

# Language evolution, narrative and the nature of cognition

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## Abstract

This paper supports the hypothesis that the forms that modern language assume are constrained by the need to represent externally, a wholly mind- internal Narrative of Thought. Beginning with an overview of research into the role of narrative in human culture, we go on to trace the trajectory of language evolution in relation to human cognition. We note the behavioural innovations that occurred less than 2 million years ago and argue that they arose from a greater degree of cooperation than any previous hominin species had displayed, and led to the emergence of intentional communication in the form of protolanguage. However, this stage in hominin cognition was not indicative of a qualitatively distinctive mode of thought, being grounded in subitizing, and that this is reflected in the cultural stasis that characterises the subsequent million years. The evolution of a uniquely human form of cognition, a System 2 type of thinking in Dual Processing Theory, is a more recent event which enabled the creation and retention of narrative structures through the recursive embedding of simple propositions. This new type of thinking and its external representation in linguistic narrative are seen to coevolve with aspects of autobiographical memory, a sense of self, and Theory of Mind.

**Key words:** *Narrative, Language evolution, Subitizing, Dual Processing Theory*

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## 1. Introduction

In recent years a number of studies have sought to explain aspects of the role of what we might term a ‘will to narrative’ in how, when and why language emerged and evolved in the hominin lineage (e.g. Tomasello, 2008; Victorri, 2002; Ferretti et al., 2017). In this paper we assess current evidence from anthropology, palaeontology, linguistics, and the cognitive and biological sciences, to provide more conclusive evidence that narrative, as both linguistic device and mental capacity, is the driving force for language evolution. We evaluate and synthesize some of the most important findings in these various disciplines to construct the most plausible ‘abduction’ (in the sense of C. S. Pierce) that can be made about the nature of the human capacity for narrative, which is commensurate with the scarce evolutionary data available. We intend this to be of use to researchers working in a variety of areas. It is worth noting at the outset that we assume a computational explanation of cognitive processes as the most credible explanation that accounts for the combinatoriality, systematicity and productivity of thought. While we shed further light on the nature of these processes in relation to language evolution, we do not have space to consider the arguments founded on alternative positions, such as connectionism and situated (embodied) cognition, which are extensively discussed and widely available elsewhere in the literature (e.g. Fodor, 1975, 2008; Pinker, 1997; Chalmers, 2011 and the subsequent debate along with the author’s response in Chalmers, 2012.)

We begin the next section with an overview of research into the role narrative plays in human culture, and go on to discuss the problems of definition in section 2. In sections 3 and 4, we examine the first significant developments in hominin cognition and communication, and we look in detail at two major hypotheses: subitizing and Dual Processing Theory. In section 5, we address the issue of the emergence of complex language, and,

in the following section, discuss the role of narrative in relation to memory, sense of self and Theory of Mind, before finishing with some concluding remarks.

## **2. The case for narrative**

It has long been recognised that all cultures have narratives and stories, and we have a compulsion both to tell and hear them (Barthes, 1966, Boyd, 2009). They permeate our lives in a number of domains including folk tales, comics, paintings, personal conversational stories, news stories, and so on (Barthes, 1966), and have been studied in an increasing number of disciplines (Herman, 2003). Additionally, over the last hundred years or so, research into why narratives should play such an important role has gained momentum, with early researchers laying the foundations for subsequent research, which we consider below. At the beginning of the twentieth century, Freud, as a pioneer of psychoanalysis, was instrumental in helping to focus attention on the nature of narrative and its origins. His reading of Darwin and of the Greek myths (in particular Sophocles's *Oedipus Rex*) and his own observations in his clinical practice led him to understand stories, in the form of myths, as expressions of fundamental desires projected into narrative form (Totem and Taboo, 1914/1989). He considered later literature to contain vestiges of these fundamental narratives which still appeal to our desires and supply the reason why we find them so compelling (see also Bettelheim, 1976, on children and the fairy tale). Whilst within the domains of psychoanalysis the content of stories was considered to be primary, another branch of enquiry into the nature of stories focussed on their structure. Beginning with Propp's (1928/1968) morphology of the folktale, the structural analyses of narrative was developed by the likes of Todorov (1966), Labov and Waletzky (1967, to which much sociolinguistic analysis of narrative is still indebted) and Genette (1972/1980). The

