forms very differently. For instance, an internet search on the phrases *the job is simple*, *it's [it is] a simple job*, *this job is simple* and *this is a simple job*, shows the following[254]:

	Worldwide	**British**	**British %**	**Comparators**
The job is simple	511	20	3.9%	3.9%
It's a simple job	272	48	17.6%	14.9%
It is a simple job	344	44	7.8%	
This job is simple	32	1	3.1%	3.1%
This is a simple job	138	17	12.2%	12.2%

Figure 8 - Internet comparison of British versus other usage

From this example it would appear that, in identity clauses, British English speakers are about four times more likely than other English speakers to use an empty subject (*it*) and a full object, rather than an empty object and a full subject. This is not a full study and cannot be taken as

[253] **Andreas Kathol**, *Linear Syntax*
[254] Alta Vista search, 6 August 2003 by the author

definitive – context, among other factors, has not been addressed – but it illustrates the sorts of issues that a tree-structure grammar tends to ignore.

Kathol's conclusion is cautious but revealing:

> Even if some variant of a linearization-based, topological model proves insightful for all the languages discussed here, there is no underlying assumption that a topological structure similar to the one postulated for Germanic is necessarily universal and hence should be detectable to the same extent in every language. Rather, a somewhat weaker claim is made here, namely that the option of a syntactic system that has as one of its components a linearly-defined level of organization that is in part independent of the combinatoric structure is well within the boundaries of what a possible human language can be.[255]

It seems that Kathol has identified at least one way in which the sequential representation of a language construct can be very significant (strict word order) or less so (variable word order), thus linking the sequential representation to a greater or lesser extent to hierarchical representation.

Rens Bod takes a more evidential approach to language structure[256]. As with Kathol's linear syntax, his study involves a comparison of English and a more fully Germanic language, in this case Dutch. He looks at the syntax of his chosen languages as a series of probabilistic structures: some features are common and acceptable, some are uncommon but still acceptable, and some are uncommon and unacceptable. Common and unacceptable is, of course, a category that should not exist. He compares the traditional tree structure grammar with a Stochastic Context-Free Grammar (SCFG), which he defines as follows:

> A *Stochastic Context-Free Grammar G* is a 5-tuple $<V_N, V_T, S, R, P>$ where:
> V_N is a finite set of nonterminal symbols.
> V_T is a finite set of terminal symbols.
> $S \in V_N$ is the distinguished symbol.
> R is a finite set of productions each of which is of the form $\alpha \rightarrow \beta$ where $\alpha \in V_N$ and $\beta \in (V_N \cup V_T)^+$.
> P is a function which assigns to every production $\alpha \rightarrow \beta \in R$ a probability $P(\alpha \rightarrow \beta)$, for which holds that $0 < P(\alpha \rightarrow \beta) \leq 1$ and $\Sigma_x P(\alpha \rightarrow x) = 1$.[257]

What this seems to be saying is that an SCFG consists of legitimate constructs which must have a chance of occurring in a language; and these constructs consist of transformations of non-terminal phrase strings into non-terminal plus terminal phrase strings. The transformation changes the theoretical sentence, *S*, into a produced form, *R*.

[255] **Andreas Kathol**, *Linear Syntax*, p285
[256] **Rens Bod**, *Beyond Grammar: an experience-based theory of language*
[257] ***Ibid***., p28

Bod shows that every SCFG has a corresponding tree structure. He also compares SCFG to other stochastic grammars (history-based, lexicalised tree-adjoining, and head-based) and finds them all to be wanting in one way or another. This is not surprising: sequential grammars tend to be purpose-related rather than universal.

Using Data Oriented Parsing (DOP) techniques, Bod creates an analysis model at three levels. The first level is DOP1, which is a simple tree-like analysis of constructs, and which he uses to show that language is replete with redundant constructs (redundancy of potential, not realisation); the second level is DOP2, which attempts to predict unknown words based on their probable structural meaning; and the third level is DOP3, which attempts to use code-breaking analysis techniques to impute word type from structural position. All of these parsing techniques are computational and syntactic, but Bod also looks at the semantic representation of the sentence, and it is at this level that a degree of sequential analysis enters the model. Although he retains a tree structure as far as possible, he finds it easier to analyse segments of meaning separately, in a sequential way. His semantic analysis is not as complete as that of Kathol, but its purpose is different: where Kathol is identifying the topology of the sentence, Bod is deconstructing it.

Bod recognises that there are two problems with a computational model of grammar which attempts to construct a single rule-set for any language: the first is that the rule structure used by one individual may not be the same as that used by another; and the second is that the rule structure used in one context may not be the same as that used in another, even by the same individual. Language grammar is therefore, at the level of analysis used by Bod, a probabilistic entity, and not a universal fixed thing:

> If this outcome is generally true, it has important consequences for linguistic theory. It means that the knowledge of a speaker/hearer cannot be understood as a grammar, but as a statistical ensemble of language experiences that changes slightly every time a new utterance is perceived or produced. The regularities we observe in language may be viewed as emergent phenomena, but they cannot be summarized into a consistent non-redundant system that unequivocally defines the structures of new utterances. The notion of "Universal Grammar" becomes obsolete, and should be substituted by the notion of "Universal Representation" for language experiences.[258]

[258] ***Ibid***., p145

Despite the fact that Bod bases most of his analysis on traditional Formalist tree-structure and hierarchical grammar, and his description of context-free grammar is also Formalist, his conclusions do not necessarily support the established Formalist ideas of language universals.

William Croft's Radical Construction Grammar also abandons language universals. He sets out a theory of language structure that is extensive both in its syntactic analysis and in the range of languages he uses as examples[259]. He starts by differentiating between a component approach and a construction approach. For Croft, the component approach identifies separate syntactic and semantic components linked by the lexicon, while the construction approach embeds semantic and syntactic features in the lexicon. Where a component approach is deconstructive, the construction approach is constructive.

Croft shows how certain words are traditionally arbitrarily attached to particular word classes when they demonstrate features of two or more classes, and may need to be classified as a new word class. Noun/adjectives are one example (e.g. *the poor*). Croft maintains that grammatical universals need not rely on universal "atomic" primitives, instead he proposes that the universal primitives are in the interrelationships in language[260]. The universals are complex, not simple, and the atomic features of the complex primitives do not need to be the same in every language. This is a process approach to the problem: Universal Grammar, if it exists, is not in the components of structure but in the functions of the signalling process.

The idea that primitives can be complex is liberating in terms of syntactic analysis. Function becomes paramount, because language production is an interrelation of functions and not components. If one language appears not to have an adjectival word class then this has no universal significance, unless the language is unable to express adjectival qualities in any way. Similarly, if a language (like English) can express adverbial qualities in several ways (*apply again, reapply, apply once more*) this also has no universal significance, and the different methods can be attributed to new word classes if this proves useful.

So what are the universals that Croft recognises? He analyses the subject-verb-object clustering in several languages, and finds that it cannot be privileged over ergative/absolutive/primary-object/secondary-object clustering. Although he does not label it as such, he sees a single

[259] **William Croft**, *Radical Construction Grammar: syntactic theory in typological perspective*
[260] ***Ibid***., pp47-61

instigator-action-recipient-context structure underlying both clustering systems. This leads him to conclude:

> These general principles demonstrate that the diversity in how languages encode participant roles in syntactic roles does not preclude the existence of universals of grammar. Universals of grammar exist, but only in relation to the concepts encoded by grammar. The distribution patterns (semantic maps) of syntactic roles in languages reflect the structure of the conceptual space of events and their participant roles. The encoding of participant roles largely respects the aforementioned general principles of the form-function mapping.[261]

Radical construction grammar enables Croft to consider grammar as a conceptual space onto which individual language grammars can be mapped. To look for universals between languages is unproductive because each language occupies only a part of grammatic space. Instead, radical construction grammar attempts to determine if there are limits to that grammatic space, and the extent of exclusivities (where having one feature automatically prevents a language from having the other). He admits that this task is enormous and that he has only begun to scratch the surface, but the gains to be made from an RCG approach would seem to be both more productive and more revealing than the Minimalist approach.

Another sequential grammar is that of David Brazil. He worked mainly in the area of speech utterances which, he found, followed a different syntactic process to that of written utterances. Unfortunately, he died in 1995, the year that his first major analysis was published[262], so his theory remains largely unexplored. However, Brazil's approach, like those of Croft and Kathol, is very different to normal syntactic analysis:

> A common assumption that underpins much contemporary grammar can be crudely expressed like this:
>
> > Let us assume that the mechanisms whereby words are assembled to make larger units will be revealed to us if we begin by thinking of speakers as aiming, in everything that they do linguistically, at the production of objects which we call 'sentences'.
>
> The alternative that this book explores can then be equally crudely expressed like this:
>
> > Let us assume that the mechanisms whereby words are assembled to make larger units will be revealed to us if we begin by thinking of speakers as pursuing some useful communicative purpose and as aiming, at any one time, at the successful accomplishment of that purpose.[263]

With this approach we are concerned not with well-formed and ill-formed utterances, only with utterances. The speaker is not governed in their speech production by what matches an internal

[261] ***Ibid***., p147
[262] **David Brazil**, *A Grammar of Speech*
[263] ***Ibid***., p2

set of rules, but by what they need to do to produce cognitive consonance in, or relevance for, the listener. If there are any rules they are rules of convention, short-cuts the speaker can use because of a shared communication culture with the listener. We are dealing not with a species that is genetically compelled to signal in a pre-specified structural way, but with individuals who want to exchange messages, and will do so by any means that works.

Brazil's methodology involves telling the same monologue to each of his study subjects individually; the study subject then has to tell the story to someone else, and this second telling is recorded. The emphasis for the study subject is not on detailed accuracy but on making the story interesting to the final listener. The experimental data therefore consists of a series of monologues which are topically but not directly similar. The intention is to create a corpus of idiosyncratic language instances which can be analysed to identify common features. As with the other sequential grammars, the approach is empirical.

Brazil's analysis covers both grammatical and prosodic features – he contends that syntax in speech is not just a matter of words and word order, but speech markers that act as utterance terminators, linkers and emphatics. Prosodics remain an understudied area of linguistics, and has been downplayed in some syntactic studies[264]. Brazil builds a syntactic structure for analysing spoken texts which takes account of apparent ungrammatical errors as constraint changes, indicating a change of topic or intention, and which treats the whole text as a single utterance of varying contexts. Brazil's work presents a useful new way of looking at speech acts as sequential events, and it is a pity that he did not live long enough to propose a unified theory for spoken syntax.

The final sequential grammar to be considered here is Richard Hudson's *Word Grammar*[265]. This looks at language constructs as relational structures, initiated by a *head* (not necessarily the first word in the construct) which controls a number of *dependents*. For instance, adjectives are dependents of nouns, and nouns act as heads in noun phrases. Nouns also act as dependents in verb and adpositional constructs, creating a logical hierarchy in the sequential word-bound constructs. However, this is a hierarchy of suspended expectations, not a two-dimensional cognitive hierarchy being expressed in a one-dimensional medium.

[264] **John Goldsmith**, From Algorithms to Generative Grammar and Back Again. In *Papers from the 40th meeting of the Chicago Linguistics Society (2004)*. Available at http://hum.uchicago.edu/~jagoldsm/Papers/CLS2004.pdf
[265] **Richard Hudson**, *English Grammar*

Essentially, when we hear the partial construct *this is a matter of…*, our expectation is for a noun, not a noun phrase as in the Formalist model. The fact that we encounter an adjective, *…great…*, does not remove the expectation of a noun, merely suspends it: the adjective is a dependent of a noun head so it is acceptable in this position. If we had encountered an adverb, *…really…*, then the expectation would be for an adjective, further suspending our noun expectation. Grammaticality is produced not by completion of a formal grammatical tree, but by fulfillment of our expectation about what should happen next. So, in the construct above, we see the construct as ungrammatical or incomplete until our expectation of a noun has been met: *this is a matter of really great concern*. If we then encounter another word after this we know it is either another head or a dependent of another head. So the word *…to….* indicates that we are expecting a noun or similar word, such as *…us*.

Word Grammar deals with the single dimension of speech as a single dimension of meaning; it is not a two- (or multi-) dimensional grammar being squeezed into a single dimension, it is a one-dimensional grammar translating multi-dimensional mental models between the minds of sender and receiver. Currently, most of the work on Word Grammar is in English, but there have been some favourable outcomes when it has been applied to other languages. However, as it is case-driven and explanatory rather than predictive, there is no implication that what has so far been discovered will prove to be universal.

The development of sequential models of language is a product of both Formalist and Functionalist theorisation. Of the sequential grammar models reviewed here, those of Kathol, Bod and Croft clearly show their Formalist roots; Brazil's analysis is functional, and Hudson's Word Grammar draws on both areas of knowledge. They do, however, share one feature in common. From the five models given above, it is clear that sequential grammars tend to be data-driven in their approach: theory must emerge from the evidence, not vice versa. They all seem to accept that detailed grammatical structure is likely to be *ad hoc* and not subject to universal significance, and universal features of language are likely to be found outside the specifically linguistic grammatical structure as well as within it.

There is also an emphasis on the three-argument form in all of these models. For Kathol and Hudson it is in the head-driven nature of language: each head creates an expectation of the complements that accompany it, which has to be based upon a limited number of acceptable sentential forms. For Croft it is in the clustering expectations of the receiver. For Bod it is in the DOP3 level, imputing word type from structural position. It is harder to identify the emphasis

on three-argument form in Brazil's work because he is interested in the whole human communicative spectrum, but his experimental method relies heavily on the signalling process of a sender telling a receiver about a story while being observed by a fourth party, and the story told relies on a fourth party (the sender) telling-about instigators and recipients in action with contexts; the three-argument model is implicit throughout Brazil's analysis.

6.2. The System of Language Grammar

We now have sufficient information to propose a system of language grammar. It is not a system of universals, however, but a system of potentials. Within language we see the potential of a three-argument sequential flow consisting of instigator, recipient, context and action – *John saw the book on the table*; the requirements of this model could also be met by a two-argument sequential grammar – *John saw the book, the book is on the table*. In practice, however, there appear to be no human languages that rely on this reduced form.

In order to merge the language models of structure and process set out here we need to review what we have. We have four components (instigator, action, recipient and context), which co-identify with four functions. The structure of these components is a hierarchy imposed by a two-dimensional three-argument model on a one-dimensional signalling mode: the requirement of linking three things to the action makes the model two-dimensional, and the one-dimensional process flow of speech therefore requires rules of transformation to convert the two dimensions to one. The functions of language use this process flow to ensure the transfer of meaning between sender and receiver, and the Hallidayan metafunctions provide the conduits for the transfer of meanings. The existence of a common lexis and set of rules of transformation for sender and receiver makes the whole system work, but this commonality need not be innate: the recognition of the intentions of the sender by the receiver and *vice versa* allows a negotiation towards that commonality – a *becoming to mean*.

Seen in this way, language is a system with both structure and process. As with signalling, the components of structure – instigator, action, recipient and context – co-identify with the functions of process; but, unlike signalling, within language the hierarchy of structure has component reuse and limited recursion, the process occurs in multiple flows, and both hierarchy and flows rely on a non-linguistic cognition of the intentions of others.

This model lacks both the detail of Formalist models and the sophistication of Functionalist models. It does, however, close the circle of structure and process in language and nonhuman

signalling; and it provides a basis for studying language as a unified system. It also relates language as a system back to the system of signalling in general, and therefore opens it up for consideration as part of general signalling and general cognition. In the next two chapters we will see how this hybrid view of grammar affects our understanding of self-reference through intentionality, and the significance this has for language origins.

7. Modelling the Self

The question of selfhood is key to the theory proposed in this dissertation, and has long been recognised as vital for an understanding of language. Even before Darwin's theory of evolution by descent, Wilhelm von Humboldt stated that:

> … the customary demands of mankind are satisfactorily met by forces of nature and by the mechanical continuation of human activity. But the appearance of a greater individuality in individuals and in peoples, practically inexplicable by any derivation, interferes suddenly and without warning with the course more obviously determined by cause and effect.[266]

As humans, aware of our own individuality, we must each be aware that we are different to all other humans. However, in order to be aware of our uniqueness we also have to be aware that there are other beings who have the capacity to be the same as us, but who are not us. I must simultaneously have an awareness of my own self-image, the image of me maintained by you and others, and images of the relationship between me and you held from a possible fourth-person viewpoint. I am aware not just of myself, not just that you have a model of myself, but that others can have models of the relationships between me and you; and, most importantly, that the viewpoint of those others can be adopted by both me and you.

This raises a series of questions: are humans the only species that does this? If so, how do we do it? Why do other species not do it? What advantages do we get out of being able to do it? And what costs do we pay for being able to do it? This chapter attempts to answer these questions by reviewing current theories on consciousness, and by building a description of selfhood that accommodates the model-building capacity needed to support the human ability to adopt the viewpoints of you, me and others. We start, however, with the issues of intentionality and Theory of Mind, and what they imply for the origins of grammar.

7.1. Intentionality, Theory of Mind and Modelling

Intentionality is the power of minds to be about, to represent, or to stand for, things, properties and states of affairs[267]. The concept was reintroduced to modern philosophy by Franz Brentano in 1874 in his book *Psychologie vom Empirischen Standpunkt*[268], but it has its origins in medieval scholastic philosophy.

[266] **Wilhelm von Humboldt**, *Linguistic Variability and Intellectual Development*, p4
[267] *Stanford Encyclopedia of Philosophy*, http://plato.stanford.edu/entries/intentionality/
[268] **Franz Brentano**, *Psychologie vom empirischen Standpunkt*, Leipzig: Duncke & Humblot, 1874. (2nd edition, enlarged by Oskar Kraus, 1924, Leipzig: Meiner).

Intentionality has many levels. For instance, when I think about an apple I am using first level intentionality towards that apple. This is the lowest level of intention, and it seems to be a condition of all mammals and, probably, all vertebrates. Humans, however, and some animals, are able to think about thinking about things. When I think about your reaction to the apple I am using second order intentionality towards the apple: I am trying to see the apple in the way that it appears to you. This level of intentionality is necessary for Machiavellian intelligence: I have to be able to predict your likely actions in order to anticipate them[269].

The next level, third order intentionality, involves me thinking about your reaction to someone else's reaction to the apple: *I believe that John disapproves of Mary's intention to eat the apple*. This level seems to have been achieved only by humans. Chimpanzees and bonobos appear able to use second order intentionality, while monkeys cannot[270]; but third order intentionality seems to be a feature of acculturated humans only, and it seems to be the outcome both of being human and of being in a socialised culture.

The capacity to perform at third order intentionality appears to give higher levels "for free". Once I have the concept that you are able to model the intentions of a third party, my view of you must necessarily change; and the knowledge that the third party can also model intentions is a natural entailment from the fact that you and the third party are interchangeable. If any species becomes capable of third order intentionality then we would expect the use of higher levels of intentional analysis to be unexceptional; currently we know this to be true only for humans.

This ability to see the three levels of intentionality as a syntax of cognition is the fourth-person viewpoint: the self is able to take a step away from the intentionality process in which it is necessarily embroiled, and disinterestedly model the intentional relationships between others as a framework of roles into which different individuals can be slotted without affecting the framework itself.

This syntax of aboutness, or intentionality, is sequential – it involves one person's thoughts about another person, whose thoughts are about another person; but it is also a nested syntax with recursion – B's thoughts in *A's thoughts about B's thoughts about C* are actually a subset of A's thoughts, and not B's thoughts at all. Each level "governs" the level directly below it, and

[269] **Richard W Byrne**, *The Thinking Ape: evolutionary origins of intelligence*, pp203-205
[270] **Robin I M Dunbar**, *The Human Story: a new history of mankind's evolution*, pp55-64

each level of thought is "bound" to the level above it. We can thus see in intentional thought both structure and process working simultaneously, in a similar way to the structure and process we see in language.

There are, however, problems with the intentionality model. It takes no account of who is at each level of intentional thought: me, you or someone else. The privileging of first and second person isn't just a linguistic trope, it is a cognitive response to the very different natures of the three persons – and, by extension, of the disinterested fourth-person viewpoint from which the other three roles can be objectively examined.

The knowledge I have of my intentions should be more complete than the knowledge I have of your intentions; and my knowledge of her intentions should be less immediate and less vital than my knowledge of your intentions. We can thus see important knowledge differences between "I believe that you know what she is thinking" and "she believes that I know what you are thinking". The syntax of intentionality is semantic as well as syntactic.

Intentionality also has problems with the linguistic expression of the intentional act itself: different acts, represented in language by similar forms, produce different levels of intentionality. "I know x" is a simple statement in its denotation, and implies only the intentions of an indivisible self towards x. In fact the message is so banal and non-relevant to any discourse that, when we hear it uttered, we take it to be a connoted emphatic, implying my knowledge of x is better than yours, or that it should not be questioned, or that it legitimises some other knowledge of mine. In contrast, "I believe x" implies a divided self, a level of intentionality by the self to the self: one part of me knows x, and another part knows the possibility of not x. It is not the task of this dissertation to assess which of these selves is the "real" self and which the model, both can be treated as models for language purposes. The important fact is that the intentionality implicit in the act of thinking is affected by the model expressed in the thought.

Another way of looking at levels of cognition is by considering Theory of Mind (ToM). This is once again a concept attributed to Franz Brentano, although his is an introspective definition: for humans, every idea involves two levels of thought: the ideation itself and the thought about the idea. Michael Tomasello offers a more conventional view of ToM, dividing human representations of others by age into: animate agents (up to about age 2); intentional agents (up to about age 4); and mental agents (over age 4). He reserves ToM for the ability to see others as

mental agents who are able to have a mental life as rich as the self[271]. ToM is, under this definition, a binary genetic switch: as a species you either have the potential for ToM or you don't, and as an individual you either have ToM or you don't. This is unlike intentionality, which theoretically can be a matter of degree within a species.

The current conventional approach to ToM is that only humans have it, and only humans after a certain age (usually said to be about 4). Tomasello links this appearance of ToM with the achievement of full language syntax[272]. This makes ToM both a genetic and a social phenomenon. Genetic, in that it is virtually species-wide and only species-wide; and social, in that it requires the presence of other minds, preferably themselves already exercising ToM, in order to have any value.

ToM is often thought of as corresponding to second order intentionality, which means that it is a feature of both human and some primate cognition[273]. Yet, as we have seen, the syntax of intentionality does not really begin until the third level – which most commentators agree seems to be beyond all animals except humans. Theory of Mind does not become a theory until it is possible to see not just my thoughts about your thoughts, but also my thoughts about my thoughts about your thoughts. Only when second order intentionality becomes subject to another level of intentionality can my knowledge of your mind become my theory of knowledge of minds.

As indicated above, the syntax of third order intentionality gives higher levels "for free"; but "for free" is not really for free. Third order intentionality requires a cognitive engine with built-in redundancy because, unlike second order intentionality, it operates in multiple dimensions. As well as the dimensions of my and your intentionality, which have fixed roles in second order intentionality (it is always *my thoughts about your thoughts*, or *your thoughts about her thoughts*), third order intentionality requires a syntax of roles and occupants (it can be *my thoughts about your thoughts about her thoughts*, or *my thoughts about her thoughts about your thoughts*, or reflexively *my thoughts about your thoughts about my thoughts* – or, with the fourth-person viewpoint, *her thoughts about your thoughts about my thoughts*, and so on). This syntax of roles and occupants has a high cost in terms of cognitive capacity.

[271] **Michael Tomasello**, *The Cultural Origins of Human Cognition*, pp178-179
[272] ***Ibid***., pp181-182
[273] **Robin I M Dunbar**, *The Human Story: a new history of mankind's evolution*, pp52-61

To better understand intentionality and ToM it may help to consider cases. If we look at our closest living relatives, the chimpanzees (*Pan troglodytes*) and bonobos (*Pan paniscus*), then we are looking at animals that are cognitively very different to humans. Currently there is an emphasis on the difference between the excitable, aggressive, male-dominated societies of chimpanzees and the relaxed, socialised, female-dominated societies of bonobos[274]. These are significant differences and it is true that they offer very different models for our common ancestor, and for the earliest humans. However, the differences between *Pan* and *Homo* are vastly greater than those between the two species of *Pan*, as the following thought exercise illustrates.

Imagine you are inside an adult chimpanzee or bonobo head. What is significant to you? You are a Machiavellian thinker, so you understand that the actions of others can be influenced, you understand that others are useful or dangerous to you, and you understand that others have relationships with each other. To express this as a calculus, you have emotive mental constructs of your relationships with others which range from fear through to affection; and you have emotive mental constructs for other relationships in your group, such that you know about the fear and affection relationships between the others.

You can use these relationships to predict likely behaviours which can in turn modify your own behaviour: I fear Alf, but I have a very good relationship with Beth, and Beth has a good relationship with Alf. If I stay close to Beth, Alf is unlikely to attack me because Beth is more likely to support me than Alf, and Alf therefore risks his good relationship with Beth. And, most importantly, I can assume that Alf knows this, too.

What is happening here? We can express it in human terms as the ability to make models. I am able to model the relationship between Alf, Beth and me in terms of the separate relationships between Alf and Beth, Alf and me, and Beth and me. Two types of knowledge are needed: knowledge of how you (the immediate other) react to me, and knowledge of how others react to you. These both involve second order intentionality – the first is my thoughts about your thoughts, and the second is your thoughts about their thoughts – but they are very different types of knowledge. In the first, your thoughts and intentions directly affect me; in the second, they only indirectly affect me through my own intentions towards you and towards the other.

[274] **Frans de Waal & Frans Lanting**, *Bonobo: the forgotten ape*, ch2

There are also syntax or calculus considerations: my relationships with the world rely on a constant, *me*, relating to variables out there. In contrast, relationships between variables out there have no fixed constants. To understand relationships which do not involve *me* directly, I need to understand two types of intentionality: I need to know about your intentions to others as well as my intentions to you.

We can see two forms in these two model-making abilities. First, my relationship with others involves a simple cognitive correlation between differentiated objects (other individuals) and emotive states. This gives an action-object distinction. Second, the reaction of one individual to another is a relation between two objects, which gives a subject-verb-object two-argument form. This has implications for language grammar: could these two forms be related to similar forms in language? As James Hurford points out, the predicate-argument (object-action) distinction is neurologically based, and it is a capacity available to apes and monkeys as well as humans[275].

There is an advantage for me in being able to model the intentions that others have to each other: it enables me to co-opt the muscle power of others to support my own Darwinian fitness. However, there is a significant cost, too: it requires bigger brains, and brain cells are some of the most costly cells in the body to produce and maintain. There is also an escalating Darwinian event happening here: if my conspecifics become able to use second order intentionality when I cannot, they will be co-opting my muscle power and it is their genes that will get into the future. Second order intentionality, if brains large enough to support it can develop, will have a fitness advantage in a socialised species.

There are, however, two very important features about this model of Machiavellian second order intentionality. First, it does not rely on "me" being able to make models of me. My relationships with the world rely on a constant "me" which does not need analysis, and my understanding of the relationships between others does not require me to understand myself at all. In fact, if we look at self modelling as a Darwinian event it is difficult to see how it could ever have got started. If I make models of me I am treating myself as I treat others: I am being disinterested about me. But where is the advantage of being disinterested about myself when all around me are interested mainly in themselves? It's likely that, in this situation, nice guys finish last and my genes don't go forward to the next round of the competition.

[275] **James R Hurford**, The Neural Basis of Predicate-Argument Structure. In *Behavioural and Brain Sciences* 2003 26 (3), pp283-284

The second feature of Machiavellian second order intentionality is that these models are being built in the individual heads of the apes, and not being communicated between them. What would be the advantage of communicating these models? Information is power, it is a way of harnessing the muscle-power of others[276]. That muscle-power is limited, however, so giving away information gives away some of that muscle-power. What would be the gain in so doing? It is true that information can be used to establish relationships, but this relies on the receiver being able to trust the information. If I tell you something I know, how do you know I'm giving you real, valuable information? False information is valuable to me if you believe it, and valueless to you whether you believe it or not – so lying is always worthwhile. But then how can you trust any information I give you?[277]

Fast forwarding in evolutionary terms to *Homo sapiens*, the ability to make models of ourselves seems to be endemic. It gives us the ability to plan our lives: by making models of ourselves we can make decisions about which options to choose to achieve aims many years in the future. Model-making is also embedded in our language: we use it to place models of ourselves and others backwards and forwards in time – we communicate temporality; we use it to propose our models to others as versions of reality – we communicate conditionality; and we use it to create versions of reality which are not real – we lie, create metaphor, and tell each other stories. Somehow the major problem in receiving information has not only been overcome, it has become central to the social collusion we call language. ToM has somehow simultaneously created a syntax of intentions and created the circumstances in which this syntax is communicable. How this happened will be explored in chapter 8.

If we review the three versions of cognition offered here we can see that they offer different but complementary views on the subject. From intentionality we have the idea that thinking about thought offers levels of awareness, but it is not particular about whose thoughts or what thoughts are being considered at each level. From ToM comes the idea that the ability to think about other minds is a defining difference between humans and nonhumans, but it does not help us to describe the complexities of thought below and above the ToM threshold. Intention modelling allows us to express the relationships of intentionality and of ToM in terms of roles (me, you and other) and actions. It provides a syntax which helps in understanding how

[276] **Marc D Hauser**, *The Evolution of Communication*, pp567-608
[277] **Camilla Power**, Old Wives' Tales: the gossip hypothesis and the reliability of cheap signals. In James R Hurford, Michael Studdert-Kennedy & Chris Knight (eds), *Approaches to the Evolution of Language: social and cognitive bases*, ch7

intentionality and ToM work; but it is emergent from the systems of intentionality and ToM, and cannot exist without them.

The three versions of cognition described here create a structure which can be used both for social cognition and for language: In all of these models, however, the nature of thought, whether it is conscious or unconscious, has not been discussed. While an understanding of the nature of consciousness is not strictly necessary for an understanding of language, it is often referenced in relation to language origins and language acquisition. The nature of language use, involving both conscious and unconscious choices in constantly switching and overlaying relationships, means that consciousness cannot be fully ignored if a balanced description of the evolution of grammar is to be delivered. The nature of consciousness will therefore be reviewed next, to identify the role it plays in language.

7.2. Consciousness and Language

Consciousness is a complex issue that remains unresolved in modern philosophy. In Western culture, consciousness was long believed to be the feature that separated humanity from the rest of life. As Augustine of Hippo said:

> We see the face of the earth graced by the animals that live upon it. And, finally, we see man, made in your [God's] image and likeness, ruling over all the irrational animals for the very reason that he was made in your image and resembles you, that is because he has the power of reason and understanding.[278]

For Augustine, rationality equalled consciousness: only if you are conscious of existence can you produce a rational map of reality. But what does this rationality consist of? For Augustine the argument that men are rational because God made them so was sufficient. However, this still leaves unanswered the vital question, what is it that people are conscious of? Can consciousness truly be defined, or is it just a linguistic trope to describe a series of unrelated species-specific cognitive states? The opening words of Euan Macphail's book sum up the problem:

> Some things are conscious; some are not. Most of us believe that non-living things are not conscious and some living things are conscious. Not all living things: most of us do not believe that bacteria, mushrooms, or trees are conscious; we are certain that some animals are conscious, but are not quite sure whether all animals are conscious. Living things are basically collections of cells of various kinds. Cells in turn consist of non-living, non-conscious components. How is it possible to assemble non-living and non-conscious components to produce conscious beings? What is it about the body of conscious beings that allows the emergence of the

[278] **Augustine of Hippo**, *Confessions*, Book XIII, verse 32; pp 343-344

> mind? These questions, in one form or another, have been at the centre of Western philosophy since its origins more than two thousand years ago.[279]

What is the reality we are conscious of? We like to think that we know what is real, and this enables us to place useful values on our perception of reality. But when we look at what is really real the extent of our self-deception becomes obvious.

Descartes was able to logically reject the existence of the whole World as a figment of imagination, but recognised the need for a mind to do the imagining[280]. It is this overmind (of God) that creates all the reality our minds are forced to accept. This view was also adopted by David Hume, John Locke and Bishop George Berkeley, among others; and it is this denial of intrinsic reality that Samuel Johnson referred to when he kicked a stone, saying "thus I refute you"[281]. Bertrand Russell saw the World as a reality, but one which we can only perceive imperfectly, and which remains unaffected by our imperfect view[282]: real reality remains hidden behind our sense-models of it. John Searle differentiates between mind independent realities (such as tables and trees) and mind dependent realities (such as restaurants and forests)[283]. The independent realities have existence regardless of the existence of minds, but the dependent realities only have existence by mutual agreement between minds.

Despite these very disparate views of reality, most philosophers seem to agree that, in important ways, we cannot know what is real. It has even been proposed that we are living inside someone else's computer program, and the anomalies in our Universe are a product of poor coding[284]. The joint problems of reality, and our consciousness of that reality, have exercised the greatest minds over the past 2,500 years, they will not be solved in a few paragraphs here; but, hopefully, it will be possible to illustrate the issues of awareness and selfhood (and awareness of selfhood) that are most significant in language.

How should consciousness be defined? While a definition of terms would seem essential before beginning an investigation, it appears that there is no single answer to this question. For Francis Crick, consciousness is essentially linked to visual awareness, although he also postulates a range of awareness units scattered through the brain. These are co-ordinated by a central processor, which he identifies with the thalamus. Consciousness is a product of reverberation

[279] **Euan M Macphail**, *The Evolution of Consciousness*, p1
[280] **René Descartes**, *Discourse on the Method of Rightly Conducting One's Reason and of Seeking Truth.* Project Gutenberg: http://www.gutenberg.org/etext/59
[281] **Michael Thau**, *Consciousness and Cognition*, ch1, p39 (ISBN 0195141814)
[282] **Bertrand Russell**, *The Problems of Philosophy*, p74
[283] **John R Searle**, *Mind, Language and Society*, ch1.
[284] **John Barrow**, Glitch!. In *New Scientist*, 7 June 2003, pp44-45

between the thalamus and the awareness units which create a critical mass of electrochemical activity. Once this critical mass has been achieved the brain can respond not just autonomically to a stimulus, it can override the autonomic response and replace it with an alternative.[285] This fits with William Calvin's theory of recruiting neurons, but Calvin's view of the location of consciousness is very different.[286] Like Howard Gardner[287], he sees the communication between the awareness units as being essentially a self-organising committee process rather than centrally-controlled. Arguing against Roger Penrose's quantum mind[288], he says:

> … a more appropriate level of inquiry into consciousness is probably at a level of organization immediately subjacent to that of perception and planning: likely (in my view), cerebral-cortex circuitry and dynamic self-organization involving firing patterns within a constantly shifting quiltwork of postage-stamp-sized cortical regions. Consciousness, in any of its varied connotations, certainly isn't located down in the basement of chemistry or the subbasement of physics. This attempt to leap, in a single bound, from the subbasement of quantum mechanics to the penthouse of consciousness is what I call the Janitor's Dream.[289]

For Euan Macphail, unlike the previous commentators, consciousness is no more than an epiphenomenon of a large brain. It occurred at some stage in our phylogeny merely because the brain got large enough and complex enough for iterative intentionality to become possible. As this did not occur in non-linguistic animals, consciousness is a feature of the human animal only[290]. This is a constrained definition of consciousness, but there is now some substantial evidence in support of it[291]; and Macphail is not the only person to take this view: Julian Jaynes has advanced the theory that consciousness only appeared about 4,000 years ago. He sees humans as originally having a bicameral mind in which the "one that tells" and the "one that is told" were treated as separate personalities within the same brain. With the increasing complexity of civilisation brought about by writing, this bicameral brain began to break down and an internal personal dialogue began. It is this dialogue that is consciousness.

While Jaynes' theory has problems (it cannot explain how the bicameral mind broke down in isolated areas of the World without a written language, like Australia; and the bicameral mind

[285] **Francis Crick***, The Astonishing Hypothesis*, ch15
[286] **William H Calvin**, *How Brains Think: evolving intelligence, then and now*
[287] **Howard Gardner**, *Frames of Mind: the theory of multiple intelligences*
[288] **Roger Penrose**, *The Emperor's New Mind*
[289] **William H Calvin**, *How Brains Think: evolving intelligence, then and now*, p36
[290] **Euan M Macphail**, *The Evolution of Consciousness*, ch6
[291] **Chet C Sherwood, Cheryl D Stimpson, Mary Ann Raghanti, Derek E Wildman, Monica Uddin, Lawrence I Grossman, Morris Goodman, John C Redmond, Christopher J Bonar, Joseph M Erwin, and Patrick R Hof,** Evolution of increased glia–neuron ratios in the human frontal cortex. *PNAS* September 12 2006 103 (37): pp13606-13611

has no basis or precedent on which to be posited), he nonetheless provides a full and clear list of the components of his definition of consciousness.[292] These are:

- Spatialization: the ability to think of objects in terms of the space they occupy, and to give spatial metaphors to non-spatial concepts.
- Exerption: The ability to ideate an object from a series of partial representations, such as emotions, visual cues and contexts.
- The Analog 'I': the ability to see the self as an external object in various situations, either in memory or in speculation.
- The Metaphor 'Me': The ability to look out of the eyes of the analog 'I' and see what it would see.
- Narratization: seeing events as part of a continuing story, and being able to relate current events (real or speculative) to previous and future ones.
- Conciliation: The ability to identify relationships based on purely subjective or personal criteria, and the ability to posit classes from objects, based on perceived similarity of features.

This list provides a summary of the ways in which human minds think differently to animal minds, and provides a strong base from which to consider the question of how human language appeared. Of particular interest to this dissertation, as we shall see, are the analog 'I' and the metaphor 'me'.

Three other views of consciousness will be considered, because they encapsulate the current neuroscientific debate on the subject. Is consciousness a physically identifiable brain system, is it an emergent feature of other brain systems, or is it an unidentifiable product of general brain complexity?

Daniel Dennett has taken the view that consciousness is a process, but he also believes that asking the question "what is consciousness?" is pointless, it tells us nothing about the mind:

> What makes a mind powerful – indeed, what makes a mind conscious – is not what it is made of, or how big it is, but what it can do. Can it concentrate? Can it be distracted? Can it recall earlier events? Can it keep track of several different things at once? Which features of its own current activities can it notice or monitor?
> When such questions as these are answered, we will know everything we need to know about those minds in order to answer the morally important questions. These

[292] **Julian Jaynes**, *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, pp59-65

> answers will capture everything we want to know about the concept of consciousness, except the idea of whether, as one author has recently said, "the mental lights would be out" in such a creature. But that's just a bad idea – in spite of its popularity. Not only has it never been defined or even clarified by any of its champions; there is no work for such a clarification or definition to do. For suppose that we have indeed answered all the other questions about the mind of some creature, and now some philosophers claim that we still don't know the answer to that all-important question, Is the mental light on – yes or no? Why would either answer be important? We are owed an answer to this question, before we need to take their question seriously.[293]

For Dennett, consciousness cannot be defined by reference to a structure of consciousness, only by reference to a series of cognitive events which can be judged against a scale of consciousness. Consciousness is not a factual object to be measured, it is an arbitrary scale generated to explain events after the fact of self-referenced cognition.

For Steven Pinker, Dennett's view that consciousness is a process is valid; but he cannot agree with the idea that it is an illusion produced by cognitive smoke, mirrors and furious activity[294]. However, this leads Pinker down the road of Cartesian dualism, and he concludes that consciousness (or sentience, as he calls it) is real but unknowable – there are mysteries in the world that humans cannot comprehend, and consciousness is one[295]. Pinker does not explain why we should have a word, a concept, for something we can have no concept of. And, from a scientific viewpoint, the idea that there are areas of the Universe where scientists may not tread is ideologically unacceptable – doubly so when that area is inside the scientist's own head.

The third view of consciousness is that of John Searle, and he sees it as a direct product of the brain. In Searle's view, consciousness is real and knowable because brains are real and knowable. Just as other products of the brain, like language, can be studied and analysed, so consciousness should be amenable to study:

> I, on the other hand, want to insist that where consciousness is concerned, brains matter crucially. We know in fact that brain processes cause consciousness, and from this it follows that any other sort of system capable of causing consciousness would have to have causal powers at least equivalent to the threshold causal powers of brains to do it. An "artificial brain" might cause consciousness though it is made of some substance totally different from neurons, but whatever substance we use to build an artificial brain, the resulting structure must share with brains the causal power to get us over the threshold of consciousness. It must be able to cause what brains cause.[296]

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[293] **Daniel C Dennett**, *Kinds of Minds: towards an understanding of consciousness*, p210
[294] **Steven Pinker**, *How the Mind Works*, pp147-148
[295] ***Ibid***., pp561-565
[296] **John R Searle**, *The Mystery of Consciousness*, p191

For Searle, consciousness may be an emergent feature of large brains or particular types of brains, but it has a reality somewhere in the structure of that brain. Even if it is a conceptual reality rather than a physical reality, it will be traceable to real features within the brain.

How do these different views of consciousness relate to views on language, if at all? Paradoxically, the Formalists tend towards the consciousness-as-process ideas of Dennett and Pinker while the Functionalists tend towards the consciousness-as-structure ideas of Searle. This is understandable: if language is an independent structure, as the Formalists suggest, then it cannot be dependent on other cognitive structures without losing some of that independence. By depreciating other cognitive systems which could affect the status of language as an independent structure, that independent structure is preserved. For Functionalists, consciousness provides the structure on which the processes of language can be based. So its role as a tangible structure within the brain is an attractive idea.

If consciousness is non-existent or unknowable then language can only be studied as a product of language structures. Meaning (semanticity) is either part of the illusion of consciousness and so not worth investigating, or it is part of the unknowableness of consciousness and so cannot be investigated. The only part of language that is structural or knowable is the grammar or rules. A rule-based view of language sees it as a process involving a series of transformations: an utterance is perceived and transformed into a usable thought; or a thought is generated and transformed into a usable utterance. The process is bi-directional, the same transformation rules work both ways, and consciousness is irrelevant.

In contrast, if language is a product of structures of consciousness then it is entirely a process that can be mapped onto those structures. The functional model sees human language as a conceptualisation process involving a series of translations. An utterance is perceived, certain concepts are consciously extracted from it, and these concepts form the framework of a usable thought; or a conscious thought is generated and concepts in it are assembled into a usable utterance. This process is not strictly bi-directional as different concepts are activated by or activate different thoughts or utterances.

What can be made of these two different views? The first is that approaching language from the direction of consciousness is fraught with problems. However, the views that exclude consciousness from language analysis seem to be somehow defeatist. On a personal basis I feel that I am conscious, I am me, and I have control over me. These “facts” are so taken for granted

that our whole culture is based around them: the courts would rightly take a dim view if Samuel Johnson gave Daniel Dennett a good kicking and then claimed that it hadn't been a conscious act.

If consciousness cannot be wholly excluded from language analysis, how far should it be included? There is one important way in which consciousness is significant in language: the ability of the self to make models of itself requires a type of self-consciousness which is at the heart of language – both in terms of the persons within language and in terms of the roles represented by the utterance itself. This relationship between language and self is explored next.

7.3. The Self and Language

When reviewing the issue of self in language the first question that needs to be addressed is simply, what is the self? Or, to put it in more immediate terms, what is me? This is not the same question as the ubiquitous "who am I?", which aims to identify an intimate self, mostly through introspection. "What is me?" attempts to describe the self as an externalised model – the viewpoint is not that of the interested self but of the disinterested fourth-person. We are looking at Jaynes' metaphor 'me', not the analog 'I'.

Susan Greenfield answers the question "what is me?" by reference to an always-present self and an awareness of that self through linguistic self-reference:

> … language gives us a symbol for something that normally does not make inroads into our senses, simply because it is always there: one's self. As soon as we have a simple word for ourselves then we can inter-relate the self in context. We can become self-conscious. This self-consciousness, combined with the ability to escape from the here and now, is surely what really distinguishes us from almost all other animals, as well as seemingly inhuman human infants.[297]

In Greenfield's formulation the self in context (the metaphor 'me') is a conscious reflection, or model, of one's self (the analog 'I'). We are able to describe our model self because it is a direct product of our conscious cognition; but we can only imperfectly describe our true self – others seem able to describe our true selves more accurately than us. Tomasello sees this process the other way around: it is our increasing self awareness in childhood that creates our knowledge of the capacities of others[298]; but this is not a common viewpoint. David Dunning, Chip Heath and Jerry Suls show that self-judgements on intelligence have a low correlation with real

[297] **Susan Greenfield**, *Brain Story: unlocking our inner world of emotions, memories, ideas and desires*, p169
[298] **Michael Tomasello**, *The Cultural Origins of Human Cognition*, pp70-77

intelligence, completion of our tasks is always behind our estimated completion, and we are incurable optimists when it comes to our own health[299]. Roy Baumeister, Jennifer Campbell, Joachim Krueger and Kathleen Vohs show that our self-esteem does not match well with the esteem given by others, and it also does not correlate well with academic achievement[300]. Benjamin Franklin said "there are three things extremely hard: steel, a diamond, and to know one's self". This would appear to be a reasonable view in light of the evidence.

It seems likely, therefore, that we understand others better than we understand ourself, and most knowledge of ourself comes not from introspection but from modelling the minds of others and their intentions towards us. Self awareness is better served by comparison than by introspection.

The attempt to "know thyself"[301] is a conscious cognitive act for humans, it is not the same as the self interest, or selfishness, that Richard Dawkins sees as underpinning the evolutionary process. Dawkins' selfishness is not concerned with activities at the phenotypic level but at the genetic level. If they are expressed at the phenotypic level then they are expressed as autonomic responses to environmental stimuli. Genes do not choose to be selfish, they are selfish because only selfish genes survive: genetically inspired actions that favour the phenotypic self and its reproduction lead directly to genotypic survival, actions that favour others do not. There may be an indirect path to survival by favouring others, but that indirection has to be advantageous enough to outweigh the direct path of non-co-operation before altruism should appear[302]. Selflessness may be a moral aspiration in many human societies, but in evolutionary terms it is usually an aspiration to genetic extinction. There is no intentionality in Dawkins' gene model of selfishness, any more than there is intentionality in a hurricane: both are natural phenomena and controlled by fully explicable rules external to the phenomenon.

Genetic selfishness is different to sense of self, which in turn is different to self awareness. Genetic selfishness is a default state which does not require consciousness. It ensures survival, and requires no more knowledge of the self than that the world is divided into self and not-self. What is inside the line, the self, is the ends; the rest, the other, is just means. Of course, with a binary model such as this only one of the items needs to be defined. It would seem that the self is the easiest to define, but it is also the least useful. The self is that part of the Universe that is

[299] **David Dunning, Chip Heath and Jerry M Suls**, Picture Imperfect. *Scientific American Mind* Vol 16 No 4, 2005, pp20-27
[300] **Roy F Baumeister, Jennifer D Campbell, Joachim I Krueger & Kathleen D Vohs**, Exploding the Self-esteem Myth. *Scientific American Mind* Vol 16 No 4, 2005, pp50-57
[301] Said to be written over the door of the temple of Apollo at Delphi
[302] **Richard Dawkins**, *The Selfish Gene*, ch5

already under control, so it is trivial; much more important is that part of the Universe that has to be manipulated and negotiated. A feature of genetic selfishness is therefore likely to be a lack of comprehension of the self. *Sense of others* gives immediate advantages, it allows an organism to subvert the survival of those others to its own purposes; *sense of self* gives no such immediate advantages.

Although the sense of self does not have direct advantages, it does have indirect advantages: it allows an organism to exercise choice between strategies. In any situation there is usually more than one viable strategy of advantage to the organism, and the ability to choose effectively between them maximises the advantage of each strategy. Adopting a single strategy for a situation relies on there being no organism with effective choices at the other end of the strategy; as soon as a single strategy approach is met by a variable response (which an effective choice allows) then it ceases to work as effectively, and the productive single strategy can become counter-productive. However, in order to make choices an organism must have a rudimentary understanding that there is a self to make the choices. This understanding does not have to be a conscious act, it need be no more than a recognition at the genetic level that the other half of the binary relationship, self and non-self, exists.

As soon as there is an understanding that there are choices, however, it becomes advantageous to model those choices onto other organisms. If I come from a lineage that has been successful because it is able to make choices, then my immediate rivals are likely also to come from that lineage. The ability to anticipate their choices is the next logical step in gaining a reproductive edge. It becomes advantageous to develop *other awareness*, a knowledge that others have choices that can affect my choices, and the ability to anticipate those choices. The model of the choices available to other organisms (and their possible responses) can be no greater than the knowledge I have of my own choices, so greater sophistication in knowledge of the self leads to more sophisticated models of others. These are two different types of knowledge, though: my choices are unconscious, they are selected by emotional bias and can be dictated by my feelings; in contrast, my analysis of your choices has to be, on some level, a conscious act – I have to be aware of your choices in order to cognitively evaluate them. For instance, the classic choice of fight or flight need be triggered by nothing more than a specific hormonal response, but the hormones dictating the appropriate response will be determined by cognitive triggers based on expectations of outcomes. We need conscious cognition to choose a course of action based on the possible actions of others, but we can rely on our autonomic responses to carry out that course of action.

In analysing your choices I am trying to evaluate your intentions: which choice will you make? But I am not evaluating my own intentions – they emerge from my feelings about your intentions and do not need conscious analysis. This means that the aboutness in this intentionality is not about me but about my model of you. There is no Theory of Mind in other awareness. To use Tomasello's definitions, I am not treating you as a mental agent; and I'm not treating myself as an agent at all. *Other awareness* allows me to generate an increasingly sophisticated map of your intentions, but it provides only a limited and difficult-to-expand toolbox to deal with those modelled intentions. It provides Machiavellian intelligence, but with no immediate way to allow that Machiavellian intelligence to become recursive human intelligence.

With humans and language we have a new type of self to be recognised. Michael Tomasello and Josep Call label this *self as social agent*[303]; Steven Pinker labels it *self-knowledge*, giving it as one of the three definers of consciousness (the other two being *sentience* and *access to information*)[304]; and Jerome Bruner calls it *the transactional self*[305]. In this dissertation this final stage will be labelled *self awareness*, the fourth stage of modelling. Somehow humans are able to extrapolate from making Machiavellian models of others to making models of ourselves, which allows us to conceptualise ourselves as if we are looking in from the outside. The picture we have of ourselves is often inaccurate, but the ability to generate it at all is an evolutionary conundrum: how have we become able to take a disinterested viewpoint of ourselves?

To reiterate, the four stages of awareness can be represented as follows:

- **Sense of others: e**vents outside the self dictate the responses of the self.
- **Sense of self:** the self has optional responses, but these responses are autonomic, not conscious. Dorothy Cheney and Robert Seyfarth refer to this as self recognition[306].
- **Other awareness:** others can be modelled to predict their behaviour. There is intentionality, but only in the model of the other. There is no need for recognition of the interpersonal structure of "me" and "you".
- **Self awareness:** others are the model for predicting both their own behaviour and my response. There is intentionality in my model of others, so there must be intentionality in any model I make of myself; and if there is intentionality then there must be a "me" and a

[303] **Michael Tomasello & Josep Call**, *Primate Cognition*, pp337-338
[304] **Steven Pinker**, *How the Mind Works*, pp134-136
[305] **Jerome Bruner**, *Actual Minds, Possible Worlds*, ch4
[306] **Dorothy L Cheney & Robert M Seyfarth**, *How Monkeys See the World: inside the mind of another species*, pp240-246

> "you" to have it. Comprehending this peculiarly human level of awareness seems to be what poses such a problem for autistics[307].

Self awareness is a process that makes possible what we do with language. The reason why internalised modelling became externalised in language is a matter of human acculturation and will be explored in chapter 8, but self awareness also establishes the rules which make language so powerful: it allows models of the intentions of others to become recursive models of the intentions of the self and others. The self becomes identified with the other to such an extent that their roles in language are interchangeable: I can see myself as simultaneously two objects, the thing that instigates an action and the thing that is the recipient of the action. I can also see you as both instigator and recipient, and both of us can be replaced in a construct by third parties: yesterday's "you" becomes today's "they", which I can tell another "you" about.

The dual self image permitted by this modelling – Jaynes' analog "I" and metaphor "me" – is prevalent throughout language. It is even possible to identify the roles in specific English usages. For instance, the apparently interchangeable reflexive forms *I hate me* and *I hate myself*, seem to have different roles in the identification of the nature of self[308], with *me* representing the analog "I" and *myself* representing the metaphor "me".

Self awareness would seem to be a function of socialisation. Kenan Malik shows that self awareness is intimately tied to language and social living – unless we have the knowledge that others have intentionality we can never have knowledge of our own intentionality:

> Humans, however, are symbolic creatures, with language, self awareness and a social existence. These three phenomena are intimately interconnected. Language can only exist in a social form, but it also helps create the possibility of a social existence beyond simply the kinds of individual interactions that animals experience. The existence of a community of beings possessing language allows us to make sense of our inner world, and hence to become self- consciousness. At the same time, I am only conscious of myself insofar as I am a member of such a community.[309]

This socialisation dimension means that two further capacities become possible with self awareness. The first of these is anticipation, or a second-guessing between intentions: I know your options, and I know my options, so I should choose the one that gives me the best result in response to your best choice. But then you know my options and you know your options, so you

[307] **Simon Baron-Cohen**, *The Essential Difference: men, women and the extreme male brain*, ch10
[308] **Martin Edwardes**, I like Both Myself and Me, *Proceeding of the Camling Conference 2003*
[309] **Kenan Malik**, *Man, Beast and Zombie: what science can and cannot tell us about human nature*, p220

may choose the option that gives you the best result in anticipation of my best response to your best choice, so I should choose the best response to that option… There is a recursion between your intentionality and mine within both of our minds, and this recursion is one of the capacities that enable language – as the Hauser, Chomsky and Fitch model predicts[310] (although it is not the only condition necessary for language).

The second question (or series of questions) that self awareness makes possible is speculation on the intentions of others to each other, with no direct reference to the self's own intentions. Other individuals are modelled not just as animate agents with linking relationships, but as mental agents with their own intentions. Modelling the intentions of others in not done to identify strategies which are directly useful to me, but simply to identify what is going on. It is this capacity that enables and informs the insatiable and disinterested curiosity of humans[311].

So out of self awareness come these three further types of cognition:

- **Reflexion:** the analog "I" is separable from, and interchangeable with, the metaphor "me".
- **Anticipation:** there is a recursion between intentionalities.
- **Speculation:** the intentionality of others is modelled in language into both the recipient of the action and the instigator – roles become interchangeable.

The four stages of mental modelling take us from the reactive state of genetic replicators to the human ability to anticipate the thoughts of others. For Paul Bloom this last stage, self-awareness, is an important feature not just in being human but in language learning itself: children do not learn words by associating sounds with objects and events, they learn them by inference from the intended meaning of others. This is significant, because it means that children, when they begin to utter their first associative words, already have sufficient modelling ability to understand that the word-sign is a negotiation between them and other people. They also understand enough about intentionality to know that the meaning of a word-sign is in the intention of the speaker (sender), and it is the role of the listener (receiver) to try to apprehend that meaning[312].

[310] **Marc D Hauser, Noam Chomsky & W Tecumseh Fitch**, The Faculty of Language: what is it, who has it, and how did it evolve? In *Science* vol 298 22 November 2002, pp1569-1579
[311] **Ian Stewart & Jack Cohen**, *Figments of Reality: the evolution of the curious mind*, pp163-164
[312] **Paul Bloom**, *How Children Learn the Meanings of Words*, ch3

Children are able to attain a Theory of Mind because they are born with a theory of theory. They seem to understand implicitly the process of thesis-antithesis-synthesis which is the heart of human scientific method. They apprehend the world, make models of it, check those models against new realities as they arise and modify their models appropriately. Alison Gopnik, Andrew Meltzoff and Patricia Kuhl call this "the scientist as child", comparing the childhood modelling which builds adult competence with the ability to continue modelling into adult life. Humans continue to play in the "mental sandpit" of modelling throughout their lives[313].

Self modelling raises the issue of temporality: humans have an image of themselves as continuous with their past selves and future selves, but they are also able to see those past and future selves as if they were other people. This is something that non-linguistic animals are unlikely to be able to do: it is probable that they have a sense of the continuity of the self inasmuch as survival is its own testament to continuity, but it is a trivial sense which only serves to inform the current self. The trick of seeing time as episodic through the eyes of past and future selves requires a mechanism for identifying those past and future selves. Non-humans can see time as passing before the self, but they cannot see the self as passing through time.

We can thus see that self modelling is intrinsic to the symbolism of language. In chapter 8 we will see that it is involved in the cognitive revolution that made us human; chapter 9 will show that it is necessary to our concepts of temporality and therefore tense, and that it allows us to dabble in the what-if universe of modality; and in chapter 10 its role in language acquisition will be shown. Self modelling would seem to be one of the prime mobilisers of language.

7.4. Self and Others as Models

In this chapter we have looked at intentionality, Theory of Mind, consciousness, the self, and mental modelling. This is a wide range of topics, and it has only been possible to provide a surface analysis of them all. We have seen, though, that each of them provides a different view of what it is to be human.