structuralist approach to storytelling found its apotheosis in the cultural anthropologist Lévi-Strauss's collection and analysis of Amerindian myths in his monumental four volume *Mythologiques* (1964; 1966; 1968; 1971). What was important for Lévi- Strauss was not so much the content of a narrative but the way in which the material of a narrative was organised. Lévi-Strauss's (1958) interpretation of myth draws on the Saussurian model of language: myth has both a *langue* (a grammar or structure) and a *parole* (various iterations of narratives). For Lévi- Strauss, myth's function is essentially 'scientific': it aims to resolve fundamental contradictions at the heart of human experience, such as: life and death, male and female, or nature and culture. It supplies an alternative means of understanding the world not based on the kind of scientific thought as it developed in Western industrialised societies.

From this broad base, which linked narrative with the inner workings of the mind, either in terms of content or structure (a dualism which persists as a problematic tension in much narrative research, Herman, 2003), there developed a number of other approaches to narrative, including, more recently, its relationship to evolutionary theory. Narratives are seen by some as a means of improving our chances of finding a mate (Miller, 2000) and by others as the evolutionary development of play undertaken during ontogeny (and engaged in by all mammals), which helps to mould our social skills (Boyd, 2009). They are equally considered to be a mechanism for honing neurocognitive organisation, thus enabling us to deal with potential situations which may arise in the future, but of which we have no direct experience (Tooby and Cosmides, 2001); this latter being something which Pinker also acknowledges when he says that 'fictional narratives supply us with a mental catalogue of the fatal conundrums we might face someday and the outcomes of strategies we could deploy in them' (1997: 543). Others consider them a means of understanding and coping with 'trouble' (Bruner, 2002), and a mechanism for dealing with crises (Victorri,

2002). They are at once deemed ‘useful fictions’ which act as a means of combatting anxiety generated as a result of the amount of information that human beings have to process (Austin, 2010), and as a means of exercising our Theory of Mind (ToM), thereby constituting a ‘workout’ for the mind (Zunshine, 2006). Additionally, they are viewed as vehicles of mental time travel (Corballis, 2013; 2015; Ferretti et al., 2017) and imaginary projection (Turner, 1996). Stories are also seen as a kind of ‘social glue’ which enhance social cohesion (Dissanayake, 1992; Gottshall, 2013;) and as a means of forming alliances (Dessalles, 2014).

Further studies have also more specifically suggested links between the evolution of language and narrative. Gardenfors (2017), drawing on Zlatev’s (2013) Mimesis Hierarchy, argues that gesture and then pantomime initially developed as a mode of instruction in early hominin tool production, and were later exapted for a communicative or narrative function. Ferretti et al. (2017) argue that narrative pantomime precedes narrative in linguistic form, (see also Sibierska, 2017 for similar arguments). Tomasello (2008), asserts that language developed for narrative, while Victorri (2002) suggests that the narrative function developed in *Homo sapiens* in the transition from protolanguage to what he calls a ‘fully fledged human language’, as a means of recalling and resolving social crises.

What is clear from all this is that narratives and stories have long been seen as central to human cognition (see also Turner, 1996; Hermann, 2003; 2013); that we are caught up in ‘storying the world’ (making sense of the world through stories) or ‘worlding the story’ (interpreting stories) (Hermann, 2013) in fundamental ways, and that they also play a vital role in our evolutionary history. As readers might have noticed in the above account, so far we have been using the terms ‘narratives’ and ‘stories’ synonymously. In the following section, we address the problem of definition and introduce a working distinction between the two terms.