To be human means being able to use second and higher orders of intentionality; it means being able to see others as mental agents, with a cognitive life as rich as the self's; it means being aware of my own mental life as a metacognitive event – being able to think about my thinking; it means being aware that there is a me to be thought about, to be planned for, and to have

[313] **Alison Gopnik, Andrew Meltzoff & Patricia Kuhl**, *How Babies Think*, pp155-162

unrealistic expectations about; and it means having the ability to create a model world inside my head which is as significant to me as the real world outside my head.

All of these features rely on an ability to make models of myself inside my own head. This is a very unusual talent, and problematic in Darwinian terms: to make models of myself I have to step backward from myself: I have to try to view the "real" me from a fourth-person viewpoint. This means I have to be disinterested about myself, to try to see myself as others see me; and this is a skill that we are far from practiced at. Our self models are almost invariably wrong in significant ways: we overestimate ourselves and delude ourselves about our abilities. There is one person in the Universe that we need to be totally honest about, and we cannot do it.

Seen from this viewpoint, self awareness would seem to be a counter-productive developmental feature. And if a developmental feature is disadvantageous to the self then, in order for it to survive in a Darwinian world, it has to provide a larger, countervailing advantage. If the relative reproductive success it brings is great enough then almost any individually negative feature can be tolerated – up to and including personal sterility, as in the *hymenoptera*. So what is the strong countervailing advantage that self modelling gave in order for it to become a standard feature of human individuals? This question will be explored in the next chapter.

8. From Nonhuman Signalling to Language

So far we have looked in detail at signalling and language. The importance of viewpoint (first, second, third and fourth person) has been stressed to show that both signalling and language are systems with structures and processes; and it has been shown that it is possible to view both of them as only structure or only process. In the case of signalling it is possible to see the process of signalling through the structure, and the structure of signalling through the process. For language this is not the case: seeing language as a structure makes it difficult to see it as a process, and *vice versa*.

It has long been accepted in linguistics that this separation of methodologies corresponds to a separation of philosophies about language: while most Formalists and Functionalists accept that each others' methodology is "doing linguistics", there is often an implicit view that the other methodology is somehow inferior. To Functionalists, Formalist grammatical analysis cannot explain the purpose and use of language; and to Formalists, Functionalist semiosis and pragmatics are non-linguistic and cannot explain the nature and form of language. I hope I have demonstrated in this dissertation that both methodologies are needed to produce a full map of language as a system.

The analysis of structure and process in chapters 3 to 6 addressed the linguistic questions "what features of grammar emerged first, and what is their effect on signalling?" The analysis of selfhood, Theory of Mind and intentionality in chapter 7 addressed the psycho-social questions "what cognitive needs does grammar enable, and what communicative needs does it satisfy?" This chapter will concentrate on the anthropological questions, "where, when and how did grammar appear?" By the end of this chapter a cohesive argument should have been built setting out a model for the appearance of grammar which is consistent with the appearance of culture, language and humanity itself.

In this chapter I will be looking only at the human species *Homo sapiens*, *Homo heidelbergensis* and *Homo ergaster*, and both *H. heidelbergensis* and *H. ergaster* will be considered only in terms of their role as precursors of *H. sapiens*. The debate over the linguistic abilities of other species is not covered here, and the linguistic abilities of the precursor species are examined only in terms of what they would have needed to allow the appearance of full language grammar in *H. sapiens*.

The word *appearance* is used in this chapter to differentiate it from the *origins* of grammar. As we have seen, most of the cognitive systems needed for language grammar – segmentation, the action-object distinction, and hierarchy – would all be present as language potentials before the *Homo sapiens* speciation event. It is not the origins but the realisation of those potentials and their expression in human signalling that is of interest in this chapter.

8.1. Where Did Grammar Appear?

The "where" of the appearance of grammar is now uncontroversial, although it is intimately tied to the much more controversial "when" question. If language grammar is a genetically universal human capacity then it must have appeared at the time of the speciation event that created us. If, on the other hand, it is a cultural response to the need to share social models then it is most likely to have occurred when humans, *Homo sapiens*, were still geographically proximate. It is also likely that it appeared when the need to share social models itself appeared; and if this need was a product of speciation then grammar would have become necessary for communication soon after speciation.

Either way, grammar is likely to have appeared close to the speciation event, so locating where that event happened will tell us where grammar appeared. It is now widely accepted that the human species *Homo sapiens* first appeared in Africa, somewhere in the Rift Valley between the Afar region of Ethiopia and Lake Victoria[314] [315]. Grammar, a universal feature of human language (itself a universal feature of being human) can therefore be uncontroversially identified as an African event.

This leaves the questions of *when* and *how* grammar appeared; and these, as we will see, remain strongly disputed issues.

8.2. When and How Did Grammar Appear?

Looking back over the history of humankind, there are several significant events that indicate changes of survival strategies. Many of them are seen in terms of increasing intellectual achievement, but it must be remembered that the *Homo sapiens* humans that first walked in the Rift Valley are virtually identical to those flying over it nowadays. Modern human culture is a

[314] **Tim D White, Berhane Asfaw, David DeGusta, Henry Gilbert, Gary D Richards, Gen Suwa & F Clark Howell**, Pleistocene *Homo sapiens* from Middle Awash, Ethiopia. In *Nature* vol 423, 12 June 2003, pp742-747
[315] **Ian McDougall, Francis H. Brown & John G. Fleagle**, Stratigraphic placement and age of modern humans from Kibish, Ethiopia. In *Nature* vol 433, 17 February 2005, pp733-736

product of the same type of brain that produced the earliest human culture in Africa. Nonetheless, one of these human survival strategies resulted in the appearance of grammar and complex symbolic language; and if we review the strategy changes in order we should be able to identify the event before which language and grammar were unnecessary, and after which they had to have existed.

Looking backwards from today, the first event that has possible significance for language is the appearance of organised civilisations, about 10,000 years ago. City states would have required specialised economic roles, political hierarchy and a high level of interpersonal reliance, all of which imply significant systemic differences from pre-civilisation culture. As the source of language, however, organised civilisation has a major problem: even today not all human cultures have reached the city state stage, yet all human cultures have language.

The genesis of civilisation would therefore seem to be an unlikely event for the appearance of grammar, yet at least one writer has identified it with a language-related development. For Julian Jaynes, true consciousness is a product of urban living, specialisation and writing, which together caused the breakdown of the pre-urban bicameral mind. The pre-urban mind was incapable of self modelling because the ego and super-ego existed completely separately; and, when complex social structure created the need for them to communicate, consciousness emerged[316]. Jaynes, however, provides no neurological evidence for the bicameral mind or for its breakdown, and his view of the birth of civilisation as a cognitive re-mapping event remains a minority position.

Going further back in time, the next major event that has been associated with the appearance of grammatical language is the flowering of culture represented by the Upper/Middle Paleolithic transition, about 40,000 years ago[317]. This appears to have been a Eurasian event, and involved an apparently sudden increase in the type, functions and specialism of tools. Prior to this, the tools in the flake-based tool set were both less sophisticated in form and less specialised for purpose, and there were fewer types. It also seems that humans developed both multi-staged technologies and depictive art around the beginning of the Upper Paleolithic; and, if those two

[316] **Julian Jaynes**, *The Origin of Consciousness in the Breakdown of the Bicameral Mind*
[317] **Sheldon Klein**, The Analogical Foundations of Creativity in Language, Culture & the Arts: the Upper Paleolithic to 2100CE. In Paul McKevitt, Sean O'Nullain & Conn Mulvihill (eds), *Proceedings of The Eighth International Workshop on the Cognitive Science of Natural Language Processing (CSNLP-8)*. Amsterdam: John Benjamin, 2002. pp347-371

great icons of symbolic culture, art and technology, appeared at that time, surely language and grammar must have done so, also?[318]

A closer examination of the evidence, however, indicates that this may be an optimistic view of what was happening 40,000 years ago. The problem is that the artistic evidence does not fit well with the technological timescale. It is true that the earliest depictive cave art known is at Chauvet in France and dates to 32,000 years ago[319], but the archaeology of adornment art indicates that it is a much more ancient phenomenon: a shell necklace had been found at Blombos cave in South Africa and dated to 80,000 years ago,[320] and similarly pierced shells found at Skhul in Israel and Oued Djebbana in Algeria have been dated to 100,000 and 135,000 years ago[321]. There is also evidence of early ochre crayon use, probably for body painting[322]. Adornment art is too early for the Middle/Upper Paleolithic transition.

Steven Mithen originally took the view that the Middle/Upper Paleolithic transition involved a reorganisation of the brain which broke down the barriers between previously isolated cognitive modules – natural history intelligence, social intelligence, technical intelligence, and so on[323]. Richard Klein takes the view that art at the Middle/Upper Paleolithic transition kick-started a genetic/cultural change which spread from Africa around the World[324]. Both of these views, however, raise the problem of propagation: both models require a brain reorganisation on a species-wide scale, which must involve a genetic component. This has to start with a single individual and propagate through an entire population. This propagation is unlikely to have happened in the time available since the start of the Upper Paleolithic because the human population was already too spread out geographically to allow any genetic trait to become truly universal. The Middle/Upper Paleolithic transition is not a good candidate for the appearance of grammar.

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[318] **Grahame Clarke**, *Aspects of Prehistory*, ch3
[319] **J.M. Chauvet, E.B. Deschamps and C. Hillaire**, *Dawn of Art: The Chauvet Cave*. (1996) Harry N. Abrams, Inc, New York. English translation by Paul G. Bahn
[320] **Christopher Henshilwood, Francesco d'Errico, Marian Vanhaeren, Karen van Niekerk & Zenobia Jacobs**, Middle Stone Age Shell Beads from South Africa. In *Science* vol 304, 16 April 2004, p404
[321] **Marian Vanhaeren, Francesco D'Errico, Chris Stringer, Sarah L James, Jonathan A Todd & Hank K Mienis**, Middle Paleolithic Shell Beads in Israel and Algeria. In *Science*, vol 312, 23 June 2006, pp1785-1788
[322] **Ian Watts**, The Origin of Symbolic Culture. In *The Evolution of Culture*, Robin Dunbar, Chris Knight & Camilla Power (eds), ch7
[323] **Steven Mithen**, *The Prehistory of the Mind: a search for the origins of art, religion and science*, ch9
[324] **Richard G. Klein, Graham Avery, Kathryn Cruz-Uribe, David Halkett, John E. Parkington, Teresa Steele, Thomas P. Volman & Royden Yates**, The Ysterfontein 1 Middle Stone Age site, South Africa, and early human exploitation of coastal resources. In *PNAS*, April 20 2004, Vol 101, no 16, pp5708-5715

The next known major event in the human story is the diaspora out of Africa about 75,000 years ago. Little is known of this event, but it probably represents no more than a stage in the general human diaspora. To our view of history this event looks significant; but, if it occurred via land bridges out of Africa, it required no new strategies, technologies (such as rafts) or cognitive or cultural capacities. If the appearance of grammatical language relies on a genetic or cultural event then the diaspora out of Africa is not a good candidate: it is likely to have been just business as usual, but somewhere else.

Before the African diaspora there would seem to be only one other identified event that could have caused the appearance of language and grammar, and that is the speciation event. This occurred somewhere between 400,000 and 130,000 years ago[325], probably around 250,000 years ago; and it is a good candidate for the appearance of grammatical signalling – except for the nature of speciation and the nature of grammar itself.

We have seen that grammar needs an action-object distinction; this is likely to have been within the capacity of the *Pan/Homo* common ancestor – it is certainly within the capacities of modern *Pan* and modern Humans. Grammar also needs a subject-verb-object-context three-argument form; while this is not proven to be within the capacities of Pan, the two-argument form required for social calculus does provide a base on which the three-argument form could be built. We have also seen that grammar requires signal segmentation, but that this is within the capacity of monkeys in the wild and chimpanzees and bonobos acculturated to humans. If grammar was "switched on" genetically by speciation, what exactly was switched on?

If we consider language itself as the speciation event then the same question arises: what part of language switched on? It is highly likely we already had vocalisation so, despite the view of Michael Corballis[326] and others, this is not a good candidate. Vocalisation is, anyway, only the channel for signalling and is unlikely by itself to have generated structure and process.

Even generosity as a handicap display cannot really explain what humans do with language. It has been shown that generosity can be a costly signal of fitness if third parties see and comprehend the generosity[327] [328], but this provides only a partial explanation for language

[325] **Chris Stringer & Peter Andrews**, *The Complete World of Human Evolution*, pp158-161
[326] **Michael C Corballis**, *From Hand to Mouth: the origins of language*
[327] **Kobe Millet & Siegfried Dewitte**, Altruistic behavior as a costly signal of general intelligence. In *Journal of Research in Personality* (2006) in press
[328] **Eric Alden Smith & Rebecca L. Bliege Bird**, Turtle hunting and tombstone opening: public generosity as costly signalling. In *Evolution and Human Behavior* 21 (2000) pp245–261

signalling: language is used for much more than just public display. While most language is communicative, much involves dialogue without a third party present, and much involves negotiation to new meanings rather than just presentation of information. It is clearly not a handicap display.

So which event in the history of *Homo sapiens* allowed us to use grammar and language? As the answer is currently "none of the above", there has to be an event missing. We can say that this event generated an important advantage for humans and that language was a key feature of the event, otherwise we have no way of explaining the sustained continuity of language; and we can say that this event was likely to rely on an evolutionary change, even if the event was not itself an evolutionary change. We can also say that this event probably occurred close to the speciation event, when humans were a limited, localised species. This would provide a simple explanation for the universality of human language: all humans have it because their ancestors were present when it began.

Fortunately, there is a theory that fits this timescale. It involves a cultural event, so requires no direct genetic explanation; and it left no technological tool set, but it did leave an archaeological trace in the form of art. We cannot know directly whether this theory is correct, so it is offered here as a *Just So* story; but the archaeological evidence[329], the evidence from traditional stories[330], and the anthropological evidence[331] all point to this being a viable explanation.

Before we get to the *Just So* story, however, we should try to identify what it was about the speciation event that made us the particular type of humans we are. Was it just an increase in brain volume, or was it something that the extra brain space allowed us to do? Our story of becoming human needs a prologue.

8.3. The Prologue

What are the capacities significant for language that were likely to be in place before the *Homo sapiens* speciation event? The significant features of grammar identified in this dissertation – segmentation, hierarchy, the action-object distinction, and modelling of others – all seem to

[329] **Christopher Henshilwood, Francesco d'Errico, Marian Vanhaeren, Karen van Niekerk & Zenobia Jacobs**, Middle Stone Age Shell Beads from South Africa. In *Science* Vol 304, 16 April 2004, p404
[330] **Chris Knight**, Menstrual Synchrony and the Australian Rainbow Snake. In Thomas Buckley & Alma Gottlieb (eds), *Blood Magic: the anthropology of menstruation*, ch10
[331] **Camilla Power & Ian Watts**, The Woman with the Zebra's Penis: Gender, Mutability and Performance. In *Journal of the Royal Anthropological Institute*, Sep97, Vol. 3 Issue 3, pp537-560

have precedence in pre-human cognition; and some have precedence in pre-human signalling. If we look at language then the ability and need to *tell* (to issue instructions, informatives and directives about current events; in grammatical terms, using the imperative, declarative and indicative moods in the present tense) is also likely to be already present.

We have seen that the cognitive capacity to model others is likely to have been a capacity available to the *Pan/Homo* common ancestor, and that the capacity to model the self is an emergent feature of both the ability to model others and recognition that others are modelling the self. Modelling the self requires that modelling of others and the two-argument form are already present in signalling and not just in cognition: before you are able to model yourself you have to be able to recognise that others are modelling you and sharing those models with you. Modelling the self is therefore an outcome of language, not a source.

Symbolic manipulation is likewise a product of modelling others: it is the ability to cognitively interchange objects in multiple-argument forms, thus creating arbitrary connections between an object and its interchanged object. When those cognitively interchanged objects become externally expressed signs then a symbolic method of communication like language becomes necessary. We cannot know whether some nonhumans use symbols cognitively or not – the only way we can know is if they are able to externally present symbolic representation as a signalling event. There is some evidence that chimpanzees[332] and bonobos[333] can do this when trained within a human culture, although they do not appear to do it in the wild. Nonetheless, the cognitive capacity to use symbols appears to be a pre-speciation capacity.

Co-operative information sharing, as we have seen, is problematic as a speciation event: signals can only be trusted if the signalling environment is beyond fakery, whether by genetic enforcement of honesty, or by the high cost of the signal to the signaller[334]. If signals can be easily faked then they will be, because fake signals allow the muscle power of others to be co-opted. Language does not have mechanisms for suppressing fake signals; instead, fake signals have become an acceptable part of the signalling environment. There is a level of co-operation in the production and apprehension of language signals which seems to be unprecedented in nature, and this is the source of the problem: how did we get from Machiavellian signalling,

[332] **David Premack & Ann James Premack**, *The Mind of an Ape*
[333] **Pär Segerdahl, William Fields and Sue Savage-Rumbaugh**, *Kanzi's Primal Language: the cultural initiation of primates into language*
[334] **Chris Knight**, Ritual/Speech Coevolution: a solution to the problem of deception. In James R Hurford, Michael Studdert-Kennedy, Chris Knight (eds), *Approaches to the Evolution of Language*, pp70-72

where every signal has to be costly or non-voluntary to have value, to cheap and voluntary language signals?

Co-operative hunting requires a signalling system, but it is an unlikely source of grammar: it does not, for the most part, rely on complex signalling. Hunting co-operation requires the ability to accept and co-ordinate specialist roles, but this is a capacity that chimpanzees appear to have[335]. Co-operative hunting, even among modern humans, needs only simple spatial signals (left, right, etc), simple action signals (throw, hit, etc) and simple role activation signals (nomination, stop, go, etc). All signalling can be in the present tense, there is no need for past or future reference; it can be mostly holistic, there is little need for segmentation; and the signal maps onto the signalling environment – the sender of the message and the instigator within the message are both "me", and the receiver and recipient are both "you". Co-operative hunting relies on an ability to share food, not information; without this, hunting can only be sporadic and unorganised, as individuals cannot rely on a *quid pro quo* in the division of spoils. Chimpanzees share after a hunt in a limited way[336], but it is not a generous or fair enough sharing to ensure that regular hunting becomes part of the chimpanzee repertoire.

Other forms of social co-operation also do not rely on complex signalling. There has to be the opportunity to get to know others as individuals, of course, and to develop strategies to work with them; but, by the time of the *Homo sapiens* speciation event, a long history of group living had already produced features which provided the baseline for modern human co-operation. We certainly had fire and very likely cooked food[337]. Without refrigeration, meat had to be cooked or smoked in bulk, and consumed in groups. This needed a level of co-operation which could only work if the biggest and strongest were prevented in some way from monopolising the food, but it did not require language to enforce the co-operation.

Another event that is likely to have preceded the *H. sapiens* speciation event is the extension of female lifespans beyond their reproductive lifespans (postmenopausal longevity, according to Kristen Hawkes[338], or the postreproductive phase, as Hillard Kaplan and Arthur Robson

[335] **Jane Goodall**, *In the Shadow of Man*, p193
[336] ***Ibid***., pp33-34
[337] **Richard W. Wrangham, James Holland Jones, Greg Laden, David Pilbeam, and NancyLou Conklin-Brittain**, The Raw and the Stolen: Cooking and the Ecology of Human Origins. In *Current Anthropology* Volume 40, Number 5, December 1999
[338] **Kristen Hawkes**, Life History Theory and Human Evolution. In Kristen Hawkes & Richard Paine (eds), *The Evolution of Human Life History*. SAR Press: Santa Fe, USA (2006).

describe it[339]). Older women were no longer constrained by the need to support their own pre-adult children and could assist in their daughter's parenting[340]. Supporting the offspring of daughters makes genetic sense: mothers know their daughters' children are related to them, something they cannot know about their sons' children – deception at conception is easy, deception at birth difficult. By supporting their daughters' children they simultaneously enhance the survival of their grandchildren and the reproductive rate of their daughters. This kin-based allocare (caring for offspring by individuals who are not the offspring's biological parents) therefore creates a female reproductive coalition[341].

Grandmothering is unlikely to be the only source of female coalition, though: late onset puberty creates another source of allocare for human females[342]. Looking after sisters and brothers makes genetic sense, especially if it is, at that time, the only way to get your genes into the future. Neither grandmothering nor juvenile allocare can provide all the support needed by a reproducing female[343], but they both help to reduce reproductive costs. Once again, however, allocare is not a good candidate for the appearance of grammar: many mammals use allocare in a kin-based community without the need for language.

Another feature of modern humans that must have preceded our speciation event is altruistic punishment. One way to guarantee that communal hunting, communal feeding and communal reproductive support are not subject to exploitation by non-co-operators is by ensuring that non-co-operators are punished. This punishment does not need to be active sanction; in an environment where co-operation favours survival, the passive withdrawal of that co-operation is an efficient sanction. In the case of hunting this can be achieved by not hunting with non-co-operators: the non-co-operating male is excluded from the group provisioning the females, and therefore from reproduction. In the case of communal feeding, non-co-operators can be excluded from the feast; and females who cheat by providing reproductive support to those they should not can be excluded from the reproductive coalition – and therefore, effectively, from the opportunity to raise offspring to adulthood. All of these exclusions require communal action

[339] **Hillard Kaplan & Arthur Robson**, The Emergence of Humans: the coevolution of intelligence and longevity with intergenerational transfers. In *PNAS*, July 23 2002, vol 99, no 15, pp10221-10226
[340] **Catherine A Key & Leslie C Aiello**, The Evolution of Social Organisation. In Robin Dunbar, Chris Knight & Camilla Power (eds), *The Evolution of Culture*
[341] **Chris Knight & Camilla Power**, Grandmothers, Politics and Getting Back to Science. In E Voland, A Chasiotis & W Schiefenhövel (eds), *Grandmotherhood: the evolutionary significance of the second half of female life*. Rutgers University Press: New Jersey, USA (2005) ch4
[342] **Paula K Ivey**, Cooperative Reproduction in Ituri Forest Hunter-Gatherers: who cares for Efe infants? In *Current Anthropology*, vol 41, No 5, December 2000
[343] **Kit Opie**, *Testing the Grandmothering Hypothesis: the provisioning of Homo erectus infants and juveniles*. Dissertation submitted in partial fulfilment of the requirements for the degree of M.Sc. in Human Evolution and Behaviour (UCL) of the University of London in 2004

against the non-co-operator, and they may therefore require co-ordination via signalling; but they do not require a greater range of signalling features than does hunting, so they do not require complex language grammar.

There is a clue, though, in the human capacity for altruistic punishment which may provide the necessary speciation event leading to the appearance of grammar. What if humans developed an extra capacity for altruistic punishment when we speciated? It certainly seems to be true that humans have a remarkable sense of fairness, and a universal willingness to punish non-co-operators[344]; and this very unusual species-specific feature clearly needs to be fully explained if we are to understand ourselves as a species[345]. We also seem to have a concept of arbitrary grouping, and punish people who are outside of our group more than our in-group associates[346]; and it seems to be this high level of altruistic punishment that keeps most of us socially co-operative[347]. It is even possible that altruistic punishment could have led to an environment of unconditional co-operation, in which high-quality individuals demonstrate their fitness through the handicap of non-reciprocal generosity[348].

As humans we are willing to sacrifice our own assets (time and resources) to punish those who have transgressed what are often arbitrary rules, even when those transgressors have not actually damaged our own personal assets. This requires a concept of society, consisting of rules and individuals, to be present in the minds of all individuals comprising that society. Society itself is a hierarchical entity above individuals; it is the repository for the rules and the justification for the enforcement of those rules. For eusocial insects this repository is the queen, the physical embodiment of the success or failure of the colony[349]. For humans it seems to be a communally accepted myth, a story so powerful that it can subvert even selfish genetic imperatives[350].

Effectively, we are willing to punish not only people whose actions directly disadvantage us as individuals, we are willing to altruistically punish people who offend our model of this entity

[344] **Joseph Henrich, Richard McElreath, Abigail Barr, Jean Ensminger, Clark Barrett, Alexander Bolyanatz, Juan Camilo Cardenas, Michael Gurven, Edwins Gwako, Natalie Henrich, Carolyn Lesorogol, Frank Marlowe, David Tracer & John Ziker**, Costly Punishment Across Human Societies. In *Science* vol 312, 23 June 2006, pp1767-1770
[345] **Ernst Fehr & Simon Gachter**, Altruistic Punishment in Humans. In *Nature*, vol 415, 10 January 2002, pp137-140
[346] **Helen Bernhard, Urs Fischbacher & Ernst Fehr**, Parochial Altruism in Humans. In *Nature*, vol 442, 24 August 2006, pp912-915
[347] **James H. Fowler**, Altruistic Punishment and the Origin of Cooperation. In *PNAS*, May 10 2005, vol 102, no 19, pp7047–7049
[348] **Arnon Lotem, Michael A. Fishman & Lewi Stone**, From Reciprocity to Unconditional Altruism through Signalling Benefits. In *Proc R Soc Lond B* (2003) 270, DOI 10.1098, pp199–205
[349] **Andrew F G Bourke & Nigel R Franks**, *Social Evolution in Ants*, ch12
[350] **Chris Knight**, Menstrual Synchrony and the Australian Rainbow Snake. In Thomas Buckley & Alma Gottlieb (eds), *Blood Magic: the anthropology of menstruation*

we call society. We have used other-modelling to model society as an organism, an organism which both encapsulates and dictates our needs and wants. Transgressors against our social group become transgressors against ourselves, and altruistic punishments that we are willing to individually enforce become available to the social group for group enforcement.

So what were the significant genetic evolutionary events that made us human? There are likely to be two separate strands: an increased sensitivity to cheating accompanied by an increased willingness to altruistically punish cheats; and the ability to use other-modelling to treat an abstraction of socialisation – the social group itself – as a reified entity. The social group entity may have been the first symbol, the first physically unreal object to be recognised as real. The social group is a concept without purpose or value until it becomes the repository for rules and the justification for enforcing those rules[351].

It is unlikely that increased altruistic punishment and the reified social group occurred simultaneously as speciation events, one must have preceded the other. And when we look at the reification of the social group it is feasible to view it as a capacity of the *Pan/Homo* common ancestor – the ability of chimpanzees to wage sustained intergroup warfare[352] may indicate that the reification of the *ad hoc* social group was the earlier development. This may also provide the symbolic key that allows chimpanzees and bonobos to unlock human language when they are exposed to human society[353]. Indeed, the symbolisation of the social group may even provide the key for parrots[354], dolphins[355], and other animals able to decode symbolic human language.

This leaves a single speciation event: the extra sensitivity to non-co-operators and the willingness to altruistically punish social as well as personal transgressors. It was recognition of the social group as an entity, its endowment with a set of rules, and the willingness to co-operate in the enforcement of those rules, that created the circumstances for the emergence of a co-operative social structure. In turn, the co-operative social structure would have needed interpersonal information, and a form of communication to support the interchange of that information. In short, it needed language. But what was the nature of the social group that this speciation event would have created? The following *Just So* story provides a possible answer.

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[351] **Emile Durkheim**, *The Elementary Forms of Religious Life*, ch7
[352] **Jane Goodall**, *Through a Window: thirty years with the chimpanzees of Gombe*, ch10
[353] **David Premack & Ann James Premack**, *The Mind of an Ape*
[354] **Irene M Pepperberg,** The Alex Studies: cognitive and communicative abilities of grey parrots
[355] **Kate Douglas**, Unusual Suspects. In *New Scientist*, 31 July 1999, pp36-37

8.4. The Necessary *Just So* Story

In 1902 Rudyard Kipling published a collection of tall tales, *Just So Stories*, explaining how various natural histories could have, but clearly didn't, happen. In all cases the value of the story is not that it tells us the truth of what happened but that it recognises our human will to know. In this section a *Just So* story is proposed: *How the Humans Got Grammar*. It may not be fully accurate, but hopefully the story will satisfy Claude Lévi-Strauss' requirement that "a truly scientific analysis must be real, simplifying and explanatory."[356] This is a story about three species, *Homo ergaster*, *H. heidelbergensis* and *H. sapiens*. There is still no clear evidence that these species form an evolutionary succession, or that they are the only species in the succession, but they provide convenient archaeological pegs on which to hang the story.

Let us start with the species-based model of *H. ergaster*. It is likely that this species had a developing gender alliance of females for reproduction, but male alliances would have been more *ad hoc*. Childhoods would already be lengthening, so females could call on their offspring as non-fertile workers and allocarers, and as supporters against the still largely unorganised males. In addition, it is likely that grandmothering began to occur about this time, with increased female life spans permitted by a stable food supply and a less stressful lifestyle. Post-menopausal women are another important source of allocare and provisioning for their fertile female relatives, which both buttresses maternal care and allows grandmothers to extend their care for their own genetic investment[357]. This in turn helps to strengthen the female kin coalition: because post-menopausal grandmothers no longer have a breeding agenda of their own, they can concentrate on supporting the breeding agendas of others. Sterility is the ultimate Zahavian handicap: it gives the signal "trust me, I have no reproductive stake in the future". In the case of human females, this signal is mitigated by previous reproductive success – the grandmother still has an interest in her children and her daughters' children – but this is still likely to lead to reduced-cost signals between grandmothers, daughter-mothers and granddaughters.

There is a notable change to the *H. ergaster* lifestyle in the fossil record: the Oldowan axe technology gave way to the more crafted Acheulean somewhere around 1.6 million years ago. From a purely utilitarian point of view this seems inexplicable; but, as Marek Kohn points out, it can be attributed to two Zahavian handicap features[358]. The first is the simple gift of time: a

[356] **Claude Lévi-Strauss**, *Structural Anthropology*, p35
[357] **Jared Diamond**, Making More by Making Less: the evolution of female menopause. In *Why Is Sex Fun? The evolution of human sexuality*, ch6
[358] **Marek Kohn**, *As We Know It: coming to terms with an evolved mind*

male bringing a carcass, or part of a carcass, back to the home base could signal his fitness by not eating it immediately, and allowing the females to take their share first. It is the food gift used by male spiders and, in its most extreme form, by preying mantises. If the male, as part of his gift of time, goes off to bang rocks together then he may well produce a wealth of sharp edges which would be useful to the females in butchering the meat, but it is the fact that he is not feeding that is evolutionarily significant. If the male is able to produce a well-bashed stone at the end then it acts as physical evidence of time given, but its significance as an artefact may be no more than this.

It is important to note that the males are not giving away all their food here, they are demonstrating their ability to produce surpluses which they can then distribute. It is an economy based on largesse for sex, but the largesse is not distributed for immediate rewards, it is given in an environment of reciprocal exchange, where the reciprocity is always factored on future expectations: if the males don't provide meat they *will* not get sex; and if the females don't provide sex they *will* not get meat. However, as the largesse is itself a Zahavian handicap signal, it will be in the interests of males to cut their own rations as low as they can to make the signal as big as possible. All of these factors mean that females can become more home-based and concentrate on the role of reproduction rather than just survival. Tribes adopting this model will churn out more babies, and bring them to adulthood more frequently.

Females are central to the tribe in this model of *H. ergaster*, although the sex-for-meat economy remains the driving force. Disputes among females will be low key and are liable to be negotiated by appeal to the grandmothers, or controlled by a tyranny of the majority. Males remain peripheral to the forming female kin coalition, tolerated for their twin supplies of food and gametes. They will nonetheless tend to stay with one group of females because a reciprocity based on future expectations is all about building a reputation: the judgement of the fitness of an individual male based on his largesse, or surplus distribution, is neither an immediate event nor a one-off event, it is a comparative accumulation of reputation over time. If a male moves to a new group he has to start from the beginning to build a new reputation, so it is not a simple and cheap thing to do. This is very similar to the social model we see in modern bonobos[359].

It is likely, though, that a low level of co-operation is occurring among the *H. ergaster* males, allowing the organised scavenging or hunting of larger game. It is probable that dominance hierarchies would exist among males, but co-operation requires a degree of reciprocity which

[359] **Frans de Waal & Frans Lanting**, *Bonobo: the forgotten ape*, chs4-5

would mitigate this dominance[360]. This co-operation is not the same as the male-to-female handicap display of largesse, or the female-to-female reciprocal altruism of kin selection, it is more a contract of reciprocal reprisal – personal, not group, altruistic punishment. Nonetheless, we can see in this model of *H. ergaster* a series of arrangements becoming established: more formally between females, more *ad hoc* between males, and based on the sex-for-meat economy between males and females.

There would have been transitional events between *H. ergaster* and the likely successor species, *H. heidelbergensis*. The first transition is encephalisation; but, unlike the increase in brain size between *Australopithecus* and *Homo*, the limits on encephalisation are no longer food but the size of the female pelvic girdle and the earliest safe birth[361]. Male largesse creates a situation where food is no longer a limiting factor, at least not for reproduction. Increased encephalisation means that infant dependency increases, as does the dependency of mothers on their social group. Physical changes would occur to allow the largest possible brains at birth: an increase in female hip size, a non-rigid skull at birth, and an increase in the ratio of head size to body size in newborns are some of the more obvious features. Females would become more tied to temporary home bases and only willing to move when the local resources were exhausted – a similar model to the driver ant (*Eciton burchelli*) bivouacking behaviour[362]. This decrease in mobility would increase the solidarity of the female kin coalition and allow allocare to become more generalised nursery care, an allocare model similar to that of the meerkats (*Suricata suricatta*)[363].

Another transitional event may have been the extrapolation of the value of the Acheulean handaxe from an indicator of time given to a more arbitrary Zahavian handicap indicator: the ability to produce an aesthetically pleasing, symmetrical handaxe is a sign of dexterity, patience, planning, judgement… it is a sign that the offspring of this male will be both capable and "attractive" in their own right. The handaxe becomes a trinket, probably with only secondary practical use: provisioning has become so easy that time can be spent on "luxury" handicap items. The capacity to produce symmetrical objects from asymmetrical material also indicates an ability to make spatial models: to plan the alterations needed to change what is to what could

[360] **Herbert Gintis, Eric Alden Smith & Samuel Bowles**, *Costly Signaling and Cooperation*. In J Theor. Biol. (2001), 213, pp103-119
[361] **Christopher Wills**, *The Runaway Brain: the evolution of human uniqueness*
[362] **Klaus Dumpert**, *The Social Biology of Ants*, pp199-205
[363] **T. H. Clutton-Brock, P. N. M. Brotherton, A. F. Russell, M. J. O'Riain, D. Gaynor, R. Kansky, A. Griffin, M. Manser, L. Sharpe, G. M. McIlrath, T. Small, A. Moss & S. Monfort**, Cooperation, Control, and Concession in Meerkat Groups. In *Science* 19 January 2001: Vol. 291. no. 5503, pp478-481

be. This capacity is likely to be one of the precursors of both cultural hierarchy and syntax in language.

With late *H. heidelbergensis* we see the female kin coalition in control. They dictate when and where the group moves; they control the social politics of the group; they control the reproductive capacity of the group; they control the males and the food supply through sex; and the males are exploited through a series of Zahavian handicaps for the direct benefit of the female kin coalition and the indirect benefit of the group as a reproductive structure (and, therefore, the males). However, male co-operation in hunting is also likely to be increasing, allowing them to bring home even bigger lumps of meat, and reducing the need for frequent hunting. It is even possible that males of different troops could co-operate in hunting: the megafauna available at this time would feed more than one human troop. Co-operation would be increased by the fact that the males of one group would be the offspring of the females and males in another group. The "exchange" of post-pubertal males between groups would happen simply because there are only three evolutionarily viable incest-avoidance strategies for dual-gendered species: the females can remain local and the maturing males move to a new group; the males can remain local and maturing females move to a new group; or both maturing sexes can move. The model proposed here for humans is matrilocal and matrifocal, so the males must move to avoid incest.

With *H. heidelbergensis*, virtually all the necessary factors are in place for the emergence of symbolic culture. However, some final transitional events will have occurred on the road to *H. sapiens*. The first of these is male-related: with co-operative hunting there would be a need to prevent any one male from taking the credit for the provision of food. We would expect to see suppression of alpha males, as in the David Erdal and Andrew Whiten model of vigilant sharing[364], or Christopher Boehm's model of reverse dominance[365]. One method of alpha suppression would be to ensure that the meat is presented as a donation from all the men, and not just from individuals. As the men now need each other to hunt successfully (and therefore to provide food and gain sexual access) any attempt to establish an alpha role will lead to exclusion from the hunting party, failure to provide meat and therefore exclusion from reproduction: altruistic punishment is therefore needed to maintain the male *status quo*. Dominance suppression creates an emphasis on males who are not just successful hunters and providers, but who are also modest about their success. A "moral" system of individual

[364] **David Erdal & Andrew Whiten**, On Human Egalitarianism: an evolutionary product of Machiavellian status escalation? In *Current Anthropology*, Vol 35 , no 2, (April 1994) pp175-183
[365] **Christopher Boehm**, *Hierarchy in the Forest: the evolution of egalitarian behavior*

modesty, equality and anti-tyrannical sanction is likely to have developed among the males, to match the reproductive coalition system among the females. Both of these social systems could be described as pre-symbolic, or possibly even proto-symbolic – the group is beginning to become a vital feature in the survival and prospering of its members, even if it is not yet perceived as a reified entity.

If the meat is presented as a donation from all the males then the food no longer "belongs" to any one male, it is all "surplus" for distribution. The meat is no longer gifted from individual males to individual females, but from the male hunting party to the female kin coalition, where it is divided up and distributed back to all members of the troop – females, offspring and males – although it is likely the males will get the scrag ends. If the assumption is made that fire is being used to cook the meat then the transfer of the meat to females and back becomes a transformation process. This is not an unreasonable assumption: the use of fire by *H. heidelbergensis* is largely accepted, at least in the latter part of their existence, although its use for cooking cannot be proved[366]. However, within the transformation process of cooking lie more seeds of symbolic culture: Claude Lévi-Strauss identified this transformation from raw to cooked as creating two states of food: male food, just hunted, bloody, inedible; and female food, processed, not bloody, edible[367]. The two sexes, separated by social structure, are united in the feast, which is produced by the males but rendered edible by the females.

A diet with a high meat content has an interesting effect on any predator species: they find themselves with spare time. As we have seen, Corballis (among others) makes the case that language (or, at least, hominin communication) was initially gestural, with a small or negligible oral content. Corballis believes that the movement of language from gesture to sound freed the hands for manufacture, leading to our advanced technological society[368]. What, though, freed the hands for signalling in the first place? Primate hands are used for walking, climbing, feeding, grooming, manipulating … there would seem to be little bandwidth left for signalling. Meat, by contrast, provides a rich and easy diet, which creates time when the individual doesn't need to hunt or feed: it gives the bandwidth to "chew the fat".

At the *H. heidelbergensis* stage this "chewing the fat" was unlikely to be linguistic, it was probably sound-making for amusement of self or others[369]. However, time had been freed up to

[366] **Paul R Erlich**, *Human Natures: genes, cultures, and the human prospect*, pp169-170
[367] **Claude Lévi-Strauss**, *The Raw and the Cooked: introduction to the science of mythology*
[368] **Michael C Corballis**, *From Hand to Mouth: the origins of language*, pp83-89
[369] **Steven Mithen**, *The Singing Neanderthals: The Origins of Music, Language, Mind, and Body*

indulge in activities which were not directly survival-related, such as increased levels of play-related activities. It was probably at this stage that we began in a small way to become *Homo ludens*[370]: we had spare time, and the sexual imperatives of adulthood were being mitigated by social group pressures and late onset of adulthood. Clive Bromhall's neotenous game-playing children were becoming game-playing adults[371].

The second transitional event between *H. heidelbergensis* and *H. sapiens* is female related. Because of a triple provisioning effect – the amount of meat brought back from the hunt is so large, the short-term preservation of meat with fire and smoke is so easy, and the distribution of the meat is reasonably fair – the men need to hunt less frequently. However, an *ad hoc* process of hunting would be unstable and likely to break down. It would also create difficulties in the co-ordination of hunts between the males of different troops. It would be better for the females to have a regular supply of meat than an *ad hoc* supply, so they would have to take control of the hunting schedule. Co-ordinating hunting with the late waxing Moon is, as Chris Knight points out, a sensible thing to do because it extends the period of available light into the night[372]. Human night vision is not acute, but full moonlight allows us to see colour at night, which significantly enhances our ability to differentiate bush from bush meat, or to track a wounded and bleeding animal[373].

A feature of waxing Moon is that, in the tropics, the Moon rises before the sun sets, giving 20 or more hours of continuous light from sunrise to moonset. After full Moon there is a growing period of darkness between sunset and moonrise, interrupting this period of continuous light. It is therefore better to complete the hunt no later than full Moon, and be back in camp with the women at or soon after full Moon.

If hunting is limited to one part of the month then it becomes evolutionarily sensible to co-ordinate female infertility with the absence of the males, and fertility with their presence. Synchronised menstruation at new Moon or soon after becomes sensible because it means that ovulation occurs at full Moon or soon after. It is likely that, with *H. heidelbergensis*, the human menstrual cycle settled on the modern *H. sapiens* periodicity of about 29-30 days, so that it synchronised with the Moon.

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[370] **Johan Huizinga**, *Homo Ludens: a study of the play element of culture*
[371] **Clive Bromhall**, *The Eternal Child: an explosive new theory of human origins and behaviour*
[372] **Chris Knight**, *Blood Relations: menstruation and the origins of culture*, ch10
[373] **Melvin L Rubin & Gordon L Walls**, *Fundamentals of Visual Science*, 1969. Charles C Thomas, Springfield, Ill., p40

As well as co-ordinating hunting with the Moon and the fertility cycle with hunting, there is a third co-ordination which helps both the hunt and the female coalition: if females in different troops can force intergroup synchronisation of the hunt then they allow their menfolk to co-operate in the hunting of the megafauna; but they also ensure that all the men are busy at the same time and thus not bothering the women. The female kin coalition is controlling the fertility and sexual availability of the women, and male counterdominance strategies are controlling the sexual activities of the men.

This leaves the problem of how females could signal the end of fertile time and the beginning of hunting time. Knight's theory indicates that the females must "chase" the men out to hunt, using the indexical sign of menstrual blood to indicate infertility[374]. However, the menstrual blood sign is also proto-symbolic: it means "no" as well as infertile – it is an indicator of a sex strike by the women. It may well have been emphasised (even at this early stage) by animal blood, plant juices or red clays[375]. It would also have been emphasised by borrowing of blood, so non-menstrual and menstrual women could support each other in the signal[376]. It certainly would have been accompanied by noise to make the males feel as unwelcome as possible.

It is important to realise that for late *H. heidelbergensis* this would not have been formally ritualistic, there would have been no formal structure within which the message was delivered. A simple, costly Zahavian signal would have been sufficient. However, with *H. sapiens* the ritual signal would have become more and more structured and the meanings would become increasingly symbolic and arbitrary. The meat offerings brought by the men at the end of the hunt would have become increasingly a gift of appeasement, almost a religious sacrifice to allay the curse of "living in interesting times".

So with *H. heidelbergensis* we do not see the full sex strike model proposed by Knight: formalised ritual is still missing[377]. Yet it is easy to see how formal ritual could have arisen from the monthly informal monstrosity ritual of women. Initially, the women emphasised their monstrosity with *ad hoc* decoration: borrowed blood, berry juice, perhaps a few leaves, some noise-making skins, etc. Next, the women would have saved the non-perishable items used in the monstrosity sessions from one month to the next, and perhaps reserved them for use only in

[374] **Chris Knight**, *Blood Relations: menstruation and the origins of culture*, ch11
[375] **Camilla Power**, *'Beauty Magic': deceptive sexual signalling and the evolution of ritual*. PhD dissertation, University College London, 2001. 4.2 The 'sham menstruation' model and key predictions
[376] **Camilla Power & Leslie Aiello**, Female Proto-Symbolic Strategies. In *Women in Human Evolution*, ch8
[377] **Chris Knight**, *Blood Relations: menstruation and the origins of culture*, pp79-81

the monthly monstrosity. Next, the women would have made items specifically and exclusively for the monstrosity sessions: masks, clothing, decoration, sound-makers and so on. Fourth, the women would have formalised their decoration, using cosmetics and introducing a standard order of ceremonies. Fifth, they would have allocated fixed roles among themselves, so that "she who drums" was always she who drums, and so on. Finally, women would have attached a story to the ceremony both to fix the ritual and as a mnemonic for the ceremony.

These six stages of ritualization would have occurred successively through the history of *H. heidelbergensis* and early *H. sapiens*. The last stage, however, requires language and grammar to tell the story of the ceremony; so, in the model proposed here, it must have occurred after the *H. sapiens* speciation and after the appearance of language. These six stages may or may not be an accurate model of the progressive development of the monthly provisioning cycle; but we can say that, somewhere in the process of introducing ritual, the monthly monstrosity session would have become the monthly pre-hunt ritual.

Camilla Power emphasises the role of cosmetics in early societies as both an indicator of symbolic role-playing and as a creator of the female kin coalition itself. She shows, by reference to modern hunter-gatherer societies, that the female coalition is more than just a natural kinship structure, it is a ritual kinship where all women who are in the group are "kin", and all females who are potential members of the group are potential "kin". The absolute, real kinship in the *H. heidelbergensis* female coalition is replaced by the provisional, symbolic relationships in the *H. sapiens* female coalition. The proto-symbolism of cosmetics feeds the proto-symbolism of ritual, which supports the imperative message of the monthly sex strike. The cost of entering the female coalition is high, because maintaining solidarity is itself a costly signal of commitment; and the cost of defection is also high, involving ejection from the coalition and the reclassification of the female as "not a woman". Membership of the coalition is a costly, indexical signal; but the female coalition itself is both a reified abstract and a container of symbols. The first symbol is the arbitrary coalition itself; and the second symbol, also the first word given by the coalition, is a temporally conditional but currently absolute "no"[378].

With the ritualization of menstruation comes metaphoric association (females can be females, but they can be monsters, too), hierarchical thinking (a monthly cycle of change is contained in an unchanging historical process), symbolic translocation (these females are standing in place of

[378] **Camilla Power**, Beauty Magic: the origins of art. In Robin Dunbar, Chris Knight & Camilla Power (eds), *The Evolution of Culture*

animals), recursion (the symbolic translocations are reversible, repeatable and interchangeable with other symbolic translocations) and even entertainment (the signal no longer needs to be loud or long to be clear, but the females seem to enjoy giving it, and the males seem to enjoy getting it, that way). However, perhaps the most important feature of ritual in terms of language is the inherent recognition of the motivation of others. It represents the point in human history at which we became able to answer the question *what could I do if I were them?* In the ritual, the females are placing themselves in the position of both the men and the animals. They are enacting their desires for the men (go hunt) and their desires for the animals (go get caught). There is a realisation that the men and animals have their own agendas and have to be persuaded to fulfil the female agenda; but there is also a realisation that, if the women can see the point of view of the men and animals, then the men can be physically persuaded, and the animals ritually "persuaded", to see the point of view of the women. A level of recursive and abstract thought is involved in the ritual signal: We know what you want; we want you to know what we want. It is what Catherine Snow describes as intersubjectivity: the ability to perceive and communicate the mental activity, conscious awareness, motives, cognitions, and emotions of others[379].

The signal of the monthly pre-hunt ritual is still costly, but it involves an emerging consensual cycle of ritual. First there is consensus between females in staging the ritual, then between the female group and the male group in accepting the ritual, then between the males in enacting the ritual with a hunt, and finally between the females and males in fulfilling the ritual with feasting and sex. With consensus, the interests of parties in communication converge, and it becomes possible to cheapen signals. With cheap signals it becomes possible, in turn, to digitise the signal – small changes in form can stand for large changes in meaning because the sender and receiver are co-operating in the signalling process. This co-operation also allows for turn-taking as the sender and receiver negotiate their way to meaning, rather than the receiver resisting the meaning of the sender. Co-operation also releases the power of metaphor, with the receiver actively seeking relevant meaning from apparently unrelated symbols; and this allows signals to become innovative and productive, and allows the combination of signs to generate combinatorial meanings.

Although it is here called the pre-hunt ritual, the ritual is actually enacted continuously throughout the month and from month to month. The rejection rituals of dark Moon give way serially to the hunting preparation rituals of new Moon, the hunting rituals of waxing Moon, the

[379] **Catherine E Snow**, Social Perspectives on the Emergence of Language. In *The Emergence of Language*, ch9

cooking rituals of full Moon, and the honeymoon rituals of waning Moon. All human life is tied together by a constantly changing but constantly renewing ritual, and the constant need to tell each other *about* things – relationships between other individuals, relationships between individuals and groups, and relationships between individuals or groups and things. The constant state of ritual, or symbolic culture, generates the need for complex communication requiring language and grammar. The action-object distinction, the three-argument form, altruistic punishment, vigilant sharing, reverse dominance, modelling of others, Theory of Mind, intentionality are all part of the story of language; but it is the reification of the group, leading to the willingness to co-operate in the punishment of individuals who offend against the group, which created the conditions in which *telling-about* became a necessary feature of human culture.

8.5. The Appearance of Grammar?

Signals cannot be both cheap and trustworthy (as they are in language) unless the interests of sender and receiver converge. This is rare in nature, and would seem to be impossible in signals between the sexes. Yet through a process of selfish genes, kin selection, reciprocal altruism and handicap selection, precisely this circumstance has been brought about in humans.

We can even see, in the model presented here, a hint of the differing linguistic strategies used even today by men and women[380]. Early females would have needed to share details of their social life as part of a reproductive coalition, and social conversation would be important to quickly identify females who were subverting the coalition. The strength of the female kin coalition lay in the internal agreement of the females and the external cohesion of the coalition. For males, in contrast, language would be a tool for demonstrating fitness through the free gift of technological information. Also, if the reverse dominance and vigilant sharing models are correct, male reputations would rely on that strange tautology, modesty displays. There would be little use for social conversation in male coalitions, but complex signalling structures would be needed to describe complex technical processes. Only if there was differentiation in male and female socialisation and communication needs could such disparate uses of language have become institutionalised, possibly at the genetic level[381].

[380] **Deborah Tannen**, *You Just Don't Understand: women and men in conversation*
[381] **Simon Baron-Cohen**, *The Essential Difference: men, women and the extreme male brain*, pp105-111

The *Just So* model set out in this chapter is one attempt to describe hominid language development within a neo-Darwinian framework. It lists events which may or may not have happened, and which may not have happened in the order set out. However, it is a model that places the appearance of language in an environment of increasing altruism with an increasing dependence on group living – features which are clearly present in modern humans. For the greater part it relies on evolutionary effects: kin selection in female-female transactions, reciprocal altruism in male-male transactions, and a mixture of handicap selection and reciprocal altruism in male-female transactions. The symbolic and cultural revolution at the end of the process, while not itself a directly evolutionary event, is nonetheless only explicable in terms of evolutionary events.

This model would place the appearance of language sometime soon after the *H. sapiens* speciation event, which occurred about 250,000 years ago. Philology, the study of the history of language, is not an accurate science when extended beyond the threshold of writing, but it provides the best evidence we have for the appearance and propagation of language. By extrapolating backwards from today's range of languages it is possible to devise approximate timescales for the appearance of the first language. The genetic and linguistic analyses of Luigi Cavalli-Sforza[382], Spencer Wells[383] and Johanna Nichols[384] all place the root complex language at about 100,000 years ago, which is between the *H. sapiens* speciation event and the diaspora out of Africa. The model proposed in this dissertation therefore seems to be defensible in terms of the available philological evidence.

The theory proposed in this dissertation is now complete, and the origins of grammar have been attributed to three sources. For the most part, grammar comes from pre-human cognitive capacities, the ability to understand and manipulate social relationships. The second source of grammar is the *Homo sapiens* speciation event, which created the opportunity for a high level of co-operation based around altruistic punishment on behalf of the proto-symbolic social group. Finally, the third source of grammar was the cultural event that created the need to share our models of social interaction.

The complexity of grammar comes from what has to be signalled: it is a response to the problem of expressing multidimensional cognition in a one-dimensional stream of speech. As James Hurford says:

[382] **Luigi Luca Cavalli-Sforza**, *Genes, Peoples and Languages*
[383] **Spencer Wells**, *The Journey of Man: a genetic odyssey*
[384] **Johanna Nichols**, *Linguistic Diversity in Space and Time*

> 1. Much of the structure of language has no role in a system for the internal representation of thought.
> 2. Much of the structure of language has a role in systems for the external expression of thought, which includes communication.[385]

Our cognitive systems are capable of simultaneously processing multiple concepts – that is what they evolved to do, and there is no need for compromise in that evolutionary process. In contrast, language is an external representation of those multiple processes, and it is a compromise between the cognitive requirements themselves and the sequential stream of speech. The miracle of language is not, however, the complexity of grammar; grammar is only a response to the need to externally express our internal social models. In the model proposed here, the miracle of language is the willingness to send true signals, and the willingness to trust signals made by others.

In the next two chapters the way this trust works will be examined in relation to two human signalling phenomena. The first is the ability to define signal messages in terms of past, present and future: the use of temporality in language. The second is the way trust builds up in babies and infants, allowing them to enter the human signalling environment as if born to it.

[385] **James R Hurford**, The Roles of Expression and Representation in Language Evolution. In Alison Wray (ed), *The Transition to Language*, p312

Part 3: Evidencing the Theory

9. Language Grammar and Temporality

Language, as we have seen, is able to express not just the real but the hypothetical – what is not immediately and verifiably true. Hypothetical expression constitutes probably the majority of human discourse. We make – and talk about – models of reality that have been transposed into the world of what-if, or the world of never-could-be, or the worlds of the past and the future. All of these models of reality are equally unreal, although we tend to privilege our time models over our probability models: our relationship with time is closer and more real than our relationship with probability. Temporality, as used in this dissertation however, covers all forms of speculation, not just those related to time.

Temporality is an important feature of human language: a 2006 survey by the Oxford English Dictionary of a billion-word 20th century corpus showed that *time* is the most common noun in the English language, with *year* and *day* as third and fifth most common[386]. Every language has some mechanism for placing signalled events before or after the present or into the realm of probability, although the mechanisms and degree of sophistication vary greatly between languages. It is likely, though, that we are the only animal that needs, and uses, a concept of dislocated existence in our communication: we talk to each other about aspirations, fictions, possibilities, and what happened last Tuesday. Temporality is therefore both a marker of human language and a difference between human and nonhuman signalling. Whatever allows us to express temporality in language is likely to be a distinguishing feature of being human.

This chapter will provide a short overview of the nature of temporality in human experience, concentrating on its use in language. Although this cannot hope to be a comprehensive study, it should illustrate the vital role that temporality plays in language; and it should also show why temporality is a peculiarly human preoccupation. First, however, we must establish the mechanisms that are needed in language to make temporality work; and, as we will see, not all of them are obviously expressions of time or probability.

9.1. Temporality and Language

In language, time is three things simultaneously: it is an object that can have instantiation, such as *today* or *before breakfast*; it is a process of change, such as *during* or *then*; and it is a

[386] *"Time" is the most popular noun*. At http://news.bbc.co.uk/cbbcnews/hi/newsid_5100000/newsid_5105500/5105502.stm

continuity that lies behind the instantiations and process, such as *regularly* or *always*. Our expression of time is dictated by our experience of it: we live unidirectionally in time, remembering our past but having no direct knowledge of our future. This causes us to see time as serial change, and it can even be argued that it affects our understanding of concepts like volition and entropy. Certainly, our expression of time within language is more Socratic than Einsteinian, more concerned with what time means to us than what time is[387].

When comparing language to other forms of signalling one difference becomes immediately obvious: many language constructs are concerned with actions that have already happened. The advantage in being able to talk about things past is far from clear: the events have happened, what information can be transferred that will benefit both sender and receiver? Memory is certainly a powerful tool in the survival of an individual: a single bad experience can prevent repeated waste of effort. It is also likely that transfer of knowledge to offspring short-circuits the need for each generation to learn afresh. However, the advantage of transferring memories between individuals of the same generation is unclear. The gain would appear to be all for the receiver, while the sender loses a reproductive advantage because rivals survive. In a selfish gene universe it shouldn't happen.

In fact, the transfer of experience for most animals relies on genetic encoding. Individuals who indulge in dangerous behaviours, such as eating poisonous food, tend to die without transmitting many of their genes to the next generation; while those who do not indulge in dangerous behaviours, because their genetic programme precludes it, tend to survive and reproduce. Fitness is not a product of the transfer of a memory between individuals but the transfer of genetic traits between generations. This is a slow and certain process, but it also tends to adapt a species for survival in a particular environment. It is therefore vulnerable to sudden environmental changes, where the rules for success can change dramatically. An alternative and faster method for the transfer of knowledge would give a species a considerable survival advantage, because it could adapt to environmental change much more quickly. However, it would also have to involve volitional signalling, which is always open to cheating and therefore liable to be unreliable. Volitional signals should only be reliable when they produce an identifiable advantage for the sender.