## 2.1 Narrative and the problems of definition

One of the central problems when researching the nature of narrative and story has to do with definition and scope (Jahn, 2003). The problem is often exacerbated by an exaggerated need to distinguish between ‘true’ and ‘false’ stories; a distinction which is rendered superfluous when we take a historical view of the nature of narrative and storytelling. As Barnard (2016) points out, in hunter-gatherer tribes, the distinction between truth and falsehood in their stories is simply not an issue. Such has been the case for most of our history (it was only with the inception of the formal study of narrative by the likes of Aristotle and Plato, who pitted *mythos* against *logos* that it became a matter of concern). This evolutionary legacy may also be why we are readily able to suspend disbelief and become engrossed in what are evidently fictional worlds, as studies on counterfactuals and the brain have shown (Sanford and Emmott, 2012). Indeed, it is fair to say that more recent developments in narrative research suggest that drawing a precise line between the purely true and the purely false in narrative terms is fraught with problems. This however, is a matter of debate far beyond the remit of this paper. A further problem concerning definition is that narrative, and indeed narrative structures, also differ and alter depending on cultural pressures. This means that what is recognised as a coherent story in one culture may not be recognised or recalled as such in another (see, for example, Bartlett’s classic experiment, 1932). This means that pinning down narrative and story in terms of genre is also unhelpful in defining the terms.

Given the above, we will assume a definition of narrative that cuts across both culture and genre, to enable us to trace its evolutionary trajectory in terms of hominin cognition. For our purposes, we therefore treat narrative as:

*the mind-internal means by which we are able to trace (often multiple) participants, as both agents and patients, and events, which are displaced in time and space, as well as our*

*evaluations of these participants and events.*

We will reserve the term stories for the linguistic representation of such mind-internal narratives<sup>1</sup>.

In order to appreciate how and why the capacity for narrative arose in the hominin lineage, we need to retrace our steps and consider how and when language itself first came about and evolved in tandem with hominin cognitive capacities. In the following section therefore, we examine the evidence for early hominin cognitive and communicative abilities, and consider the first major developments, as well as their most plausible timeline, in our ancestor species.

### **3. Language evolution: the first stages**

#### **3.1 Early hominins: communication**

One of the few certainties in the field of language evolution, and on which all researchers agree, is that language evolved in the hominin lineage at some time following the last common ancestor (LCA) we shared with the closest extant species to modern humans: two members of the *Pan* genus, *Pan troglodytes* (common chimpanzees) and *Pan paniscus* (bonobos). This split, according to the most recent estimations, took place a little over 7 million years ago (mya) (Endicott et al., 2010; Sun et al., 2012) and the very earliest hominin species were likely members of the genera *Ardipithecus* and, later, *Australopithecus*. However, other than some adaptations for living on the African savanna, including bipedalism and loss of body hair, there is no evidence for any major cognitive or communicative developments in these species, which suggest a difference from their immediate forbears. The most probable indication of the abilities of early hominins, and what

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<sup>1</sup> We do, however, appreciate that the terms ‘narrative’ and ‘story’ can be, and often are, used in productively different ways in different disciplines (see for example, Ryan, 2007). In some cases, they are also used interchangeably to no ill effect (see for example, Herman, 2003, 2013.)

must have subsequently evolved that resulted in modern humans, can be found by examining the cognitive capacities of present day chimpanzees. With regards to communication in their natural environment, chimpanzees seem capable only of limited and inflexible vocalisations (Seyfarth and Cheney, 2012), and there is no sound evidence of intentionally deployed, semantic compositionality in any non-human vocal communication system (Hurford, 2011), although there is far greater creativity in gestural communication (see discussion in section 3.4 below). Call and Tomasello (2006) identify a range of ape gestural signals including bodily posture, facial expression and manual gestures, all of which are used in a variety of ways by individuals within species groups to achieve a particular end. Captive trained ape programmes have produced mixed results (e.g. Terrace, 2005), although there has been undoubted success using lexigrams, such as that with the bonobo Kanzi (Savage-Rumbaugh & Lewin, 1994), and sign languages. With regards to the latter, programs have been established since the 1960s (Gardner and Gardner, 1969), and have involved a number of primates including, amongst others, a chimp (Lucy), a gorilla (Koko) and an orang-utan (Chantek). Although the data remains controversial, at best these great apes have been reported to use up to 1000 signs, occasionally in spontaneous and novel strings, though even in the most successful of programmes, there is little or no conclusive evidence of communicative acts other than requests and demands for immediate gratification (for review see Gibson, 2012).

### **3.2 Early hominins: cognition**

Studies of primates, both in their natural habitat and in the laboratory, have revealed a number of higher level cognitive processes including fashioning basic mode 1 tools (e.g. Koops et al, 2015) and social intelligence (Boesch, 2005). Claims have also been made for a basic ToM and first order intentionality in chimpanzees (Tomasello, 2008; Schmelz et al, 2011; and



see discussion below). However, the evidence is not clear and others have been far more sceptical (see Penn et al., 2008). What is clear, however, is that following several million years since the split with the LCA one species of hominin began to demonstrate the first irrefutable evidence of greater cognitive capacity than any other species that had previously inhabited earth. However, here again, care is needed as palaeontologists vary in the evidence they require to justify the distinction of constituent species in the hominin, or any other, clade, with ‘splitters’ identifying a greater number of species than ‘lumpers’. The species that is of undeniable and uncontroversial significance however, is *Homo erectus* which is believed to have appeared in Africa around 1.9 mya with a body morphology not dissimilar to modern humans. The period just prior to this is associated with a comparatively large number of changes to genes and genomic regions, particularly in the Human Accelerated Region 1 influencing brain lateralisation, organisation and connectivity (Stringer, 2011; Kamm et al., 2013). One consequence of these changes was the doubling in size of the brain to an average of 800cc and an allometric encephalization quotient (EQ) (Jerrison, 1973) in the mid 60s<sup>2</sup> by at least 1.74 mya (Holloway et al., 2009). As hominin brains are nutritionally extremely expensive organs (Leonard et al., 2007) and the increased size results in such deleterious effects as high rates of maternal death in child birth (Trevathan, 1999) and extended infant ontogeny (de Leon et al., 2008), they must be associated with some powerful adaptive advantage.

Certainly, these hominins were the first to engage in behaviours that no other species had displayed. Of particular significance in this period was the revolution in tool construction. Scarred animal bones have been found in Ethiopia dating from 2.5 mya which show evidence of having been stripped of meat and thus the use of ‘Oldowan industry’ (early lower

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<sup>2</sup> Using the “homocentric” equation of Holloway and Post, 1982, which expresses each EQ as a direct percentage of the human value, taken as 100%

palaeolithic) stone flakes found nearby, associated with *Australopithecus garhi* (de Heinzelin *et al.* 1999; though see Braun, 2010, who suggests an even earlier appearance of stone tools). However, these Mode 1-category industries are not substantially different from the employment and modification of available materials for the construction of *ad hoc* tools by present-day chimpanzees, and it is reasonable to assume that such skills were transmitted through experiment and emulation. It is rather the advent of Mode 2, Acheulean (mid-lower palaeolithic) hand-axes at approximately 1.75 mya in Africa, and subsequently in other parts of the world, that indicates a technological break with the past. (Beyene *et al.*, 2013). The production of these tools involves mental rehearsal, taking a large lump of rock and, from this, imagining a finished tool, and so repeatedly knapping the rock, involving sophisticated eye-hand coordination, until the desired shape, remarkably uniform in the many examples found across modern Africa, Asia and Europe, is achieved. Other cultural advancements that accompanied this period included the first migration out of Africa indicating a capacity for innovation and accommodation to new environments, far quicker than evolutionary change could accomplish; *H. erectus* had reached modern-day Georgia by 1.7 mya and occupied three continents within a further 200 thousand years.

There seems to be a clear, probably symbiotic, link between expanded brain size and connectivity on the one hand, and cultural innovation on the other. One theory to account for this is based on the observation that the modern human digestive system is very small for a primate of our size and that a change in diet enabled the modifications to brain structure. There is evidence that *H. erectus* made use of fire and engaged in coordinated hunting and scavenging (Lynch and Granger, 2008) and this may have provided the additional sustenance to support large brains (Mann, 2012; Wynn, 2012). Wrangham (2009) favours the proposal that cooking food was initially a secondary effect derived from the use of fire to deter predators, as

these early hominins moved onto the savanna. However, a major beneficial consequence of the application of fire was that the additional processing of food achieved through cooking facilitated the shrinkage of the hominin gut, and further enabled the brain to expand by utilising energy that no longer had to be devoted to digestion. Whether or not the use of heat to prepare food was the underlying cause of neuroanatomical change, taken together, the evidence suggests the emergence of a unique degree of a vital behaviour: *cooperation*.