Non-genetic learning from teaching is a signalling process, in that it requires a sender and a receiver in the roles of teacher and learner respectively; and it favours the learner by increasing

[387] **Stephen Hawking**, *The Illustrated a Brief History of Time*, ch2

their range of survival strategies. The advantage for the teacher in producing truthful signals is not obvious, but there must be conditions under which advantage can accrue: as well as humans, ants[388] and meerkats[389] have been shown to act in a teaching role. Both of these examples, however, involve teaching in the presence of the event being taught: memories are being transferred (or created) in the presence of a current example.

The ability to transfer memories between individuals in the absence of a current example does not seem to be a feature of nonhuman signalling. A warning can only be given in the presence of a threat, so the fact that it is a warning can only be taught and learned if the threat is present; similarly, a chimpanzee can only learn termite fishing if there are termites to be fished. The transfer of memories can only take place if there is immediate deixis to the memory – both parties can point at the thing to be remembered. The sender is not necessarily transferring their memory as an idea, they are creating a similar but new memory in the receiver. Signals involved in teaching and learning for nonhumans are therefore unlikely to involve temporality because they are all current events.

The lack of signalling about past events is tied to the issue of probability, or conditionality. In nonhuman signalling every warning call has an element of conditionality: there is no point making the call unless the creature warned can change their actions to avoid the threat, or the threatening creature can be induced to change their intentions. As conditionals contain an implication of future options, so warning signals contain aspects of future temporality. However, the conditionality of nonhuman signalling is limited to expression of the future avoidable: speculation on alternative actions, past present or future, does not seem to be part of nonhuman signalling. Speculative conditionality requires the ability to use metaphor, to extract the possibilities of one situation and apply them to another. This is possible in Steven Mithen's cognitively fluid model of the *Homo sapiens* mind[390], but not in Leda Cosmides and John Tooby's modular mind of early hominids[391].

Tense and temporality in language should not be confused. Temporality is that part of a message concerned with when the action will take or has taken or may take place, whether it is complete,

[388] **Nigel R Franks & Tom Richardson**, Teaching in Tandem-Running Ants. In *Nature*, vol 439, no 7073, 12 January 2006, p153
[389] **Alex Thornton & Katherine McAuliffe**, Teaching in Wild Meerkats. In *Science*, vol 313, 14 July 2006, pp227-229
[390] **Steven Mithen**, *The Prehistory of the Mind: a search for the origins of art, religion and science*, pp154-158
[391] **John Tooby & Leda Cosmides**, The Psychological Foundations of Culture. In *The Adapted Mind: Evolutionary psychology and the generation of culture*, ch1

and whether it represents a single action or a series of actions; whereas "…tense is grammaticalised expression of location in time"[392]. Tense is the mechanism which locates an action expressed as a verb phrase to a position in time relative to the present. Temporality is much wider, encompassing time expressions not linked to verbs, which are often referred to as aspectual. Bernard Comrie distinguishes aspect from tense in the following way:

> … although both aspect and tense are concerned with time, they are concerned with time in very different ways. As noted above, tense is a deictic category, i.e. locates situations in time, usually with reference to the present moment, though also with reference to other situations. Aspect is not concerned with relating the time of the situation to any other time-point, but rather with the internal temporal constituency of the one situation; one could state the difference as one between situation-internal time (aspect) and situation-external time (tense).[393]

Temporality also includes mood, modality and conditionality. Mood is the ability to express uncertainty by the use of inflection: a tense or group of tenses (for example, the subjunctive) expresses the binary difference between the evidentially real and the proposed unreal (the *realis/irrealis* contrast). Modality is the ability to express uncertainty by using auxiliary verbs (*would, could, may, might, should*, and so on). These tend to be more flexible and capable of expressing a larger range of uncertainties than inflections, so they do not form a single binary relationship with *realis*. Conditionality is the ability to express probability in language, and is often represented by the *if … then …* sentence construct. It is also used as an umbrella term for mood, modality and conditionality.

As well as auxiliary verbs, there are adverbials (*certainly*, *probably*, *maybe*, *possibly*, *not*, *never*, and so on) which can be used in conjunction with the auxiliaries; and there are also several idioms (e.g. *in the unlikely event that*). English, like many other languages, provides a rich conditional system: auxiliary verbs are supplemented by a range of adverbials to give a extensive probability space.[394] By combining linguistic elements together a complex expression of *irrealis* can be generated: *it's possible that I could maybe get there by eight o'clock*. The iteratively conditional nature of this construct offers uncertainty in its very iteration, but it also gives the pragmatic metamessage *don't expect me at eight o'clock*.

Different languages are more or less capable of expressing different parts of the range of temporal relationships, but it is unlikely that any language is completely unable to express any particular part. For instance, a language without inflection or tense, such as BSL, is still able to

[392] **Bernard Comrie**, *Tense*, p9
[393] **Bernard Comrie**, *Aspect*, p5
[394] **Frank R Palmer**, *Mood and Modality*, ch7

place events in the past or future with the use of adverbials: The English *I went shopping* becomes *[I] [go-shopping] [before]*. Similarly, in English we have problems of aspectual clarity: we cannot differentiate between a single event and a series of events using tense only. However, once again we can add adverbials to clarify meaning (e.g. *she went shopping* is ambiguous, but *she went shopping today* expresses a single event, where *she went shopping every week* expresses a series).

Temporality is, therefore, concerned with what can be expressed in language to place events onto vectors of time and probability. Pinker sees the human understanding of temporality as a metaphor of our spatial understanding[395], but this would seem to be somewhat of a simplification: conditionality is a novel feature of time that is not present in spatial modelling. Conditionality, as the verbalisation of the cognitive act of modelling, is what Merlin Donald calls "the rehearsal and review of action"[396]. It is difficult to see how an analogy of space could permit such a novel possibility: a model of space is useful for finding out what is, the *realis* of the world, and there would seem to be little purpose in finding out what isn't; in contrast, a model of temporality is also useful for planning what isn't, the *irrealis* of the world, in order to bring it about.

Temporality is often implicated in linguistic complexity: the need to place events temporally in relation to each other is a problem that is usually solved with serially complex constructs. In *she asked him to get out to help her to reverse*[397] we can see four temporal relationships. The action of *asked* is in the past relative to the sender-now; and this is indicated by inflection. The action of *get out* is in the past relative to the sender-now but in the immediate future of *asked*; this is indicated by context, the non-finite verb marker *to*, and the internal meaning of *get out*. The action of *help* is in the past relative to the sender-now but in the immediate future of *get out*; and the action of *reverse* is in the past relative to the sender-now, in the future relative to *asked* and *get out*, but cotemporal with *help*.

Time as revealed in language is a reflection of the mental models we need to build in order to map the universe around us: we model from historical events to predicted events; we model the probable to enable us to convert it to the happened or the avoided; and we model backwards with as much facility as forwards. This last is difficult to explain in evolutionary terms: what is the advantage of modelling what might have been? As we have seen, remembering the actual

[395] **Steven Pinker**, *How the Mind Works*, pp352-355
[396] **Merlin Donald**, *A Mind So Rare: the evolution of human consciousness*, p142
[397] **David Brazil**, *A Grammar of Speech*, pp87-88

past is useful, and modelling the future helps us to avoid future problems; but the advantage of modelling the potential past is unclear – events have already had their effect and cannot be mitigated. By modelling might-have-beens we can only evoke satisfaction for a good choice, or regret for a poor choice. Neither of these mental responses would appear to have any useful survival function. They seem to be mere mirrors of the more immediate positive and negative emotional responses that must accompany the ability to make – and choose between – good and bad models of the future.

The only explanation for the ability to model the past seems to be that it is an emergent feature of the ability to model the self into the future. As soon as the first ritual-creating women realised that their models of self allowed them to plan for the future, regret was released into the World. It really was Eve who ate the apple, Pandora who opened the box, the Wawilak Sisters who released the Snake[398].

The ability to model the self is more than just a cognitive event, it seems to be implicated in language through the grammar of temporality, too. In the next section, therefore, we will look in more detail at the way in which self modelling is implicated in human temporality.

9.2. Temporality and Modelling the Self

Language, as all signalling, involves a transfer from a sender to a receiver via a message. Language messages, however, as we have seen, do not need to be about current events involving the sender and receiver. Not only can the message be dislocated in time into the past or future, it can be dislocated in terms of content: the instigator and recipient of the action signalled within the message do not need to be the sender and receiver of the message. The level of trust permitted in human language means that we are willing to accept messages about third parties as truthful and useful.

Particularly of interest, the separation of the Sender from the Instigator is tied to the ability to produce a model of our self within our own mind. This ability to self-model only becomes available when the self has the freedom to treat itself dispassionately; and this, in turn, only becomes available when the self is no longer constrained by the evolutionary imperative to always favour the self over others. While it is clear from a human perspective that modelling the

[398] For a full explanation of the Wawilak Sisters myth see **Chris Knight**, *Menstruation and the Origins of Culture: A reconsideration of Lévi-Strauss's work on symbolism and myth*, unpublished PhD thesis, available at: http://homepages.uel.ac.uk/C.Knight/menstrual_index.htm

self seems to be advantageous, from a selfish gene perspective it appears highly disadvantageous.

The imperatives of evolution dictate that it is always useful to be able to predict the actions of others – you can then take steps to counter those actions before they have occurred. Predicting others' actions allows the individual to avoid predation and unwinnable confrontations, while facilitating more felicitous encounters, such as mating. The cost of predicting your own actions, on the other hand, is that you have to take a dispassionate view of yourself – and how could being dispassionate about yourself be of advantage, when all around are intrinsically passionate about their own survival and reproduction?

If we see the development of Theory of Mind as the ability to answer increasingly complex questions about motivations, then two types of awareness must be explained. The first is *other awareness*, which gives the capacity to model others as entities with intentions. This type of awareness needs only a comprehension that others have a range of options available to them. There is no need for recognition of the self, only of the range of options; and there is no need for recognition of the interpersonal structure of "me" and "you", only of the "you" that has the options. The second type of awareness is *self awareness*, which allows the self to be modelled as a separate entity. Others treat me as if I have options, so it is very likely that I do have them; and if they see me as a "you" in the same way that I see them as "you" then it must be possible for me to see myself as a "you".

Something happened in human evolution that allowed us to pose and answer the question *what could I do if I were them?* However, it is impossible to even pose that question in a strictly evolutionary environment. To do so, the self has to be able to model itself, and be able to place that model into a range of unreal situations. The answer to the question allows *me* to understand *your* motivations and accommodate them – but why should I be interested in doing that? The self that accommodates others is not just compromising its own survival, it is promoting the survival of others over itself. It is not a strategy that gets the accommodating genes into the next generation.

It is possible to argue that a species which co-operated would have notable advantages over one that did not. However, as Richard Dawkins points out, co-operation can only exist while it does not compromise personal survival; if there is an effective non-co-operative strategy available

then co-operation will soon disappear from the species genepool[399]. Yet humans are consummate co-operators, so we must have a strategy for co-operation which is more effective and successful than pure selfishness. This strategy places us in a very unusual evolutionary niche: for humans, co-operation is so extensive that it became communicative as well as performative. As we have seen, one theory, the female kin coalition theory, seems able to provide an explanation of how we came to occupy this niche[400].

When we analyse the question that self awareness allows us to pose and answer, *what could I do if I were them*, we can see that it has two instantiations of *I* – two versions of the self. The second *I* is the self in a being environment: this self, the self-who-is, cannot be defined to the self because it *is* the self. The first *I* is the self in a doing environment: this is not a real self but a model created by the self-who-is which takes on the attributes of a non-self. Because it is a model it allows the self-who-is to play with the self-who-does, positing it into a range of circumstances without the self-who-is actually risking those circumstances. The question *what could I do if I were them* can therefore be rephrased as: *what could the self-who-does do if the self-who-is were someone-else-who-is?*

This separation of self-who-does from self-who-is means that the self-who-does can be moved not just through the realm of what-if, it can be moved through space and time, too. While the self-who-is is limited to the here-and-now, the self-who-does can be modelled into any circumstance the self-who-is can imagine. Thus the separation of the selves, created by the separation of the sender of the message and instigator in the message, also creates the possibility of temporal modelling.

The view of temporality set out here allows us to express events on two vectors. The first extends from the past into the future, and the second extends from positive certainty, through a range of probabilities, to negative certainty. The two vectors interact, so that certainty is greatest in the present, and attenuates the further into the past or future an event is placed. The distance from the present has a direct relationship with the level of conditionality, as the diagram below shows. The physical self, the self-who-is, remains fixed in the present, but it can view events as having occurred in the past, or as due to occur in the future. It does this by modelling the self-who-does into the appropriate timeslot. This is a powerful capacity, but it is a mere fragment of what we do in language.

[399] **Richard Dawkins**, *The Selfish Gene*, pp7-10
[400] **Chris Knight**, *Blood Relations: menstruation and the origins of culture*

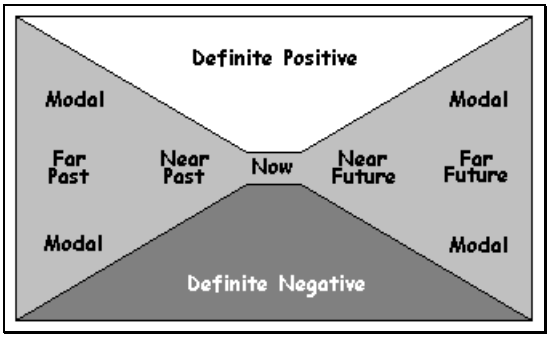

Figure 9 - The realm of language: past, present and future with conditionality

As humans we are able to divide ourselves into multiple instances. The ability to make the first model of the self carries with it the possibility of making further models. Not only can the self-who-is produce models of the self as the self-who-does, it can produce models of the self which are viewed by the self-who-is and which in turn view the self-who-does. Like a Russian doll, the self-who-does becomes a model within a model: the self-who-views, itself a model, has an internal model of the self-who-does. Bernard Comrie refers to the self-who-views viewpoint as the deictic centre, and the self-who-does viewpoint as the relative time reference[401]. The terminology used in this dissertation reflects an emphasis on self modelling.

There are now three selves, with a watcher watching the watcher watching the watched. This corresponds in many ways to Hans Reichenbach's view of temporal reference as being a relationship between point of speech (S), the point of event (E), and the point of reference (R)[402]. In theory, more instantiations of the self-who-views can be inserted between the self-who-is and the self-who-does; but, in practice, this seldom happens. For instance, if we look at the construct, *Tomorrow at this time I will be about to have finished leaving the country*, we can identify a four-part division of self. The self-who-does is *leaving the country*; A self-who-views sees this as an event in its past (*have finished*); another self-who-views sees the first self-who-views as a future self (*be about to*); and the self-who-is sees the second self-who-views as a future self (*will*). *Tomorrow at this time* adds temporal definition to the construct but does not affect the models of the selves.

This construct illustrates the problem with modelling beyond the self-who-does and the self-who-views: the cognitive maps produced are complex, and extracting meaning from them is

[401] **Bernard Comrie**, *Tense*, ch3
[402] **Carlos Areces & Patrick Blackburn**, Reichenbach, Prior and Montague: A semantic get-together. In *Articles in Honor of Dov Gabbay's 60th Birthday*, Kings College Press, 2005.

difficult. Modelling at this level is more an intellectual exercise than an everyday part of language. This dissertation will, therefore, concentrate on the relationships between only three selves: the self-who-is, the self-who-views and the self-who-does.

Temporality is not expressed within the three selves but between them; or, to put it in linguistic terms, temporality is not a feature of objects in the object-action distinction, it is a feature of actions. We should therefore look to verbs and verblike forms for the expression of temporality rather than other parts of speech[403]. The next section will therefore look at the particular way that tenses are produced in the interactions between the three selves, and it will show how the manipulation of these selves creates the range of tenses we use in English.

9.3. Temporality in Verbs

How do the three selves work together in expressing temporality in verbs? The easiest way to answer this question is to look at some tenses in English. Several linguists argue that English has only two true tenses, present and past – *do/does* and *did*.[404] These are the only inflections of verb forms, and therefore the only way that temporality is directly expressible in the verb. This, however, is a restrictive definition of tense, left over from a tradition of comparing English to classical languages like Latin; it will not be the definition of tense used here. At the other extreme, any expression of temporality on a verb can be viewed as a tense marker. This has the advantage that all temporality is included, but it has the problem that tense cannot be defined by a simple (or not so simple) set of grammar rules: it is a functional explanation rather than a formal definition. While it does get us closer to an understanding of how we use temporality in language, it also will not be the definition of tense used in this dissertation.

The traditional definition of English tenses is that constructs that include auxiliary verbs, such as *will* and *have*, count as tenses; and this certainly provides the full range of temporal relationships that need to be expressed in terms of both tense and aspect. This definition, therefore, which corresponds to that used by Bernard Comrie, is what will be meant by tense here.

If we look only at the conceptually simple tenses in English, we have the uncontroversial past perfect and future simple tenses: *I did* and *I will do*. In both of these cases, there is a self-who-is anchored to the present moment, and there is a self-who-does which has been modelled into the

[403] **Alice G B Ter Meulen**, *Representing Time in Natural Language*, pp4-5
[404] **Martin H Manser (ed)**, *Bloomsbury Good Word Guide*, p288

past or future. There is no need to posit a self-who-views as separate to the self-who-is, and a simple two-self model suffices. The temporal location of the self-who-does we will call the **action point**, the point at which the actual doing takes place.

If we include a self-who-views then we can also move this new self into the past or future, and the self-who-does then has a past or future position relative to the self-who-views. The location of the self-who-views we will refer to as the **viewpoint**. The self-who-is cannot be modelled into the past or future because it is the unmodelled self; *being* is the here-and-now part of the construct.

The relationship between the selves is sequential: the self-who-is has a relationship with the self-who-views, and the self-who-views has a relationship with the self-who-does. This means that the self-who-is has no direct relationship with the self-who-does, unless the self-who-views has been telescoped into the self-who-is.

Self-who-is	**Self-who-views Viewpoint**	**Self-who-does Action Point**	**Form**
Present	Past	Earlier than viewpoint	I had done
Present	Past	Later than viewpoint	I was going to do
Present	⇨	Past	I did
Present	⇨	⇨	I am doing
Present	⇨	Future	I will do
Present	Future	Earlier than viewpoint	I will have done
Present	Future	Later than viewpoint	I will be going to do

Figure 10 - The seven tenses

With the three selves we therefore have a range of possible temporal relationships. The viewpoint can be in the past, future or present in relation to the present point of the self-who-is, and the action point can be earlier or later than the viewpoint. In addition, the action point can be in the present, but then the viewpoint must also be in the present. The range of relationships forms a binary progression: one position for self-who-is, plus two for self-who-views, plus four for self-who-does. This gives us only seven functional tenses, as above.

Intrinsic to these tenses is the view that time is a sequential process, moving from past to future. This view is behind the two metaphors of time that Lakoff and Johnson identify: the self moving through a stream of time, and the tableau of time passing in front of the self.[405] Although there is an essential asymmetry in our view of time – we know the past and cannot

[405] **George Lakoff & Mark Johnson**, *Metaphors We Live By*, ch9

know the future – we nonetheless model it as a symmetrical structure – we can place events in the future in the same way as in the past. This symmetry of the seven tenses can be expressed in the diagram below:

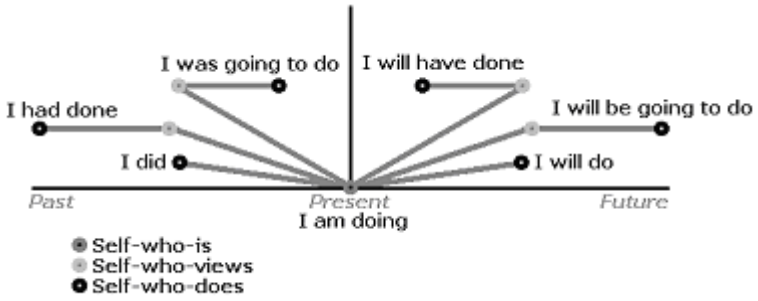

Figure 11 - The seven tenses expressed on a timeline

However, this collection of tenses leaves out several important functions of the linguistic expression of temporality. We don't just place an event on a timeline in relation to the present and a selected viewpoint, there are a range of other temporal effects that we use to express the nature of the event. These are continuity or imperfection, imminence, conditionality and connectivity. These functions are not outside the model, they are part of it, and they will be described here to show how they fit in.

9.3.1. Continuity

Continuity expresses temporality at the action point, and it can occur in one of three ways: it can be a single event, completed at the action point, as in *I shot the sheriff*; it can be a single event not completed at the action point, as in *I'm writing a letter to papa*; or it can be a series of events, some of which are complete at the action point, and some of which are not, as in *I go to school every day*.

Continuity therefore relies on the action itself for its instantiation. All verbs contain continuity semantically, and the type of continuity is dependent on the action itself. For instance, the action of *shooting* in the first example above is a split-second event, and does not easily lend itself to incompletion: *I am shooting the sheriff* usually implies a future event rather than a current, incomplete event. Similarly, *I like my sister every day* sounds odd because *like* is a single event which can never be completed at the action point.

Continuity is therefore sometimes excluded from a discussion of tenses because it is implicated within the semantic content of a construct. It is, however, an important feature of the way we

express time in language, and in many languages maps directly onto the verb as one or more tenses.

9.3.2. Imminence

Imminence is concerned with temporal distances. An action point can occur close to a viewpoint or further away; and a viewpoint can be close to the present or further away. Of course, if either point is actually in the present then telescoping occurs, and imminence disappears. The seven tenses given above can dictate the temporal ordering of action point and viewpoint, but they cannot determine the distance between them: that is the job of imminence.

A completed action can have variable distance from the present, although in many languages only two distances are recognised. In some East African languages, there are two distinct past tenses to indicate imminent and non-imminent events[406], and this is partially the case in English. Imminence can be illustrated with the following two sentences: *I walked the dog* and *I have walked the dog*. The viewpoint of the action is the same for both sentences (the present) and the action point is also the same (the past); but the action point of the second sentence has greater proximity to the present than the action point of the first.

Imminence can occur in the future, too. In the sentences *I will walk the dog* and *I am going to walk the dog*, the viewpoint is the same for both (the present) and the action point is also the same (the future); but, once again, the action point of the second sentence has greater imminence. *I am about to walk the dog* has even greater imminence, which shows that, in English, imminence can be viewed as scalar and not just a binary dichotomy.

In English, imminence is often expressed with relative adverbials, like *soon* and *just*. It can also be indicated by absolute adverbials, like *tomorrow* and *last week*, or with adpositional phrases, like *by tomorrow* or *before next week*. The relative adverbials tend to affect the distance between viewpoint and action point, while the absolute terms tend to affect the distance between viewpoint and the present. Thus, in *we will have almost done it tomorrow*, *almost* indicates that the viewpoint of *tomorrow* is close to the action point of doing, while the adverbial *tomorrow* fixes the distance between now and the viewpoint as one day. *Almost* also serves another temporal function, converting the action from completed at the action point to incomplete. It also, therefore, has an effect on the continuity of the construct, showing that temporal effects cannot always be isolated linguistically.

[406] **David Lee**, *Competing Discourses: perspective and ideology in language*, p9

9.3.3. Conditionality

Conditionality is concerned with what can be expressed in language in terms of the certainty or uncertainty of events. It allows events to be placed onto a second vector of probability, in addition to the first vector of time. In English, however, conditionality is mainly expressed through adverbials; it has limited expression through catenative verbs. For instance, *I may have eaten* and *I may eat* are permissible English forms, but **I may had eaten* and **I may will eat* are not. With adverbials the range of temporal expression is wider: *perhaps I had eaten*, *perhaps I will eat*, *perhaps I have eaten*, *perhaps I was going to eat*, *perhaps I will have eaten*, *perhaps I will be going to eat* … These all add uncertainty outside of the verb construct. Events in the future of the viewpoint already have the uncertainty of an unknown future, and adding an adverbial – *perhaps, maybe, it is likely that* – only increases the uncertainty. Events in the past, in contrast, have greater certainty, and adding an adverbial can convert certainty to uncertainty – *perhaps I have eaten*.

Catenative conditional verbs also reflect the asymmetry between past and future, and the replacement of *will* with *may* illustrates this particularly well. *I may have eaten* does not express the same temporality as *I will have eaten*: while *will* expresses a viewpoint in the future, *may* causes the viewpoint to elide into the present. It seems as if this form of conditionality moves the viewpoint through the vector of probability instead of through time, indicating that conditionality is indeed a second dimension working with unidimensional time.

9.3.4. Connectivity

Unlike the rest of temporality, connectivity is not an expression of temporality *within* a language construct, it expresses temporality *between* constructs. It is the feature that facilitates the never-ending discourse of language, and lies behind Alexander Pope's "nothing stands alone"[407].

Temporal connectivity can identify events as cotemporal, as moving forward in time, or as moving backward in time. In *he looked and listened / he looked before listening / he looked after listening*, the connective determines which event happens first, if either. Connectives can also place identities into a time series: *he ate the plum, then the peach and lastly the banana*. Here an Action (*eating*) is being applied to a series of objects in turn. As with other temporal deixis, tense and word (or grammar and semantics) have to act together: *he will build the house*

[407] **Alexander Pope**, *Essay on Man*, p31

then he has bought it sounds nonsensical because of the temporal clash of the first event occurring after the second, where *then* indicates it should be before. If we replace *then* with *if*, *when* or *after* then the sentence works, as long as *it* is a reference to something other than *the house*. Building the house brings it into existence, and no action can happen to it before it exists[408].

While some connectors, like *after* and *before*, explicitly create the temporal relationship between actions, this is not true for all connectors. For instance, in *he jumped on his horse and rode into the sunset* we see *and* as having temporal deixis, because the two events must happen serially. They are both in the past, both are complete, but the first has to happen before the second because of the semantic metamessages in the construct: *jumping on* implies becoming a rider, while *riding* implies being a rider. Compare this to *he sat on his horse and stared at the sunset*: here, the two actions are not semantically related and can be contemporary. To convert the actions to a series we would use *and then* or just *then*.

Connective temporality comes in three forms. Some connective words carry low levels of temporality. For instance, *I went to the cinema and saw a film*: we know that one event happened after the other and, contextually, we can work out that going to the cinema comes before seeing the film; but we also know that this is not a given, only a reasonable assumption. Some connectives carry oblique levels of temporality. For instance, *I went to the cinema because I wanted to see a film*. Once again, we know the order of events: *going to the cinema* must precede *seeing the film* because the first event is causative of the second. *Wanting*, however, must precede both *seeing* and *going*: the connector *because* creates a complex of temporal relationships. Finally, some connectives carry high levels of temporality. For instance, *I went to the cinema before I saw the film*: the ordering of the two events is explicit and subject to only one interpretation.

Connectives allow events to be placed into a structured temporal relationship, a capacity at the heart of human story-telling. This is no small side-effect of language, it is central to it. Every time we make models we are telling ourselves a story, extrapolating existing circumstances through a net of possibilities to reach a conclusion. And if the first story does not end in happy ever after, we can model others until we get the result we want.

[408] **Norbert Hornstein**, *As Time Goes By: tense and Universal Grammar*, ch2

Continuity works at the action point, determining the duration of the action; imminence works between action point, viewpoint and now, determining the distances between the points; and conditionality operates in the separate dimension of *realis/irrealis*. This gives a rich two-dimensional space for the linguistic expression of temporality. Connectivity works in yet another dimension of temporal space. In this dimension, individual events can be tied together not just in terms of their temporal order but in terms of their probability. Connectivity is perhaps the most important dimension in terms of narrative: without the ability to link constructs together logically and semantically, dialogue becomes an exchange of unrelated facts, and narrative becomes impossible. As narrative is a clear differentiating feature between signalling inside human culture and outside it, the importance of connectivity cannot be overstressed. It is the temporal relationship that gives purpose to all the other temporal relationships.

These four functions – continuity, imminence, conditionality and connectivity – share one thing in common: they are all expressions of relationships between the modelled action point, the viewpoint and the current moment. This relationship is more than just a product of the representation of temporality, it is a relationship with correspondences throughout language. For example, the unmodelled self (the self-who-is), the proximate self (the self-who-views) and the distant self (the self-who-does) are clearly related to the three persons, I, you and they. This correlation between temporal features and other features of language will therefore be reviewed in more detail next.

9.4. Action, View and Now

As we have seen, the combination of viewpoint and action point creates seven tenses: the present tense, involving only the self-who-is; two simple tenses, involving a self-who-does modelled into the past or future; and four complex tenses involving a self-who-views modelled into the past or future, and a self-who-does modelled into the past or future of the self-who-views. In contrast, Halliday and Matthiessen identify no fewer than 36 tenses in English, but they include conditional, imminent and complete/incomplete forms[409].