### 3.3 Cooperation and communication

We take cooperation not to mean some form of purely altruistic aid, as is often assumed, but rather the engagement in collaborative activity for mutual benefit. However, this definition does little to mitigate the classic problem of accounting for cooperation in evolution: that of freeloaders (also referred to as ‘freeriders’ in the literature, see e.g. Dunbar, 1999). Outside of close kinship, substantial cooperation appears to be only evident in nature in insects, as evolution tends to eliminate adaptations that enable cheats to thrive. Melis et al. (2006) point out that of all the non-human Great Apes, only common chimpanzees display any collaboration in their foraging techniques and that this is qualitatively distinct from human-type cooperation (for example dominance relationships are not suspended in the interests of mutually beneficial outcomes, and consequently freeloaders are able to profit). Nevertheless, there does seem to be some evidence of a *latent* cooperation in chimpanzees which, although rarely, if ever, displayed in the wild, is sometimes seen in captivity in interactions with humans, and possibly also with each other (Gibson, 2012). What appears to be clear is that, like the other aspects of hominin cognition and its behavioural manifestations discussed here, cooperation evolved in two distinct steps, the second of which we discuss in section 4.2 in relation to DPT.

The first step occurred around the same time as the emergence of *H.*

*erectus* when there was a period of climate change resulting in the extension of the African savanna and the range of fauna competing for means of sustenance. (de Menocal, 2004; van der Made, 2014). Boyd and Richerson (2009) argue that against this changing background the successful hominin species developed a process of cumulative cultural innovation enabling them to occupy a greater range of habitats and exploit a wider variety of resources. Tomasello et al. (2012) suggest that this evolutionary step took the form of learning to forage collaboratively and share the rewards, possibly in the form of scavenging for megafauna (Bickerton & Szathmari, 2011). At the same time there coevolved a basic propensity for coordination, including a primitive ToM, and the implementation of the concept of reputation and punishment to deter freeloaders. More recently, early research findings based on neural crest stem cells support the notion of a ‘self-domesticization’ in hominins whereby features such as cooperation were positively selected for, including through sexual selection, although currently posited time scenarios are focused on early *H. sapiens* (Wilkins et al., 2014; Theofanopoulou et al., 2017).

At least since Grice (1957) it has been understood that cooperation is central to language use. Indeed, cooperation is a necessary prerequisite for intentional communication, and Tomasello (2008) argues that the vital cognitive element for communication was an understanding of relevance and a sharing of salient content with conspecifics. Along with many writers in the field (e.g. Bickerton, 2009; Tallerman, 2012), we assume that the earliest form of language was a simple protolanguage that emerged during the period currently under discussion.

### **3.4 Protolanguage**

While we agree with Tomasello (ibid.) and others (e.g. Ferretti *et al.*, 2017) that in the absence of recourse to established conventional symbols, the earliest communication must form a physical continuity with

primate communication and consist of iconic gestures and holophrastic pantomiming, we differ from the implication in these studies that the system had a likely duration of many thousands of years. Orzechowski et al. (2015) argue that the earliest intentional communication was initially multi-modal until the appearance of an auditory mode which came to dominate. This is accounted for in terms of a ‘trade off’ between usability/learnability (simplicity) and expressivity (complexity) while minimizing energy requirements. This is achieved through a rapid ‘drift to the arbitrary’ (Tomasello, *ibid.*: 219) in which ‘expressive gestures give way to even more expressive, ‘finely grained’ vocal gestures like abstract and arbitrary communicative constructions’ (Vasil et al., 2020: 16). In other words, the computational efficiency of processing conventionalised, rather than iconic, signs, as well as the obvious benefits of communicating in the dark (see reference to Wiessner, 2014, in section 6.3) and freeing the hands to engage in parallel tasks, would result in the early emergence of a vocalised protolanguage<sup>3</sup>. Certainly adaptations that benefit vocalisation are presumed to have first appeared contemporaneously with early *Homo*. These include the disappearance of small cavities above the vocal folds which are found in all other primates, and while the earliest hominins appear to have possessed these air sacs, they seem to be entirely absent by the time of *H. heidelbergensis* around 0.5 mya (de Boer, 2012). The primary function of these air sacs is not clearly understood though they are believed not to be purely vestigial, and de Boer argues that their absence in modern humans enables the production of clearer and more distinct vowel patterns. The other significant adaptation is the descended larynx, the emergence of which is also associated with early *Homo* (Laitman, 2010). Such a modification