In English, all of the seven tenses can be expressed through the use of inflection and catenation: Imperfectives can be produced for each of the tenses given, and imminence can also be inserted. For instance, *I was intending to do it* can be made less imminent (and less perfective) by using

[409] **Michael A K Halliday & Christian M I M Matthiessen**, *An Introduction to Functional Grammar*, third edition, pp340-342

the construct *I have been intending to do it*, and even less imminent (although more perfective) with *I had been intending to do it*.

Imminence, as has been stated, is a function of the relationship between the viewpoint and the action point, or the viewpoint and the present. For instance, in the construct *I was just about to walk the dog* we can see greater imminence than in *I was about to walk the dog*; but the imminence of *just* can be between viewpoint and action point or viewpoint and present depending on context. In answer to the question *when are you going to walk Fido?*, the imminence is between viewpoint and present; in answer to the question *what were you doing when the lightning struck?*, the imminence is between viewpoint and action point.

The question of verb temporality is relatively simple when we consider single action structures, for example: *I did it*, *I will do it*, *I could have done it*, *I am doing it*. While the structuring of the tense may get quite complex (*I would have been going to be doing it*) it is nonetheless explicable in terms of the temporality functions already discussed (the example analyses to a view point in the past, an action point after this, with conditionality and continuity in the action). While the temporality rules may be simple, the application of them can create elaborate language constructs. Temporality in language is an area where complexity propagates further complexity, what Marcello Barbieri calls "a convergent increase of complexity"[410].

One instance of this complexity is the double-action sentence, such as *he told me to do it*. Here we have the action of *telling* with an instigator of *he* and a recipient of *me*, and the action of *doing* with an instigator of *me* and a recipient of *it*. We could rearrange the meaning of this into the structure *he told me that I was to do it*, which shows that the two actions are distinct and separable. But this does not alter the fact that English has connected the two events together as a temporal cause-and-effect structure.

One thing of note in the double action is that the object of the first verb becomes the subject of the second. *I begged Mary not to go* places *Mary* as the recipient in *begging* and the instigator in *going*. *Mary* has two temporal locations, as the recipient at the time of begging and as the instigator at the time of going: she has been given a continuity through time. Despite having no object, intransitive verbs are not excluded from the first position in double action constructs: *she wanted to get away, I tried to stop her*, which both show that in the case of the intransitive verb the semantic instigator is the same in both verbs. This seems to indicate that the intransitive is

[410] **Marcello Barbieri**, *The Organic Codes: an introduction to semantic biology*, p90

acting reflexively, so that the instigator and recipient of the first action are co-identified. This makes the instigator of the second action the recipient of the first action, just as for transitives.

Another example of double verbs occurs in the nesting of reported speech – the message within the message. For example, in *"John saw Mary," said Tom to Joan*, the reported speech action point (*saw*) precedes the action point of the *saying*. This is another way in which complex temporal relationships can be created. For instance, in *Tom had told Joan that John would have seen Mary before Christmas* we can see the following temporal points: *Tom* has a viewpoint in the near past, and the *telling* occurs at an action point in the far past. *John* has a viewpoint in the past, after the action point of *telling* but in an unknown relationship with *Tom*'s viewpoint; and the action point of the *seeing* is before *John*'s viewpoint but probably after the *telling* action point. In addition, the *seeing* action point occurs before the fixed point of *Christmas*, which also has to be in the past. If *would* is replaced by *will* then *Christmas* is likely to be in the future, but the other relationships remain unchanged.

Traditionally in the expression of temporality in language the recipient is fixed to the action – it cannot have a separate temporal identity. This is the basis of the subject-predicate analysis of a sentence. When the recipient is an unrepresented case (the intransitive) its linkage to the verb is unsurprising – what is not there cannot be given a relative temporal position. However, when it is present there is no reason why the temporal status of the recipient could not be separately represented. The recipient and the action are not always co-temporal, as the following constructs illustrate:

- *I built a wall* – the *wall* cannot exist until the *building* is completed;
- *I demolished the wall* – at some point in the process of demolition *the wall* ceased to be, but the process both preceded and followed this moment;
- *I built a relationship* – the *relationship* exists at the same time as the *building* of it, the building is a process of change.

These constructs all rely on the temporality implicit in the semantics of the verb: some verbs imply a fixed temporality between recipient and action (statives, as in *I like biscuits*), but some do not (dynamic verbs or processives, as in the three examples above). If the process is creative or destructive then the recipient will come into existence or cease to be during the process; if it is transforming then the recipient will exist throughout the process, but in different forms. Individual verbs carry their own stative/processive significance for the recipient; in English,

there is no temporal mechanism external to the verb for expressing this relationship[411]. This is not just a limitation of English, it occurs in the Romance languages, the Germanic languages, and such diverse languages as Maori, Welsh and Euskera. It could even be a universal limitation, in which case it says something specific about the human relationships of instigator, action and recipient. It is certainly a limitation within the Formalist S ⇨ NP + VP formulation of a sentence.

It is clear that the viewpoint and the instigator share a relationship, in that the viewpoint is the instigator's viewpoint. Similarly the recipient and the action point share a relationship, because the recipient has the same temporal location as the action. So we can see that temporality, or verb temporality at least, is intimately tied to the form of language. Temporality is only explicable if an instigator-action-recipient two-argument structure has been incorporated into language. However, if instigator-sender dislocation (which is an outcome of self awareness) did not occur until after the female kin coalition was established, as is proposed in this dissertation, then we can also say that a fully articulated tense structure could not exist until then, either. Everything seems to rest on that moment of self awareness, when the question *what could I do if I were them?* became answerable.

It would seem that we are not born with a full model of temporality: children under the age of about four seem to divide the world into "now" and "not-now". Not-now has a considerably reduced value compared to now, so events in the not-now are less valuable that those in the now. In a televised experiment, a group of children of various ages was asked to choose between having a single piece of chocolate now or a bar of chocolate in 10 minutes: the under-fours universally opted for the small piece now, while the over-fours universally opted to wait[412]. In the light of the argument made here, it is reasonable to view the under-fours as unable to project a self into the future to accept the whole bar, all they have is the self in the present to accept the single piece.

There are two final temporal points to be considered, and those are the sender point and the receiver point. The receiver point is always physically in the present and is always co-temporal with the message itself. With speech this creates no problem because the sender point is also co-temporal; but with writing the sender point will always be in the past and will precede the receiver point. However, when reading, we tend to view the text as being written in the present

[411] **Michael A K Halliday**, *On Language and Linguistics*, pp7-12
[412] **Sarah Brewer**, *A Child's World: a unique insight into how children think*, pp179-183

even though we know it was generated in the past: we treat the sender point as co-temporal with our receiver point, even though it isn't.

The sender point is capable of more variation than the receiver point: we are able, using analogy, to treat the sender point as being in the past or future of its physical time, thus creating the illusion that the message is not co-temporal with the sending of it. The sender can adopt a point in the past co-temporal with the events of the message, thus giving them a dramatic immediacy, as in *we clear away the bricks, and what do we find underneath? More bricks!* It is also possible to adopt a point in the future, especially when the purpose of the message is speculation: *if we go down that road does it leave us any closer to home?* We often use this adopted future sender point as a rhetorical device. *I'm putting on my coat and going home* does not imply that the action is happening now; it is a conditional action that will happen very soon if the receiver does not take urgent steps to stop it.

The self-who-does, self-who-views and self-who-is have a close correspondence to the three voices in language: the self, the directly addressable non-self, and the non-self that is not directly addressable. Bloomfield refers to these as "speaker, hearer and third person"[413], and we traditionally refer to them as the three persons, or the three voices. We use pronouns, a special class of words, to represent them. Different languages use different ranges of pronouns, but they all come down to the three voices that we use to identify roles in the signalling three-argument form: the sender, the receiver and the referent. Each voice has a singular and plural form, although the range and nature of plurals in each voice varies from language to language.

Because the three voices are ubiquitous we should expect them to express something fundamental in all languages, possibly something fundamental to language as a communicative device; and this is precisely what we find[414]. In all signalling, we see a natural relationship between the three components around the message: the message sender, who is always the first person, *me*; the message receiver, who is always the second person, *you*; and the referent of the message, which is always a third party. In language terms this can be expressed as ***I*** *inform* ***you*** *about* ***it***.

It is therefore clearly no coincidence that there are three voices (I, you and they), three objects to a signal (sender, receiver and referent), three objects in a message (instigator, recipient and

[413] **Leonard Bloomfield**, *Language*, p224
[414] **Émile Benveniste**, The Nature of Pronouns. In *The Signalling Theory Reader*, ch19

context), and three selves in temporality (self-who-is, self-who-views and self-who-does). At some level there are correspondences between the three components in each of these models.

The correspondences are not, however, absolute. Interchangeability is a feature of human language, which means that, while the components have fixed roles in each of the models, the relationships between the components in different models is not fixed. For instance, the sender is always the first person, I, and the instigator is a product of the dislocation of the message from the signal; but this dislocation means that the instigator need not be the first person in all cases – not all messages need be about the intentions of the sender. Similarly, the self-who-is is the unmodelled self, and corresponds to the sender of the signal; but it is also the self that cannot be referenced in language – any reference to the self by the self is automatically a model of the self. Understanding the correspondences in the explicit communicative models helps us to understand the cognitive social model that lies behind them, but looking for formulaic equivalences is not productive.

We can now see that temporality in language is a complex of functions for describing viewpoint, action point, continuity, imminence, conditionality and connectivity. In English it is served by inflected and catenative tenses and by deictic lexemes, and this is able to express almost all the complexity needed for human linguistic expression. This is mostly achieved through the application of language-local rules, but behind those rules lie certain universals based around the components of language. Because the range of components is limited, the range of rules that can be derived from them is also limited – but those rules do not themselves need to be universal. Daniel Nettle describes a virtual "language pool" in which the full range of language rules exist. Some rules are mutually exclusive; but no language has to use the whole range, the same range, or even the same sorts of rules – many subsets of the pool of rules will work[415]. The components of language define a rule-space which language can then use to define temporality: the rule-space is universal, but any rules that issue from it will not and cannot be universal.

9.5. Why Time is Important to Humans

Time, and its expression in language, temporality, are key to understanding what makes us human. Because we are able to make models of ourselves, we are able to overcome the problem of viewing everything from the present. By modelling ourselves as future or past entities we

[415] **Daniel Nettle**, *Linguistic Diversity*, pp5-11

create the twin possibilities of planning and reviewing our actions; but modelling ourselves also allows us to model ourselves as a model of a model, so that we can review our plans before they are enacted.

We are a species which possesses the strange attribute of language – probably the only species so endowed; but language is only the external instantiation of a mental modelling process. This process allows us to generate models of the actions of others, attribute our own options to those models, and predict and plan for those actions. At some stage and for some reason, humans developed a highly co-operative social structure, which meant that it became profitable to communicate and share our models with other individuals. However, the sharing would have made us aware of the fact that others were attributing intentions to us as individuals, so our modelling of others was able to become a modelling of ourselves as others.

The modelling of ourself opened up the possibility of modelling both ourself and other selves into the past and future, and of telling each other about those models. We became able to plan co-operatively, and use Merlin Donald's Plan-Execute-Review cycle as a sharable experience rather than just an internal, personal one.

If the model presented here is correct then self modelling is vital to language. It determines our ability to model events involving ourselves; and our models of our own events determine our ability to express time within language. Language is clearly a product of a high level of co-operation, and it is this extreme co-operation which creates the willingness to give and receive truthful messages. Robert Burns was almost right when he said in his poem, *To a Louse*: "O wad some Pow'r the giftie gie us, *to see oursels as others see us!*" But it is the ability to see ourselves as we see others that is the reason why we have language.

For Chomsky, recursion is currently the *sine qua non* of language.[416] However, as Tom Dickins points out, recursion is a process which requires functions with which to operate. It requires a system of exchangeable tokens, or symbols, to create a structure in which form can recur without meaning recurring[417]. If the model proposed in this dissertation is correct, then recursion is only an emergent property of the process leading to temporality: the Russian dolls of self form a potentially infinite recursion of models, and the orders of intentionality they imply form

[416] **Marc D Hauser, Noam Chomsky & W. Tecumseh Fitch**. The Faculty of Language: what is it, who has it, and how did it evolve? In *Science* vol 298 22 November 2002, pp1569-1579
[417] **Thomas E Dickins**, General Symbol Machines: the first stage in the evolution of symbolic communication. In *Evolutionary Psychology* 1, pp192-209

the basic structure for recursion throughout language.[418] Recursion is not the source of all things linguistic; instead, it is a product of self modelling, which in turn is a product of the sharing of multiple-argument models through language.

[418] **Robin I M Dunbar**, *The Human Story: a new history of mankind's evolution*, pp47-69

10. Language Grammar Acquisition by Children

A large body of data on child language acquisition is building up in scientific literature, but what all this data shows is a matter of keen debate. In linguistics, the two dominant views of language acquisition – the nativism of formal linguistics and the acquisitional approach of functional linguistics – can often use the same data from different perspectives to support contradictory arguments. Important issues in child language acquisition remain subject to dispute, and no single theory can yet claim conclusive proof.

Perhaps, however, there is truth on both sides. This is the pragmatic approach adopted by many investigators of child language acquisition, who borrow from both approaches to the debate to explain their evidence. This pragmatic approach is also used in this dissertation. Some aspects of language, such as phonetic control, are innate and best explained in terms of genes or, at least, in terms of direct physical development. Other features of language, such as lexis, are learned and more easily explained in terms of socialisation and acculturation; they can be explained only indirectly in terms of genes and evolution. Other features, such as grammar, need to be explained in terms of both genes and acculturation: there is something intrinsic about the two-argument form, and probably about the three-argument form; whereas, for example, the English use of determiners is clearly learned. The two approaches, nature and nurture, are not mutually exclusive but complementary.

Early work on child language acquisition was exemplified by Jean Piaget, who was one of the first to formally describe childhood as a series of identifiable phases[419]. He identified four stages of development. First is the **sensorimotor stage**, which runs from birth to about two years of age. In this stage, which Piaget labelled as *infancy*, children experience the world through movement and their senses. The second stage is the **preoperational stage**. This runs from ages two to seven, and is involved with the acquisition of motor skills. Piaget called this the *pre-school stage*, although it runs into what is, in most modern cultures, the schooling period. It is in this stage that most language acquisition occurs. The preoperational stage is followed by the **concrete operational stage**, running from ages seven to eleven, in which children begin to think logically about concrete events. Piaget labels this *childhood*. The final stage is the **formal**

[419] **Jean Piaget**, *The Language and Thought of the Child*

operational stage: after age eleven children become adolescents and begin to develop abstract reasoning[420].

There are issues with Piaget's model. It does not describe the process of language acquisition with any accuracy, and it is overlaid with sub-stages and autonomous events. For instance, Piaget puts the key event of the emergence of consciousness at about nine months[421], which does not map directly to his stages. There are also indications that adolescence is not the final stage – adolescents still have an inadequate model of reality[422], which indicates that there is at least one extra milestone not included in Piaget's model. Piaget's theories have also fallen out of favour because of the growing Formalist view that much human development is innate and activated rather than learned[423]. However, his basic concept, that development is structured in a series of identifiable stages, has become standard in child language acquisition literature.

For Lev Vygotsky child development is driven by learning from the example of adults and peers. This learning is seldom the outcome of deliberate teaching, it is a process of socialisation which we, as humans, are innately prepared for. Where Piaget takes the view that thought precedes and produces language, the situation for Vygotsky is more complex. Forms of pre-thought and pre-language exist before age two, when they merge to produce verbal thought, a hallmark of being human[424].

Vygotsky sees child development as being continuous, apart from the transformative step up to verbal thought. Different threads of cognition are developing continuously and simultaneously, driven both by maturation processes and by learning – and one can feed and enhance the other. For Vygotsky, each thing to be learned relies on the pre-existence of things already learned; and each thing learned opens up the possibility for other things to be learned. He describes this scope for, and limit on, new learning as the Zone of Proximal Development[425].

In the different approaches of Piaget and Vygotsky we again see the problem of structure versus process. Piaget's structural model emphasises the stages of development and provides an approximate timetable for events to happen; but it also does not adequately explain the

[420] **Peter K Smith, Helen Cowie & Mark Blades**, *Understanding Children's Development* (4th edition), pp391-393
[421] **Jean Piaget**, *The Psychology of Intelligence*, pp113-114
[422] **Leslie Sabbagh**, The Teen Brain, Hard at Work – No, Really. In *Scientific American Mind*, vol 17, no 4, August/September 2006, pp20-25
[423] **Domenico Parisi & Matthew Schlesinger**, Artificial Life and Piaget. In *Cognitive Development* 17 (2002) pp1301–1321
[424] **Lev Vygotsky**, *Thought and Language*, pp80-83
[425] **Lev Vygotsky**, *Mind in Society: the development of higher psychological processes*, ch6

transitions between the stages. Vygotsky's model emphasises the process of continuous development, but it sees child development as an individual response to specific learning circumstances, and does not really explain why almost all human children seem to pass through the same stages of development at approximately the same times. As with all structure versus process issues, the full answer is likely to come from a synthesis of the two ideas.

This chapter will attempt to make this synthesis, at least in relation to three questions concerning the development of human children into social and cultural beings: when and how do humans begin to co-operate; what are their views of self at various developmental stages; and how does their language develop – is it a process of acquisition or activation, or is it a combination of these? If the theory proposed in this dissertation is valid then we should see correlations between the timescales for co-operation, selfhood and language development. However, we must start with a question from the other side of the problem: if language has an effect on the ontogenic development of children, could children have had an effect on the phylogenic development of language? This is the question posed by Terrence Deacon, and in the next section his solution is discussed.

10.1. Children and Language Origins

Although child language acquisition should be a fertile ground in which to seek the origins of language, the spectre of Ernst Haeckel's Recapitulation Theory – "ontogeny recapitulates phylogeny"[426] – has created an atmosphere of caution. Haeckel's idea was that the process of foetal development involves transition through all the major stages of evolution. It was a seductive idea, offering a way to marry Darwinian evolution directly to developmental biology; but it became increasingly untenable as knowledge of foetal development improved. Important stages, such as the development and atrophy of gills, did not work in the way predicted. Haeckel's theory should not, however, be completely dismissed; it may have limited application in processes which are not directly genetic, such as language acquisition. Language seems to be a case where individual development is a good model for the development of language as a species phenomenon, in that language acquisition is in large part a process which has only indirect genetic explanation. The ways children acquire language today are likely to be similar to the ways the first forms of language were acquired.

[426] **Ernst Haeckel**, *The Evolution of Man*, p2. Project Gutenburg Ebook, 2005 (1912)

Terrence Deacon provides a model of how ontogeny can recapitulate phylogeny. He takes a largely non-nativist approach to language origins, seeing language as a learned response moderated by genetic limitations. His theory is that language has not always been an elegant and integrated system. Initially, it was disjointed and complex, a series of responses to different signalling needs; the structural rules for referring to one class of objects could not be extrapolated to other classes. Effectively, the first languages had no single grammar, only *ad hoc*, circumstance-specific sets of rules; but over many generations these rules were refined and integrated until we reached our modern, open-ended languages. This process, Deacon believes, was not a direct cognitive attempt to make better language, instead it was the outcome of an accumulation of errors made by children over generations. These errors simplified language by making it more "child-friendly"[427].

Deacon's theory reverses the normally accepted train of events: language does not start simple and get complex, it starts complex and gets simple. Language is not a unitary thing that suddenly sprang into being[428], sprang into being in steps[429] or slowly developed as a single entity[430]; nor is it a thing that appeared out of a single signalling need and then expanded into other areas[431]; instead, it is the merging of separated, already-existing signalling structures. Language has no primogenitor, it is a byproduct of socialisation.

Deacon's theory matches the current evidence on child language acquisition. Children, it is known, over-generalise linguistic constructions, and in English this is often demonstrated by the overuse of standard case endings, such as plural *–s* and past perfect *–ed*. Thus we can hear constructs like "where those dogs goed?" and "childrens" from 1 to 3 year-olds. There even seems to be a stage where the correct past tense, which has already been learned, is reinterpreted when the general rule is grasped. So a child will change from saying "ate" to "eated" and then back to "ate"[432]. More interestingly, in view of Deacon's theory, some childhood forms do not revert. Thus the past perfect form of *burn* used to be *burnt*, an irregular form left over from the Germanic roots of English. Nowadays it is perfectly acceptable to use *burned* – at some stage in the recent past the over-generalisation of the regular past participle when applied to *burn* has not reverted to the older form in enough individuals, and this has changed the acceptable adult form. Another example would be the plural forms of *formula*: the anglicised *formulas* is steadily

[427] **Terrence Deacon**, *The Symbolic Species: the co-evolution of language and the human brain*
[428] **Noam Chomsky**, *Language and Problems of Knowledge: the Managua lectures*, pp183-184
[429] **Derek Bickerton**, *Language and Species*, p 128
[430] **Steven Pinker**, *The Language Instinct*, p366
[431] **Steven Mithen**, *The Prehistory of the Mind: a search for the origins of art, religion and science*, p213
[432] **Kim Plunkett**, Connectionist Approaches to Language Acquisition. In Paul Fletcher & Brian MacWhinney (eds), *The Handbook of Child Language*, ch2

replacing the latinate *formulae*. Both of these are examples of English moving from a complex set of multiple rules to a simpler, single rule.

Deacon's position places him in conflict with the Formalist Universal Grammar model, although he does not dismiss universality from his theory. For Deacon, language universals occur as emergences from the interaction between linguistic possibility and phenotypical limitations:

> They [language universals] are convergent features of language evolution in the same way that the dorsal fins of sharks, ichthyosaurs, and dolphins are independent convergent adaptations of aquatic species. Like their biological counterparts, these structural commonalities present in all languages have each arisen in response to the constraints imposed by a common adaptive context. Some of the sources of universal selection on the evolution of language structures include immature learning biases, human mnemonic and perceptual biases, the constraints of human vocal articulation and hearing, and the requirements of symbolic reference, to name a few. Because of these incessant influences, languages independently come to resemble one another, not in detail, but in terms of certain general structural properties, and any disruption that undermines a language's fit with its hosts will be selected against, leading to reconvergence on universal patterns.[433]

These are not the spandrels of opportunity that Stephen Jay Gould and Richard Lewontin propose[434], they are barriers of possibility that limit the range of language, as Daniel Nettle proposes[435].

The theory as stated so far remains a theory of language diffusion, not origins. In order to explain language origins, Deacon takes the view that the major difference between our minds and those of apes is the ability to think symbolically with ease. We do not need to change mental gears to enter a symbolic thought-universe, we are born into it, and it is only with difficulty that we can change mental gears to leave it. Deacon sees the ability to think symbolically reflected in modern human brains, where the prefrontal cortex is greatly expanded compared to our ancestors[436].

For Deacon, therefore, the *Homo sapiens* speciation event would have been the appearance of symbolic thought. It is a reasonable viewpoint, but requires symbolic thinking to be excluded from the capacities of all other animals. It is certainly true that, in their own environments, no

[433] **Terrence Deacon**, *The Symbolic Species: the co-evolution of language and the human brain*, p116
[434] **S J Gould & R C Lewontin**, The Spandrels of San Marco and the Panglossian Paradigm: a critique of the adaptationist programme. in *Evolution*, ch25
[435] **Daniel Nettle**, *Linguistic Diversity*, pp5-11
[436] **P Thomas Schoenemann, Michael J Sheehan & L Daniel Glotzer**, Prefrontal White Matter Volume Is Disproportionately Larger in Humans than in Other Primates. In *Nature Neuroscience* vol 8 no 2, February 2005, pp242-252

other animals have been conclusively shown to use symbolic representation in their signalling; but it cannot be excluded as a cognitive capacity. When we look at animals trained in human language (for example, Koko the gorilla[437], Kanzi the bonobo[438], Sarah the chimpanzee[439], Alex the parrot[440]) we cannot explain their behaviour easily without recourse to the conclusion that some kind of symbolic representation is going on in their brains. It may be that symbolic representation is more common in animal cognition than we believe, and it is the absence of symbols from their signalling that needs to be explained. And if that is the case then it is not symbolic capacity that differentiates us from the other animals but whatever allowed that symbolic capacity to become shareable.

One other problem exists with Deacon's theory, although it does not detract from his main thesis. Because language development in the species is a product of language development in individuals, there has to be a mechanism for the language of one generation to pass to the next: language cannot be refined through the generations if it cannot also be passed intergenerationally. It would seem likely that Deacon should propose a heterogenous social system in which children are exposed to a range of idiosyncratic adult language sets from which they can cherry-pick their own rules. Inexplicably, he takes the view that long-term pair-bonding, which he refers to as marriage, is the basis of society. He is careful to state that the marriage he is referring to is not the Western monogamous model, it can include multiple partnerships, but he takes the view that these partnerships have to be monogamous and stable over long periods, and that "two males almost never have simultaneous sexual access to the same reproducing female"[441]. This just does not match the data available from pre-urban societies[442] [443] [444].

Deacon recognises the importance of meat to hominine groups, and that co-operative meat-sharing between males and females is advantageous at the species level; but the model he proposes to explain co-operation (males give meat in return for sexual fidelity from the females) is both unenforceable at the individual level, and isolating at the gender level: males out hunting have no way of enforcing fidelity in their wives if both husband and wife are part of a social

[437] See Francine Patterson's site at http://www.pbs.org/wnet/nature/koko/asl.html
[438] **Sue Savage-Rumbaugh & Roger Lewin**, *Kanzi: the ape at the brink of the human mind*
[439] **David Premack & Ann James Premack**, *The Mind of an Ape*
[440] **Irene M Pepperberg**, The Alex Studies: cognitive and communicative abilities of grey parrots
[441] **Terrence Deacon**, *The Symbolic Species: the co-evolution of language and the human brain*, p385
[442] **Stephen Beckerman & Paul Valentine**, *Cultures of multiple fathers : the theory and practice of partible paternity in lowland South America*. Gainesville, USA: University Press of Florida, 2002.
[443] **Theodore C Bergstrom**, On the Economics of Polygyny. *eScholarship Repository*, University of California. http://repositories.cdlib.org/ucsbecon/bergstrom/1994A
[444] **Mervyn C Goldstein, Ben Jiao (Benjor), Cynthia M Beall & Phuntsog Tsering**, Fertility and Family Planning in Rural Tibet. In *The China Journal* no 47, January 2002, pp19-39

group, so they would have to sequester their wives away from the group – which means that they would have no mechanism or incentive to co-operate in the organisation of a hunting band, and their children would have no social group in which to produce consensuses of new language forms.

However, the problems with Deacon's model in terms of the transmission mechanism should not be overstated. The heart of his theory, that language is in a constant state of change because of infidelities in transgenerational transmission, is clearly true. The way human children acquire language is not just a reflection of the way humans got to language, it *is* the way humans got to language. Grammaticalization, as this process of language change is known in linguistics, began when the first segmented utterances were made, and it continues to happen today[445].

10.2. Children and Co-operation

Humans co-operate; we have built both physical and social edifices that are beyond the abilities of most other animals, and co-operation is at the heart of our signalling system, language[446]. But are we born co-operative? Looking at the behaviour of infants it would seem to be so, and there are good evolutionary reasons to believe it is so. We are a co-operative species, which means that, for whatever reason, co-operation is a trait that makes a fit human being[447]; and any trait that is selected for in an evolutionary environment will tend to get emphasised. If co-operation is a positive outcome of genetic traits then successful co-operators raise more children with those traits to adulthood. This creates a feedback loop which emphasises the genetic traits that advance co-operation[448]. Of course, co-operation remains a strange trait to be emphasised genetically because it is always open to exploitation by non-co-operators; but if the altruistic punishments for non-co-operation, such as social exclusion, are sufficiently debilitating to non-co-operating individuals then co-operation remains the fitter strategy.

Yet we are not born fully co-operative. We have certain skills that are present at birth, such as an awareness of and attraction to other humans, especially our primary carer[449], and we tend to treat most of our encounters with others, up to the age of four at least, as benign. There is a

[445] **Paul J Hopper & Elizabeth Closs Traugott**, *Grammaticalization*
[446] **Paul Grice**, *Studies in the Way of Words*, pp26-31
[447] **Peter D Taylor & Troy Day**, Cooperate with thy Neighbour? In *Nature*, vol 428, 8 April 2004, pp611-612
[448] **Arne Traulsen and Martin A. Nowak**, Evolution of cooperation by multilevel selection. In *PNAS*, July 18 2006, vol103 no29, pp10952–10955
[449] **Jane M Healy**, *Your Child's Growing Mind: a practical guide to brain development and learning from birth to adolescence*, pp15-17

default assumption, which appears to be innate, that people are co-operating with me even if I am not yet able to understand how to co-operate with them[450].

Nonetheless, most of our co-operative behaviours are acquired after birth. Children do not play co-operatively until about age three: below that age they use parallel play, sitting and playing in the same place, sometimes with the same objects, but not at the same game[451]. And, even though three-year-old children are willing to share an imagined universe for play purposes, there is an important difference between the co-operation of a three-year-old and that of a four-year-old. At age three we co-operate because our desire to play our game must mean that everyone wants to play our game – there is only one intention in the universe. At age four we are aware that others may or may not want to play – they have their own intentions. This ability to view others as having intentions is often regarded as the start of Theory of Mind, and therefore the starting point for the use of language as true dialogue rather than vocalised thought[452]. Russell Meares and Gavin Sullivan take the view that before this point the child does not have an internal dialogue of "inner speech", only external "social speech"[453].

If co-operation is innate for humans, but also the product of socialisation, can we get any clues as to the relative importance of these two effects by looking at cases where things have gone wrong? There are two types of child to be studied here: sociologically deprived children – those given a grossly abnormal childhood; and pathologically deprived children – those living at the extreme end of the autistic spectrum. There have been few well-recorded cases of feral children, and not many more anecdotal tales. The best documented case is that of Genie, who was kept isolated from human company by her father in a world without language until age 13. Her subsequent exploitation by scientists and abandonment by Social Services meant that she never experienced anything like a normal life; and as a test of nature versus nurture, Genie's case is hopelessly compromised. She eventually disappeared into obscurity when she dropped off the radar of scientific novelty[454].

Other feral children provide similar problems in assessing the relative impacts of nature and nurture on development: the extreme circumstances of their lives mean that it is hard to isolate causes and effects in the abnormality of their personalities. However, some general conclusions

[450] **Alison Gopnik, Andrew Meltzoff & Patricia Kuhl**, *How Babies Think*, pp25-31
[451] **Sarah Brewer**, *A Child's World: a unique insight into how children think*, pp30-31
[452] **Joseph Foley & Linda Thompson**, *Language Learning: a lifelong process*, pp25-29
[453] **Russell Meares & Gavin Sullivan**, Two Forms of Human Language. In Geoff Williams & Annabelle Lukin (eds), *The Development of Language: functional perspectives on species and individuals*
[454] **Michael Newton**, *Savage Girls and Wild Boys: a history of feral children*, ch7

can be drawn. The first is that, in all cases, both socialisation and language were abnormal, and never developed to unremarkable normality. The second is that the levels of socialisation and language finally achieved varied considerably, although there was a rough equivalence of the two levels in all cases – high language achievement mapped to high socialisation, and *vice versa*. Third, although the level of co-operation is also highly variable, where language and socialisation are high then so is co-operation; but it is impossible to judge whether co-operation is the source or outcome of language.

When looking at autistic children, nature and nurture are easier to disentangle. Most autistic children are exposed to childhoods similar to those of other children, it is their response to the care and support offered that is unusual. Autistic children are desocialised in regular and predictable ways: they seem to have a faulty Theory of Mind, they are literal in their linguistic comprehension, and they are deficient in their linguistic production. They also have difficulties co-operating with others, whether in shared enterprises or at play, preferring stereotyped patterns of behaviour to experimentation.[455]. There is something clearly different about the autistic brain.

Uta Frith believes a single cognitive component is damaged in the brains of autistics, and identifies this component as "the ability to think about thoughts or to imagine another individual's state of mind". This maps well to the term *Theory of Mind* as used in this dissertation[456].

For Simon Baron-Cohen the problem is more complex: humans have two stimuli that are significant in our development of Theory of Mind. The first is the Intentionality Detector, which maps the actions of others onto a mental representation of desires and goals; for instance, seeing a person walking can be interpreted as their wish to move towards or away from something. The second stimulus is the Eye Direction Detector, which maps the gaze of others as indicating desires and goals; for instance, the observed person could be looking at what they are moving towards or away from. Both of these stimuli are dyadic representations between the observed agent and their goal, but they are combined in the Shared Attention Module to give a triadic relationship between the agent, the self and the goal. Baron-Cohen does not provide a mechanism by which the role of non-self agent can be redefined as the self, and this may be a

[455] **Peter K Smith, Helen Cowie & Mark Blades**, *Understanding Children's Development* (4th edition), pp477-481
[456] **Uta Frith**, Autism. In *The Scientific American Book of the Brain*.

problem with his analysis. Nonetheless, the Shared Attention Module sets the stage for the Theory of Mind Module, which makes us fully human.

For Baron-Cohen, autism is an impairment of the Shared Attention Module. Autistic children interpret the actions of others in a mechanistic way, and are able to identify where the attention of others is directed; but they cannot understand that there is a reason why others have goals, so there is no triadic relationship possible between self, other and goal. Theory of Mind is compromised before it begins[457].

It is now becoming clear that autism is identifiable in terms of brain function. When performing tasks that involve modelling the minds of others, non-autistic and autistic brains have very different patterns of activation: the prefrontal cortex is heavily used by non-autistics but remains inactive in autistic brains[458]. This area of the brain is larger in humans than other animals, and is associated with distinctly human cognitive faculties: planning, imagination, selfhood, other awareness, working memory, and space-time cognition[459].

Through the study of autism we can thus see both the significance of co-operation for humans, and what part of the brain is involved. As the prefrontal cortex in archaic *Homo sapiens* was almost as well-developed as in modern humans[460], we can say with some confidence that our speciation event did not involve a dramatic change in this area of the brain. But we can also see that, through the prefrontal cortex, co-operation is intimately tied in to modelling of self and others. Do we co-operate because of our modelling, or do we model to enhance our co-operation? The answer is probably that each enhances the other: modelling allowed our ancestors to anticipate and accommodate the intentions of others, which enhanced our co-operation; and co-operation gave us better understanding of the intentions of others, enhancing our modelling. The next section will look at the other half of this feedback loop: modelling of self and others.

[457] **Simon Baron-Cohen**, *Mindblindness: an essay on autism and Theory of Mind*, chs4-5
[458] **Rita Carter**, *Mapping the Mind*, pp141-143
[459] **Susan Greenfield**, *Brain Story: unlocking our inner world of emotions, memories, ideas and desires*, pp144-153
[460] **Leslie Aiello & Christopher Dean**, *An Introduction to Human Evolutionary Anatomy*, ch10

10.3. Children and Selfhood

The link between language acquisition and selfhood has a long pedigree. For Richard Albert Wilson, writing in 1937, the emergence of consciousness of self was the defining event in becoming human as a species[461].

Jean Piaget describes young children as linguistically egocentric: their utterances are mostly concerned with making explicit their internal dialogue rather than taking part in social dialogue, so their inadequate model of selfhood makes for a suboptimal use of language[462]. For Lev Vygotsky, the emergence of consciousness is gradual – a series of emergences of "consciousness of". Egocentric speech is only the first step in the internalisation of language, and is replaced at about age five by inner speech. Only when this has been achieved does self-consciousness begin[463].

We know from our own experience that knowledge of self is not present from birth: few if any humans remember their first year of life, and memories before age four are usually disjointed and isolated from the life-memories we use to define our self. In the first six months, babies are unaware that they are individuals and seem to treat other people and objects as physical extensions of themselves[464]. Between six months and two years, the infant is acculturated by their care-givers, what Kenneth Kaye describes as a development "from an organism to a person"[465]. After age two there is an identifiable self being asserted, and this often creates a period of carer-child conflict referred to as "the terrible twos"[466].

Alison Gopnik, Andrew Meltzoff and Patricia Kuhl provide a comprehensive description of the capacities in the developing child's knowledge of self and others, and a timetable for their appearance[467]. In the first few months the baby is learning how to use its birth-knowledge. It knows about human faces and voices, and it is busy learning to associate them with its caregivers – the baby is learning how to identify others. It also soon begins to learn about expressions, and what they can say about how the caregiver behaves. By age one, they are also beginning to see others as agents – people have an effect on the world and pay differential attention to it. The infant is learning what pointing and eye direction mean, and will look at the

[461] **Richard Albert Wilson**, *The Miraculous Birth of Language*, pp143-146
[462] **Jean Piaget**, *The Language and Thought of the Child*, pp39-43
[463] **Lev Vygotsky**, *Thought and Language*, pp217-235
[464] **Sarah Brewer**, *A Child's World: a unique insight into how children think*, pp17-23
[465] **Kenneth Kaye**, *The Mental and Social Life of Babies: how parents create persons*, p205
[466] **Sarah Brewer**, *A Child's World: a unique insight into how children think*, pp218-222
[467] **Alison Gopnik, Andrew Meltzoff & Patricia Kuhl**, *How Babies Think*, ch2

objects being attended to by others. Additionally, they are learning that the world can be affected remotely if the muscle-power of others can be recruited for the infant's use.

By eighteen months the child has usually gained an awareness that others have variable usefulness to the child – sometimes the other will help, other times they will not. They are also beginning to understand that others may not know everything the child knows, so giving as many clues as possible will facilitate the satisfaction of the child's wishes. It is probably not coincidental that children begin to use indexical word labelling at this age.

Empathy for others begins at about age two, and it is the conflict in the child's mind between getting their own way and pleasing others that leads to the tantrums. At age three the child is beginning to take control of their emotions. They are also fending for themselves in important ways, such as feeding, washing and dressing: given the raw materials, they can have a go at finishing the job. And they are learning about deception, although they do not seem to be very effective at it. They are aware that others have beliefs different to their own, and that these beliefs are manipulable – although their attempts to manipulate them are usually hopelessly ineffective. At age four this final problem is solved, and children are recognised to have a complete Theory of Mind: they can make effective guesses about what others are thinking and can attempt to manipulate those thoughts. They also learn an important lesson at this stage: successfully deceiving others who are aware that they can be deceived is a costly process in terms of cognition, involving deception in multiple modalities[468]; and when those others are humans they are more than willing to altruistically punish those they find deceiving them[469]. Nowadays, this punishment often takes the form of denying the child one of their innate needs: the need to socialise ("go to your room", "stand in the corner", "I'm not talking to you until you say sorry", and so on).

In the Gopnik, Meltzoff and Kuhl model we see a steady increase of knowledge of self, in lockstep with socialisation and co-operative behaviour. The young baby has no need for a concept of self or other, but the ability to co-opt the muscle-power of others – and the willingness of parents to have their muscle-power co-opted – creates a situation where having a concept of other is advantageous. As the child grows it learns that others are not just objects to

[468] **Alison Wray**, Dual Processing in Protolanguage: performance without competence. In Alison Wray (ed), *The Transition to Language*, pp128-129
[469] **James H. Fowler**, Altruistic Punishment and the Origin of Cooperation. In *PNAS*, May 10, 2005, vol 102, no 19, pp7047–7049

satisfy demands, they are agents who may or may not assist in particular circumstances. This leads on to the concept of manipulating others, the Machiavellian intelligence of apes.

But for humans, raised in a highly co-operative linguistic culture, the modelling of the child by others also becomes obvious to the child. The simple sentence "let's go to the park" requires the child to understand that the adult has a model of the child in a different place and time to now. Comprehending that others are making models of you allows you to make a model of yourself. Your model of you is actually your model of their model of you. As Gopnik, Meltzoff and Kuhl say of two-year-olds:

> It seems to most of us that the Other Minds problem really is about others. While we must infer the thoughts of other people, we at least know for certain what we think ourselves. In fact, Descartes argued that the only thing we really know for certain is what we think ourselves; "I think, therefore I am." The children, though, make just the same mistakes whether they are reporting their own mental state or predicting the mental states of other people. It's as if they have a single theory about the mind, which they apply both to themselves and to others. They don't seem to understand their own minds any better than they understand the minds of the people around them. It may seem that we learn about other people by comparing them with ourselves. But, in fact, the research suggests that we also learn about our own minds by observing other people.[470]

From the modelling of others, the modelling of the self as a first-person agent becomes possible. Self-knowledge becomes both advantageous and sought-after. We begin to build a model not just of what others think about us, but what we want to think about ourselves: we define and build our own individual personalities. Co-operation, socialisation and culture drive us towards language, language drives us towards self awareness, and self awareness drives us towards further co-operation. Our innate need to co-operate is the engine that powers language acquisition and Theory of Mind; but it is the co-operative culture of altruistic punishment that creates the environment in which these systems can flourish.

10.4. Children and Language

I have argued above that the process of individual grammar acquisition can follow a roughly similar path to the cultural process of grammar genesis. The mental structures that enabled the generation of grammar in the first ever language are likely to be the same mental structures that a child uses to generate their own grammar. It should be possible to see the same stages of syntax in child language acquisition as has been posited for the origins of grammar: first, there should be monolithic, holistic signals; then the two-part, one-argument segmented signals of

[470] **Alison Gopnik, Andrew Meltzoff & Patricia Kuhl**, *How Babies Think*, p47

action-object syntax; next, the three-part, two argument signals of subject-verb-object syntax; and finally the multi-segmented signals of full speech. In addition, the child's mental modelling capacity should be mappable to the same check points as the grammatical stages. These checkpoints are not analogue – we would not expect to encounter two-and-a-half word utterances – so they should be amenable to a Piagetian approach.

Several attempts have been made at producing a Piagetian structural model of language acquisition. Roger Brown was one of the first, and he proposed three stages of language acquisition in young children. He divided the child's life into pre-language, which lasts up to about 6 months; one-word utterances, which lasts up to about 18 months; two-word utterances, which lasts up to about 36 months, and full language which starts at about 36 months[471]. Kathy Hirsh-Pasek and Roberta Michnick Golinkoff produce a slightly different agenda: up to about 9 months the child is involved with acoustic packaging, associating sounds with things; from about 9 months they are working on segmentation and linguistic mapping, matching words to things and learning about attention; from about 24 months they are dealing with complex syntactic analysis, at least to the level of two-argument forms; and from about 36 months they are dealing with full language[472].

Michael Halliday's functional approach to his son's language development was less concerned with a timetable, and more with the process of development. He sampled his son's communication every six weeks from 9 months to 18 months, measuring developments against seven message functions: the instrumental function, messages about the child's physical needs; the regulatory function, messages to control the behaviour of others; the interactional function, establishing the sender-receiver relationship; the personal function, messages about the child themself; the heuristic function, asking questions about the world; the imaginative function, establishing a shared fantasy world with others; and the informative function, telling others things they don't know[473].

Halliday discovered that the total of utterances in all functions steadily increased. He also found that throughout the study period there were no informative utterances, and heuristic utterances only began to occur in the last sampling, at 18 months. Imaginative utterances only began at 12 months. Because of the limited numbers in his sample size (most of the individual function

[471] **Roger Brown**, Three Processes in the Child's Acquisition of Syntax. In *Psycholinguistics: selected papers by Roger Brown*
[472] **Kathy Hirsh-Pasek & Roberta Michnick Golinkoff**, *The Origins of Grammar: evidence from early language comprehension*
[473] **Michael A K Halliday**, *Learning How to Mean: explorations in the development of language*

counts were below 10) it is hard to make statistically significant judgements on his data, but he clearly identifies a phase change after the 16.5-month sample: the number of utterances of all kinds in the final sample was 145, just one less than the total number of utterances in all other samples. At about 18 months, language use appears to take off both in the number of functions used and in volume.

Halliday also identified three phases of language development which extended into adulthood: language learning, which is dominant up to about two years; learning through language, which starts at about two years of age; and learning about language, which starts at about age four[474]. For Halliday, language is not a skill fully accomplished in the early years, it continues in different ways throughout life.

Alison Gopnik, Andrew Meltzoff and Patricia Kuhl offer yet another timetable of childhood language acquisition. Up to about 12 months the child is organising sounds into syllables, and this divides into three stages. Up to 8 months there is generalised soundmaking, which is indistinguishable between children of different language environments; at about 8 months language-specific babbling begins, with the production of sounds relevant in the child's individual language environment; and words begin to be used at about 12 months, if a word is considered to be an arbitrary relationship between an object or action and a sound string. Wordlike sounds occur earlier, but it is at about 12 months that the child begins to ask for labels, often by using a single word demand such as *wassat?* or *wassis?* By about 24 months the child is using a simple grammar, initially two-word but later becoming slightly more complex. However, the full structure of language is not used at this stage; for instance, English-speaking children do not fully recognise or use affixes like plurals and inflections at this age. By about 36 months the child is using full syntax, and can produce three-argument sentences involving adpositionals[475].

The phase shifts of language given by all the models above are highly variable, and nobody would back a species-specific calendrical schedule for language learning[476]. However there is agreement about there being several stages in language acquisition; and, more importantly, there seem to be detectable phase changes between the stages – as if a new set of rules is being

[474] **Michael A K Halliday**, Three Aspects of Children's Language Development: learning language, learning through language, learning about language. In *The Language of Early Childhood*, ch14
[475] **Alison Gopnik, Andrew Meltzoff & Patricia Kuhl**, *How Babies Think*, ch4
[476] **Elizabeth Bates, Philip S Dale & Donna Thal**, Individual Differences and their Implications for Theories of Language Development. In *The Handbook of Child Language*

learned and applied, sometimes replacing the old set and sometimes supplementing it. These stages can be identified as:

- **The pre-language stage**: a sound is a sound. It can attract attention but there is little differentiation between the effect of different sounds.
- **The phonetic stage**: some sounds appear to elicit better responses from carers than others. These are the language sounds that the carers associate with "being human", but the child is not aware of this. Leila Berg describes this as speaking a language tune, "the tune of … people who are important to him, and who respond with delight"[477].
- **The word stage**: sounds have meaning. Objects can be requested or named with sounds. Personal wants can be better met by making the right sound for the effect desired. The use of sounds is however, indexical and not symbolic.
- **The two-word stage**: words can be combined to produce more accurate requests and enhanced outcomes. There is some symbolic usage at this stage in that sound combinations are recognised by the child to be segmented words which can be used in a range of circumstances[478]. There is also a growing recognition that words combined in different ways have different effects: *kiss teddy* means that mummy is to kiss teddy; *teddy kiss* means that teddy is to kiss mummy[479]. The child seems to grasp the interchangeability of proto-symbols within a fixed structure, with the binary action-object relationship being the basis for the structure. This seems to be the highest stage reached by animals taught human language in a human cultural environment[480].
- **The simple grammar stage**: for every action there is someone to do it and someone or something to which it is done. *Mummy kiss teddy* is different to *teddy kiss mummy*, but *daddy kiss teddy* is also different; *juice in cup* is one outcome, but *juice in bottle* is another. Most importantly, *I want x* seems to work better than *gimme*, and adding *please* works even better.
- **The full language stage**: the child's knowledge of the syntax of their first language(s) is largely complete; although there may still be complex relationships to be found in language, no new set of rules will be needed to understand them, only occasional, local rules.

[477] **Leila Berg**, *Look at Kids*, p7
[478] **Michael Tomasello**, *Constructing a Language: a usage-based theory of language acquisition*, pp139-140
[479] **Alison Gopnik, Andrew Meltzoff & Patricia Kuhl**, *How Babies Think*, p117
[480] **Michael Tomasello**, On the Different Origins of Symbols and Grammar. In Morten H Christiansen & Simon Kirby (eds), *Language Evolution*, ch6

The last four stages are similar to the stages of species language development proposed in this dissertation: monolithic signals in nonhuman signalling; an object-action syntax allowing two-part segmented cognition (although for nonhumans, not actually producing signals); an instigator-action-recipient syntax, which allows two-argument grammar but not complex hierarchical grammar; and full three-argument grammar, which allows full language.

The stages of language acquisition occur at approximately the same time in all humans because there is a predisposition in humans towards language. This predisposition is likely to have evolved over the 5,000 generations of human selection in a linguistic culture, and it is likely to be at least partially encoded at the genetic level: humans born predisposed to language are likely to have had greater reproductive success than those born with less predisposition in that area. This does not, however, need to be a predisposition towards any particular form of language – the fact that there is so much grammatical variation between languages makes this unlikely. There is no requirement for anything more than the most basic Universal Grammar, satisfying the need for the exchange of three-argument models.

Early language acquisition by children is happening in an environment where the sender does not necessarily have the same map of an utterance as the receiver. Where the receiver hears *dada* as a word, the sender is only aware of it as a sound; the term *wassat?* represents a full sentence to the receiver, but a single prompting word to the sender. Children can produce utterances that meet the adult definition of a sign or a segmented signal without being aware that they are doing so.

What causes this benign cognitive dissonance? The first explanation is provided by Robbins Burling: language development is not as swift or complete as current models lead us to believe[481]. The second explanation comes from Alison Wray: it is possible for the child to produce utterances which make them appear cleverer than they are – performance without competence[482]. Add to this the current Western cultural view that children of age four to five are sufficiently capable in the use of language to enter a formal education system (the Greeks and Romans waited until age six to seven – Piaget would have approved), and we have a cultural model of the child's brain as "largely complete" by age five. This is remarkable in terms of brain development, which we know continues apace through puberty[483]; it is also remarkable in

[481] **Robbins Burling**, *The Talking Ape: how language evolved*, ch8
[482] **Alison Wray**, *Formulaic Language and the Lexicon*, part III
[483] **Leslie Sabbagh**, The Teen Brain, Hard at Work – no, really. In *Scientific American Mind*, vol 17 no 4, August/September 2006, pp20-25

terms of time barriers to language acquisition. The cut-off point for the start of language learning is commonly put at about age eleven[484]; even Steven Pinker puts it no earlier than six[485]. After this age, full syntactic language seems to be unachievable, but starting at any point before the cut-off age seems to produce full language competence.

One of the more reliable measures of child language capability is the size of their vocabulary. This is commonly expressed as being 50-500 words by age two, then increasing by about 3,500 words a year until age six, at least 3,000 words a year until age 17, and thereafter a few hundred a year[486]. As the difference between 3,500 and 3,000 is not great, it would be fair to say that there are three significant periods in lexical acquisition: up to age two, two to 17, and over 17. In lexical acquisition there appear to be no significant events occurring at 18 months or 36 months. In addition when we look at some specific cases of complex language acquisition, we see that "full language" may be a premature description for the five-year-old. In the English passive construction, children appear to be relying on unreliable non-embedded structural clues:

> Comprehension of the passive also requires that the child notice and understand the function of the closed class word "by" (as in "The dog is being chased by the girl"). Since early speech is notorious for the absence of closed class items, and since theories of adult parsing (e.g. Wanner and Maratsos, 1978; Marcus, 1980) require the exploitation of the closed class, comprehension of the passive becomes of great interest. On this score, Maratsos and Abramovitch (1975) showed that children are sensitive to markers for the passive. Children's comprehension was disrupted when they were given sentences without the "by" (as in "The cat is licked the dog") or with a nonsense syllable inserted into the position occupied by the "by" (as in "The cat is licked po the dog").[487]

Some events, such as full comprehension of reflexives, occur even later:

> When studies have manipulated the internal structure of the sentences in which anaphors occur, correct comprehension is sometimes as late as age eight. One way to complicate a sentence which includes an anaphor is to have it mention other potential referents for the anaphor. Deutsch, Koster, and Koster (1986) tested Dutch children with sentences such as the following:
>
> (8) The brother of Piet washes himself.
>
> (9) The brother of Piet washes him.
>
> Children appeared to reach asymptote on sentences like (8) by the age of eight. At the age of six, they were still only getting around 50 percent correct – too close to chance to consider reliable. Yet, the pronoun sentences such as (9) were even more difficult: even by age ten, children only got around 80 percent correct.[488]

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[484] **Ray Cattell**, *Children's Language: consensus and controversy*, pp193-200
[485] **Steven Pinker**, *The Language Instinct*, p293
[486] **Eve V Clark**, Later Lexical Development and Word Formation. In *The Handbook of Child Language*, ch14
[487] **Roberta Michnick Golinkoff & Kathy Hirsh-Pasek**, Reinterpreting Children's Sentence Comprehension: toward a new framework. In *The Handbook of Child Language*, p449
[488] ***Ibid***., pp455-456

This seems to give us a model of language development in children somewhat at odds with nativism[489]. Grammar acquisition is not a slow process of activation, but a process of experimentation: for a few months before they switch over to the new rule set of a new level of grammar, children are using a supplemented version of the old set, or they are shoehorning the new constructs into the old rules. For instance, when a child produces its first *dada* or *mama* we are willing to accept that it may be an accidental sound with no lexical content; but when we, as linguists, hear *kiss teddy* we are less willing to believe that it may actually be seen by the child as a single lexeme or sememe, *kissteddy*. If we accepted this then we would be forced to the conclusion that the moment when *kissteddy* becomes *kiss teddy* cannot be known, all we can say is that it must have occurred sometime after it apparently occurred. This is not a happy scientific conclusion, it says that our current methods and tools are not able to do the job we have given them; but sometimes the unpalatable has to be faced.

What can be said about similarities between the phylogenic and ontogenic development of grammar? It is true that phylogeny and ontogeny do not match exactly, but the ways in which they do match are notable. Phylogeny is likely to have gone through one-word, two-word, simple sentence and complex sentence stages, just like ontogeny, although not necessarily to the same schedule. In both models, temporality develops from a state where past and future have no reality to one where they can be used for modelling and exchanged between minds. Chris Knight has produced a list of dichotomies between nonhuman signalling and language[490]; and, if we apply this to children, we can see that they start off as indistinguishable from nonhumans. Child signalling starts off as analog, holistic, redundant, conservative, indexical, asynchronous and rule free, features that Knight identifies with nonhuman signalling; and it ends up as digital, combinatorial, productive, innovative, symbolic, synchronous and rule bound, the identifying features of language.

The newborn baby enters the world with some grammar capacities genetically encoded. Most importantly, they have not just the capacity to communicate, but a driven will to do so. It is possible that, as some linguists believe[491], this will is all that is needed. However, it is likely that evolution has also enhanced our communicative capacity since we first started using segmented signalling; and, if we continue to value fluent language use, it will continue to do so. It is likely that at least some aspects of grammar are genetically controlled.

[489] **Ray Cattell**, *Children's Language: consensus and controversy*, ch5
[490] **Chris Knight**, Sex and Language as Pretend Play. In *The Evolution of Culture*
[491] **Geoffrey Sampson**, *Educating Eve: the language instinct debate*

Over the years, however, several informed opinions have built a comprehensive argument against the position that language grammar is only explicable in terms of innate mechanisms. Robbins Burling has argued that the Formalist principle, that partial syntax cannot exist in language phylogeny[492], is disproved by partial syntax states in current language use; and that pidgins and child language use are the most obvious examples of this. He also looks in detail at child language acquisition and shows many cases where comprehension is obviously preceding production. These include nominalization, simple syntax and morphemic case-marking: in all cases children seem able to react correctly to spoken instructions incorporating these features, although they do not produce them in their everyday speech[493]. The language acquisition and production process is not a simple bi-directional system.

Burling also looks at the point at which a child becomes language-competent, this being usually identified as around five years of age. Burling points to the research of Carol Chomsky[494] to show that, for tough constructions, competence is not achieved until some time later. Tough constructions include detecting the difference between deferred and reflexive pronouns, using passives correctly, and interpreting idioms such as *John is hard to see*. Some children do not achieve competence in these areas until after age eight. Burling sees this as clear evidence that we overestimate the syntactic abilities of older children, when they are actually demonstrating what Wray calls performance without competence. Because the capacity to learn language grammar is underestimated in younger children, and knowledge of language grammar is overestimated in older children, Burling takes the view that the sudden switching on of full syntactic language in children is more apparent than real.

In considering the issue of competence and performance[495], Burling looks at the language acquisition process as an exercise in comprehension, and reaches some startling conclusions. The first is that competence in comprehension often runs ahead of production: children understand constructions in their first language some time before they begin to use them in speech. The second conclusion is that comprehension of the phonetic form of language is based partly upon an understanding of the gestures that accompany the sounds. Far from being in an impoverished speech environment, children live in a multi-modal world full of signals, and rich in redundancy.

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[492] **Robbins Burling**, *The Talking Ape: how language evolved*, ch6
[493] **Robbins Burling**, The Slow Growth of Language in Children. In *The Transition to Language: studies in the evolution of language*
[494] **Carol Chomsky**, *The Acquisition of Syntax in Children from 5-10*. 1959. Cambridge, Mass, USA: MIT Press
[495] **Robbins Burling**, Comprehension, Production and Conventionalisation in the Origins of Language. In *The Evolutionary Emergence of Language: social function and the origins of linguistic form*

Burling sees language as continuous with other forms of signalling, tracing a path from instrumental signals through ritualised signalling to conventional language. For instance, a dog's snarl is a ritualised form of bite: it has all the aspects of a bite (drawn-back lips, lowered bottom jaw, tense facial muscles) without the bite itself. The snarl has become ritualised in two ways: first, it stands for the bite without the bite occurring, and second it has become accentuated (lips drawn back even further than necessary, a growl added) to improve the message[496]. Ritualisation enhances the signal to emphasise the meaning of the gesture; and it contrasts with its opposite, conventionalisation, where the signal is reduced. Ritualisation occurs where the interests of sender and receiver are in conflict; conventionalisation occurs where they are in synchrony. A conventional signal arises when individuals replace a ritualised gesture with something simpler, such as often occurs in mother-child relationships. The interests of the mother include those of the child, so they are both seeking the same co-operative end: the signal to achieve that end need be no more than something the other party can recognise. This co-operative signalling bears a close resemblance to the reduced and symbolic nature of language[497].

Burling's phrase "comprehension without production" appears to be diametrically opposed to Wray's "performance without competence"[498]; but the two terms describe different effects on the language process. If I gain the understanding that *san fairy ann* is a World War I expression meaning *it doesn't matter*, but I never use it, then I am displaying comprehension without production; if I carry around in my head the knowledge that *san fairy ann* means *it doesn't matter*, but I do not know that it is a corruption of *ca ne fait rien*, then I am treating it as a holistic utterance and displaying performance without competence. It is possible for both to be operating at the same time.

Burling's work represents an important reanalysis of the data of child language acquisition and, when taken with Deacon's view of language development, poses some important questions about Formalist analyses of the data: language acquisition does not necessarily have to rely on a specialised universal cognitive device.

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[496] **Robbins Burling**, *The Talking Ape: how language evolved*, pp13-15
[497] **Chris Knight**, Play as Precursor of Phonology and Syntax. In Chris Knight, Michael Studdert-Kennedy & James R Hurford (eds), *The Evolutionary Emergence of Language: social function and the origins of linguistic form*, ch6
[498] **Alison Wray**, Dual Processing in Protolanguage: performance without competence. In Alison Wray (ed), *The Transition to Language*, ch6

10.5. The Human Child

the relationship between the human child and language is complex but vital. Language is a cultural skill the child cannot function successfully without. Indeed, children who are disadvantaged in the comprehension of speech (those with hearing difficulties, for instance)[499] or disadvantaged in its production[500] are often sidelined in human interactions. The very words, *deaf* and *dumb*, have associated meanings that render them unsuitable as effective neutral descriptors. Production and apprehension are not always good measures of competence, but we usually treat them as if they are.

As scientists, our view of the nature of language can affect our view of child development. If we see language as a self-contained cognitive module then we will look for a regularised schedule of development, and treat aberrations from this schedule as systemic failures. Successful developments in other cognitive areas have no bearing on language development, and the pathologies of language must be treated separately to other pathologies.

If, on the other hand, we see language as a product of other cognitive systems then it is difficult to identify any language-specific pathologies. What appear as linguistic issues must be the visibly emergent features of other developmental problems. This second view seems to map better to reality than the modular approach: most language impairments are traceable to nonlinguistic causes, and the remaining specific language impairments have a range of causes which do not indicate a single modular deficit[501] [502]. For instance, Mryna Gopnik's initial excitement at discovering a family that seemed to display a language-only deficit[503] has been moderated by further studies[504]. Child language acquisition seems to be the outcome of an interaction between innate capacities, physical system constraints and acculturation.

If we try to reconcile all models of child development set out above, we do not get a clear picture of how children achieve language, as the figure below shows.

[499] **Jonathan Rée**, *I See a Voice: language, deafness and the senses – a philosophical history*
[500] **Shula Chiat**, *Understanding Children with Language Problems*
[501] **Paul Fletcher**, Specific Language Impairment. In Martyn Barrett (ed), *The Development of Language*, ch13
[502] **Jon F Miller & Thomas Klee**, Computational Approaches to the Analysis of Language Impairment. In Paul Fletcher & Brian MacWhinney (eds), *The Handbook of Child Language*, ch20
[503] **Myrna Gopnik**, Familial Language Impairment: more English evidence. In *Folia Phoniatrica et Logopaedica*, 51 (1-2) 99, pp5-19
[504] **K E Watkins, N F Dronkers & F Vargha-Khadem**, Behavioural Analysis of an Inherited Speech and Language Disorder: comparison with acquired aphasia. In *Brain* (2002), 125, pp452-464

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<tr><th>0-6</th><th>6-9</th><th>9-12</th><th>12-18</th><th>18-24</th><th>24-36</th><th>36-48</th><th>>48</th><th>Theorist</th></tr>
<tr><td colspan="5">Sensorimotor stage</td><td colspan="3">Preoperational stage</td><td>Piaget</td></tr>
<tr><td colspan="5">Preverbal thought</td><td colspan="3">Verbal thought</td><td>Vygotsky</td></tr>
<tr><td colspan="6">Parallel play</td><td>Co-operative play</td><td>Intentional play</td><td>Brewer</td></tr>
<tr><td>Unaware of self</td><td colspan="4">Acculturation in progress</td><td colspan="3">Self aware</td><td>Kaye, Brewer</td></tr>
<tr><td colspan="7">Encounters with others treated by default as benign</td><td>Others have minds</td><td>Gopnik, Meltzoff, Kuhl</td></tr>
<tr><td>Learning about others</td><td colspan="2">Learning expressions and behaviour</td><td>Others are agents</td><td>Others have agendas</td><td>Empathy</td><td>Taking control of self</td><td>Theory of Mind</td><td>Gopnik, Meltzoff, Kuhl</td></tr>
<tr><td colspan="2">Generalised soundmaking</td><td>Language-specific babbling</td><td colspan="2">Single words</td><td>Simple Grammar</td><td colspan="2">Full language</td><td>Gopnik, Meltzoff, Kuhl</td></tr>
<tr><td>Pre-language</td><td colspan="3">One word utterances</td><td colspan="2">Two word utterances</td><td colspan="2">Full language</td><td>Brown</td></tr>
<tr><td colspan="2">Accoustic packaging</td><td colspan="3">Segmentation, linguistic mapping</td><td>Complex syntactic analysis</td><td colspan="2">Full language</td><td>Hirsh-Pasek, Golinkoff</td></tr>
<tr><td colspan="2"></td><td>Instrumental, Obligatory, Intentional, Personal functions</td><td>Imaginative function</td><td colspan="2">Heuristic Function</td><td colspan="2">Informative function?</td><td>Halliday</td></tr>
<tr><td colspan="5">Language learning</td><td colspan="2">Learning through language</td><td>Learning about language</td><td>Halliday</td></tr>
<tr><td colspan="5">Vocabulary up to 500 words</td><td colspan="3">Vocabulary increasing by 3,500 words p.a.</td><td>Clark</td></tr>
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Figure 12 - Different Theories of Childhood Development

However, we can very roughly divide childhood into phases based around the year boundaries. Before one year the child is involved in learning about its world, identifying its carers, and building a model of the universe; it is dividing the world into self and other and developing a sense of what that "other" is. From one to two years they are developing a sense of self. Imagination is beginning to make itself felt and is being expressed in language; and the child is beginning to see others as agents with their own agendas. After age two the child is attempting to manipulate others to achieve their own ends. The terrible twos are a time when the child is deploying the only weapons it knows about – anger, frustration and dominance – to get their own way; but it is also a time when the child is beginning to understand about the agendas of others and develop empathy – they are becoming other aware.

By age three the child is beginning to understand that others are making models of them and that they can make models of themselves. They are taking control of their own self and becoming self aware. They are co-operating in play and using all the basic forms and functions of language. However, modelling of the self is not something that happens as soon as the child is aware that it is possible; the child has to practise the skill and refine it, as with any learned skill. Thus it is not until age four that we see effective deception, intentional play and the understanding of metalinguistic effects. At age four there remains a lot to be learned in terms of how others and the self work, but the child has sufficient Theory of Mind to be able to begin the

rest of the journey to adulthood in a human culture as a self-recognising individual. They may not yet fully understand the way that human culture works, but they have the necessary tools to complete their understanding.

In the child's development, innate co-operative behaviour leads to awareness of others. This leads to a modelling of the motivations of those others, and to communication with those others via language. Through communication the child becomes aware that others are also able to model, and some of the models they make are of the child themself. Around age three the child puts this recursive knowledge to use, and begins to self model. This reveals the higher orders of intentionality created by making models within models, and leads to a Theory of Mind – not just the minds of others but the child's own mind, too. All that remains is to explore this Theory of Mind to understand others – and the self – as something more than agents.

Part 4: Conclusion

11. Summary and Conclusion

On pages 10 through 12 of this dissertation the following eight questions were asked about grammar:

- Why do we differentiate action and object, and why do we use the three-argument structure in our utterances?
- Where did the action-object differentiation and the instigator-action-recipient form come from?
- How did humans become able to habitually share knowledge, despite the costs that sharing entails?
- Could the segmented nature of language help us to understand when and how cognitive segmentation became so easy for us?
- What makes for a successful transfer of information, and why is language so effective in this role?
- Why do humans collude in constructing a shared meta-reality, and what role does language play in this?
- Is the symbolism we use in language a product of symbolic cognition, or vice versa?
- How, as a species, did we get to be good at mindreading?

This leads to a final question: how good has this dissertation been at answering these questions? All of these questions will be addressed in this chapter.

11.1. The Journey to Grammar

In answering the eight questions we have taken a journey along many different paths, visiting a range of subject areas. First was segmented signalling, and it was shown that segmentation, while not exclusive to language, is an important feature of grammar. Segmentation permits complexity in a signal; and, if this complexity becomes extreme enough, a rule system is needed to make it work effectively.

Next, meaning and value were discussed. Meaning was defined as the intentional value in a signal – signals do not have meaning unless the sender is able to model the mind of the receiver and adjust the value of the signal accordingly, and the receiver is able to model the mind of the sender to identify their signalling intention. Meaning requires negotiation in the signal; so under this definition most, perhaps all, nonhuman signals do not have meaning, only value.

The problem of how to analyse a system like signalling was next considered – should it be seen as a structure consisting of components or a process consisting of functions? The components of signalling were first reviewed and their hierarchical structure examined. The nesting of receiver and signal within signalling, sender and message within signal, and referent and receiver-action within message was shown to reflect a hierarchy of signal types in which increasing knowledge about the signalling environment permitted increasingly complex signal modelling. The relationships of sender and receiver to the signal were examined to show that signalling does not need to be seen as a single system by either party for signals to work. The values of the signal to sender and receiver are usually different, and the signal therefore represents co-incident rather than mutual interests. This raised the question of who sees the signal as a single system if the sender and receiver cannot, and the fourth-person viewpoint was invoked to explain this. This is the viewpoint of a disinterested observer – and there appears to be only one species currently capable of, and interested in, adopting this role.

The structural components of signalling were then compared to the process functions, and it was shown that there is a high level of correspondence between them: sender, receiver, referent and receiver-action are all base components of structure and functions of process. It is important to understand any system as both a hierarchical structure and a process of flows, and in the case of signalling this is made relatively simple; because structure can be easily identified in process, and vice versa, signalling can be viewed as a single, integrated system.

The component that does not map exactly to its corresponding function, the message, nonetheless displays features that indicate a level of co-identity. The three components around the message – referent, receiver-action and the message itself – map to the three viewpoints of the message – sender, receiver and fourth person. Although there is no direct mapping of component to function there is, on some level, a commonality.

When this same exercise was tried on language, an integrated model proved difficult to formulate. The traditional Formalist analysis of language treats it as a deeply hierarchical structure, with levels within levels and no obvious process flow. The traditional Functionalist analysis, on the other hand, consists of four simultaneous processes, each of which uses the same linguistic resources given in the message for very different ends. The viewpoints of sender, receiver and fourth person are represented by the textual, experiential and interpersonal metafunctions; but, because humans are able to model both themselves and others, all three metafunctions are available to all three parties to the message simultaneously. The fourth

process, the logical metafunction, allows not just the current viewpoints of self and others to become part of the message, it allows previous viewpoints to also become part of the current discourse. Language is concerned with what was as well as what is; and, by extension, what will be.

To reconcile Formalist and Functionalist models, both had to be simplified. The Formalist model was stripped down to a limited set of forms of increasing complexity. The holistic verb form combines with a noun form to make a one-argument form; the one-argument form combines with a noun form to make a two-argument form; and the two-argument form combines with a noun form to make the three-argument form. This three-argument form also reflects the Functionalist model by including the viewpoints of sender (what is said), receiver (what is heard) and the fourth person (what is meant). Additionally, structure dictates process: the linking of three objects through a single action means that the three-argument form is a two-dimensional model and therefore cannot be directly a sequential process. Sequentiality is produced by syntactic rules imposed to reduce the two-dimensional process to a one-dimensional stream of speech. In the simplified Formalist and Functionalist models we can see clear correspondences between structure and process, and a unified – although heavily simplified – system model of language becomes possible.

The nature of modelling itself was next examined. The three concepts of intentionality, Theory of Mind and consciousness were reviewed to identify their significance for language. It was shown that, while third order intentionality and Theory of Mind are defining features of being human, they do not by themselves get us to language. What they do enable is the ability to model others. Once there is understanding that there are ideas about things, and that others can have those ideas, there is a need to develop strategies to anticipate the ideas – and intentions – of others. Some other animals seem to be able to use second order intentionality – understanding that others have ideas about things – and model the minds of those others having those ideas. Only humans, however, can use third order intentionality and Theory of Mind – understanding that others have ideas about ideas – and model the minds of others modelling other minds in turn.

Humans can also do something very unusual: they can model their own minds. We don't do this with any great accuracy, although the illusion that we know our own minds best is part of being human. Self-mindreading is obviously an emergent feature of reading the minds of others, but it is puzzling in evolutionary terms: by treating the self as equivalent to others we are treating it

dispassionately. Self modelling is unlikely to have emerged simply from modelling others, it is likely that a second capacity would have been necessary. This dissertation has argued that it is the willingness to communicate our models of other minds that created the possibility for self modelling. By recognising that some of the modelled others in received signals are the receiver themself, it is possible for the receiver to see that others are modelling them, opening the possibility for the receiver to model themself. Self-modelling therefore requires the pre-existence of some form of language that allows models of others to be shared; it is a product of language and not a progenitor.

This leaves the question of how we became co-operative enough to share our models of each other, and in chapter 8 a story was proposed to explain how this could have happened. First, the standard cultural milestones in human development (civilisation, the Upper Paleolithic transition, the origins of art, the diaspora out of Africa) were reviewed and found to be inadequate explanations for language origins: either they required a pre-existing language or they could have happened without it. The cultural event likely to have seen the beginnings of full language, and therefore grammar, had to be an event requiring the sharing of two-argument models of social interaction. It required both a need to share and a willingness to do so. Only one model of the origins of human culture matched these requirements: the female kin coalition model of Chris Knight, Camilla Power and Ian Watts. This model provided the need to communicate social models in order to enforce the coalition and prevent cheating; and it provided the willingness to do so in that non-co-operation with the coalition effectively curtailed the reproductive success of cheating females. The model also provides for male-male co-operation in the hunting party, and male-female co-operation through the ritualization of sex for meat; but male-female co-operation is not individual males co-operating with individual females, it is the male group co-operating with the female group.

The cultural revolution of the female kin coalition seems to have occurred very early in *Homo sapiens* history, indicating that whatever made the coalition possible is very likely to have been part of the *H. sapiens* speciation event. According to this dissertation the twin events of increased altruistic punishment and recognition of the group as a reified entity created the necessary conditions for the female kin coalition. Humans are willing to punish others who break arbitrary rules imposed at the group level – we do not need to be personally affected by the infraction to be affronted and join in the punishment of malfeasants. The enhanced willingness to punish and the reified concept of the social group have combined to create a unique culturally enabling circumstance. The speciation events did not by themselves create

language, but they created the circumstance in which a cultural event that did require language could appear.

In chapters 9 and 10 evidence was sought for the accuracy of this theory from two very different directions. First, the grammar of temporality was examined to see if it contained any features in support of modelling of self and others. It was shown that the process of moving actions through time relies on the capacity to model the self in terms of the temporal point of the action, the adopted viewpoint of the action, and the present moment. Modelling is at the heart of our understanding of time.

The second source of evidence was the way children learn language. It was shown that both mastery of structure and use of metafunctions is a process of slow acquisition. Children do have a standard model in their heads from which language is built, but it is a model of social cognition and not a special-purpose language engine. When children acquire language they are applying models already available to them from millions of years of socialisation. It is not the grammar itself that is specifically human but the application of it to communication; and it is the sequential nature of speech that imposes a grammatical interpretation onto the cognitive three-argument form. Children do not learn language as an isolated phenomenon, they learn language to do things with words; and what they do with those words is take a full part in human society.

So what are the answers to the eight questions posed? In summary, they are as follows:

- Why do we differentiate action and object, and why do we use the three-argument structure in our utterances? *Because our cognitive models of social relationships require these forms, and a large part of what we do with language is share these social relationship models with others.*
- Where did the action-object differentiation and the instigator-action-recipient form come from? *From our social modelling of the relationships between others.*
- How did humans become able to habitually share knowledge, despite the costs that sharing entails? *We became genetically disposed to recognise the group as an entity, and to altruistically punish individuals who transgressed against the group. This, combined with a culture in which sharing social knowledge became a badge of belonging, created an environment in which honest sharing of information became a fit strategy.*
- Could the segmented nature of language help us to understand when and how cognitive segmentation became so easy for us? *No, cognitive segmentation preceded linguistic segmentation by millions of years. The signal segmentation of diana monkeys*

(Cercopithecus diana) indicates that signal segmentation is an ancient skill. However, the cognitive segmentation of social calculus provides a clue as to the types of segmentation that would have been necessary in early language.

- What makes for a successful transfer of information, and why is language so effective in this role? *In nonhumans, signals do not need to be an attempt by the sender to communicate with the receiver. Messages can pass without a cognitive relationship between sender and receiver, as long as the message produced by the sender is a reliable indicator for the receiver of a referent they would otherwise be unaware of. Neither sender nor receiver needs to be aware that the message has value to the other: information can be transferred without knowledge that it is happening. In language, however, the awareness by the sender of what will influence the receiver, and the willingness of the receiver to give the sender the "benefit of the doubt" about the relevance of their signal, creates a negotiation towards common meaning – all human dialogue is a process of "becoming to mean". This negotiation is what makes language so successful in ensuring cognitive consonance in signalling.*
- Why do humans collude in constructing a shared meta-reality, and what role does language play in this? *The meta-reality of being human is the reality of human culture. In recognising the group as a reified entity we have created something that only has existence because of our recognition of that existence – our first symbol. The acknowledgement of the group as an entity is, therefore, the first step in creating a meta-reality. With the female kin coalition this meta-reality becomes culture: group recognition is hierarchical – there are groups within groups. The female kin coalition is fully arbitrary, being linked (for very good organisational reasons) with the external object of the Moon, and (for very good communicative reasons) with the symbolism of ritual, appearance-change and role-taking. Our shared culture is our meta-reality, and language is the tool used to inform and enforce it.*
- Is the symbolism we use in language a product of symbolic cognition, or vice versa? *If the first symbol was "us", and a concept of "us" is needed for the cultural revolution that made language a necessity, then symbols in the cognitive realm must have preceded symbols – and grammar – in signalling*[505]*. There is a need, however, to explain not just the first symbol but the general process of symbolic usage; and the relationship between language and symbolic cognition is a wide, bi-directional highway. A large number of thought constructs are linguistic, in part or in whole. We use symbolic systems in*

[505] **Thomas E Dickins**, *Signal to Symbol: the first stage in the evolution of language*. PhD dissertation, University of Sheffield, 2000, p12

cognition because we have language, but what makes language such a rich symbolic system is the cognitive equivalency and differentiation processes permitted by a constantly expanding lexical structure.

- How, as a species, did we get to be good at mindreading? *The simple answer is that we are no better at mindreading than other animals. Our models of the minds of others are more sophisticated than other animals because we are able to model those minds making models of other minds; but this added sophistication does not make our models any more accurate, and may introduce new ways in which they can be wrong. What gives the illusion of efficient mindreading is the fact that we negotiate to meaning: it is easier to read the intentions of others when they have an interest in you doing so.*

Humans are good at language because 5,000 generations of human culture have emphasised genetic traits that favour language; and those 5,000 generations have also exploited the arbitrary nature of language to make language cognitively easy for humans. We did not become good at language and then begin to use it, the process of using it made both us and language good at each other. Grammar is not the product of a mutation that instantaneously gave us language; instead, there was a need to exchange accurate social models, and the form of those models and the limitations of the means and mode of that exchange are what gave us grammar.

11.2. The Journey On

What issues remain to be considered at the end of this dissertation? Because of its discursive nature there are several; and, because of its discursive nature, the theory of grammar origins presented here will remain speculative until further evidence is in place. So where will this new evidence come from?

Existing studies will need to be mined in order to discover whether they support or refute the theory proposed here. Particular attention must be paid to animal signalling studies and nonhuman language use, which have been only cursorily addressed. Studies of childhood language acquisition must also be revisited. While the examination made in chapter 10 is a hopeful indicator that cognitive and linguistic modelling is part of the child's learning experience, the studies selected are only a portion of the literature available. The extensive tests carried out by the Leipzig Primate Research Centre on infants and children have not been fully addressed, and the work of child language experts like Catherine Snow, Lila Gleitman and Eve Clark remain largely unexplored. There is much more information out there than has been discussed in this dissertation.

In addition to mining existing studies, it would be useful to define and carry out new studies based on the theory proposed here. Unfortunately, the opportunity for these kinds of study is very limited – there are few laboratories equipped for infant studies, and even fewer for animal studies. This, therefore, is likely to remain an aspiration rather than a realisation.

An even more difficult area of investigation is the genetic basis for altruistic punishment and recognition of the group. The first is already subject to extensive investigation, and I have little doubt that over the next decade the genetic and physical drivers of human altruistic punishment will be discovered. Group awareness is not currently subject to large-scale investigation, but should lend itself to an evidencing programme. The first step would be to create tests which could map group awareness as a brain function, and then identify the genetic drivers that produce that function in the brain. Studies of other primates would be needed to ascertain how the mapped functions work in their brains, and the stimulus-response conditions that trigger these functions will need to be examined. Finally, developmental child studies would be required to identify how group awareness becomes part of human cognition: is it a function that becomes active early, or is it emergent from other developmental functions?

One direction which may prove productive, and which is easier to examine, is adult grammar and modelling. The study of temporality has shown that this approach can provide useful evidence, and two other areas are likely to be particularly productive: the use and meaning of pronouns, and the use and function of the passive form. Both of these express important interpersonal relationships in language, and both are expressed as specific textual forms. Both also raise a series of questions about their expression. For instance, in most languages the first person plural pronoun is expressed as a single word, although it represents at least five very different meanings (me and you, me and someone not you, me and our group, me and my group excluding you, and me and everyone else). Regarding the passive form, in languages where it occurs it represents both an instigatorless form (*the book was read*) and a non-standard emphasis (*the book was read by John*). Yet in most languages the passive is not a special form but a specific case of the standard three-argument form. I have already undertaken some preliminary work in these areas which has not been reported in this dissertation. No contraindications for the theory proposed here have yet been found.

Another direction that needs to be further explored is Construction Grammar. This has been suggested as a useful model for language origins by several commentators[506] [507] [508], and the work of William Croft in this area has briefly been examined in this dissertation. Clearly the processes of producing language by construction and producing language by modelling are likely to have a close relationship, and work already done in this area provides a level of detailed analysis which, due to space constraints, is missing from this dissertation.

There is much work remaining to be done, but it is hoped that this dissertation provides a testable hypothesis which will inspire and encourage work in this area. I certainly hope to be able to personally add to the research being done.

11.3. The Origins of Grammar

In this chapter the process of producing this dissertation has been described in terms of a journey. This is a classical metaphor, as described by George Lakoff: changes are movements; expected progress is a travel schedule; long-term, purposeful activities are journeys[509]. In *The Fellowship of the Ring*, Frodo says of Bilbo:

> 'He used often to say there was only one Road; that it was like a great river: its springs were at every doorstep, and every path was its tributary. "It's a dangerous business, Frodo, going out of your door," he used to say. "You step into the Road, and if you don't keep your feet, there is no knowing where you might be swept off to."'[510]

Here we see a river being used as a metaphor for a road, and the road being used as a metaphor for a journey. The quotation is in turn being used in relation to the process of discovery that produced this dissertation, for which the metaphor of a journey has been used. Because I know that my readers are humans with whom I share human culture I can create this chain of meanings, from learning to changing to moving to journey to road to river, confident in the knowledge that my readers will co-operate in the mental modelling required.

Through the power of language the similarities in this chain of metaphor become more that just similarities: the dissertation truly was a journey, with the writer (and, hopefully, the reader) occupying different cognitive landscapes at the beginning and end of the journey. The mapping

[506] **Michael Tomasello & Patricia J Brooks**, Early Syntactic Development: a Construction Grammar approach. In Martyn Barrett (ed), *The Development of Language*
[507] **Paul Bloom**, *How Children Learn the Meanings of Words*
[508] **Brian MacWhinney**, The Emergence of Language from Embodiment. In Brian Macwhinney (ed), *The Emergence of Language*
[509] **George Lakoff**, The Contemporary Theory of Metaphor. In Andrew Ortony (ed), *Metaphor and Thought 2nd edition*, p220
[510] **J R R Tolkien**, *The Lord of the Rings: Part 1, The Fellowship of the Ring*, p78

of one model of reality (the journey) onto another (the dissertation) has produced not just correspondences between the two, each reality has enhanced our understanding of the other. This symbolic meaning-exchange between concepts is at the heart of language, and it is an outcome of the continuing negotiation to meaning that language involves[511].

What makes language so different to other signalling systems is not the forms that we use, nor is it the complexities that these forms allow us to communicate. The forms of grammar are both cognitively older than language and communicatively younger – grammar is an off-the-cognitive-shelf solution to a communicative need, and it takes the form it does because the cognitive models to be communicated already had that form. Grammar is not a cause of language, but its form can shed light on the initial purposes that language had to meet.

Language for language's sake does not work in evolutionary terms, it creates too many disadvantages for both sender and receiver. But language as a response to a social need does work, and a social need which is tied to an environment of high altruistic punishment and recognition of the group as an entity creates a environment where telling-about others is a fit strategy.

When we became genetically human all the capacities for language would have been present; but it is unlikely that the capacities could have been realised as language without a cultural syntax to provide the need to tell-about, the willingness to listen and the confidence to believe the telling to be true. Just any cultural syntax would not work, it had to provide systems of counter-dominance, altruistic punishment, intimate group living, allocare, role specialisation, and group and subgroup identities.

We are not the only species to have achieved this particular set of attributes, but it is notable that the other species in this circumstance also have complex societies with complex signalling systems[512] [513]. For instance, The eusocial insects (*termidae* and *hymenoptera*) have genetically suppressed cheating through fitness strategies – cheats cannot prosper in their societies because only a very limited number of the current generation can produce the next. If you are sterile, the only fit strategy left is to help your mother and sisters. Humans have adopted a different approach – probably because one human female cannot produce thousands of offspring in her

[511] **Andrew Goatly**, *The Language of Metaphors*, ch1
[512] **Reginald B Cocroft**, Vibrational Communication and the Ecology of Group Living, Herbivorous Insects. In *Amer. Zool*. 41: 2001, pp1215-1221
[513] **Wladimir J Alonso & Cynthia Schuck-Palm**, Sex Ratio Conflicts, Kin Selection and the Evolution of altruism. In *PNAS*, May 14 2002, Vol 99 no 10, pp6843-6847

lifetime. Nonetheless it seems likely that the human model was based around providing support for female relatives – a reproductive co-operative rather than eusocial dictatorship. We maintained our social compact by telling each other about each other, and we used a structure for our telling-about relationships that matched the way we mentally modelled those relationships.

We are human because, about 250,000 years ago, a new and successful mutation occurred; we live in our cultural environment because it is a successful response to being human; we have language because it is a successful response to living in a cultural environment; and we have grammar because it is a successful response to what we need to do with language. Language is doing things with words[514]; grammar is how we do it. Grammar is, therefore, primarily a response to a need and only secondarily a stimulus for change. If we want to study grammar as a phenomenon then the question "how does it work?" is clearly paramount. If, however, we wish to look at the origins of grammar then the question to be addressed is "what is it for?" Hopefully, this is the question that this dissertation has, in part, answered.

[514] **J L Austin**, *How to Do Things with Words*

Part 5: Bibliography and Index

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