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<sup>3</sup> It is unquestionably the case that contemporary sign languages equal any spoken language in terms of expressive power. However, it is also true that there is no known human community in which unimpaired members communicate primarily through a gestural system, and we presume the auditory modality to be intrinsic to the species.

also benefits the production of a range of speech sounds, though whether this was the pressure that resulted in an adaptation or whether the utility in vocalisation is an exaptation remains controversial (for opposing views see e.g. Fitch, 2010; Tallerman, 2013).

Several proposals for a description of what such a vocal protolanguage would look like have been posited (for an overview see Tallerman, 2012) and we can assume that it would be at least as complex as any symbolic communication systems that trained primates are able to acquire; Bickerton (2012) additionally suggests other ‘windows’ into protolanguage including other simple vocal communication systems, such as pidgins and early child language, both of which are compositional (rather than holistic), characterised by an isolating morphology, a lack of syntactic categories and a code based semantics (e.g. Gil, 2009). While there is near universal agreement that protolanguage would lack any form of ‘hierarchical’ syntax, there are suggestions that linear position (e.g. ‘Agent first’) may have played a role in ‘protopredicates’ (e.g. Jackendoff, 2002) and there is limited evidence that some trained primates are sensitive to symbol order (Patterson & Linden, 1981; Premack, 1983; Savage-Rumbaugh and Lewin, 1994).

However, following these shifts in behaviour which cluster around 1.7 mya, there are very few further significant behavioural developments in any hominin species for over a million years, and *H. erectus*’ long inhabitation of earth lasts until the species disappears from the fossil record 150 thousand years ago (kya).

### **3.5 The end of the first stage**

Indeed, it is the case that the stages of *Homo* evolution correspond to a classic example of ‘punctuated equilibrium’ (Gould & Eldredge, 1993). As a complementary theory to the phyletic gradualism of neo-Darwinism, the theory of punctuated equilibrium is based on:

‘a novel interpretation for the oldest and most robust of

palaeontological observations: the geologically instantaneous origination and subsequent stability (often for millions of years) of palaeontological “morphospecies” (ibid., 223).

In other words, new species appear in small isolated groups in periods of rapid change (adaptive radiations) which are then followed by long intervals of stasis in which there is relative stability of the species. Ridley concludes that ‘on the evidence so far...both punctuated equilibrium and phyletic gradualism are real facts about fossil evolution’ and even that the former ‘may be somewhat commoner’ (2004: 605). Given the subsequent almost complete stasis in *H. erectus* over more than a million years, the archaeologist Desmond Clark pointed out that if these hominins had language, then ‘these ancient people were saying the same thing to each other, over and over and over again’ (reported in Stringer, 2011: 125). An explanation for why this might be the case draws upon two theories of aspects of cognition which we examine in section 4.2: subitizing and dual-processing.

## **4. Hominin cognition**

### **4.1 Subitizing**

Subitizing (also known as ‘subitization’) refers to the ability of subjects to accurately report the number of objects in a scene without counting (Dehaene, 2011). While the limit to the number of such objects in any one scene is sometimes 3 or 5, for the majority of subjects the figure is 4 – ‘the magical number 4’ (Cowan, 2001: 87). This is also the maximum number of objects that can be stored in working memory (Luck & Vogel, 1997), and we return to memory and evolution more fully below. Trick and Pylyshyn (1994) show that in contrast to counting which is effortful, prone to error and relatively slow with a slope of 250-350 ms per item, subitizing is fast (the slope being 40-100 ms per item), effortless and accurate within the

limit of 4 +/- 1. Subitizing is attested in human infants from the age of at least 10 months (Feigenson, Carey & Hauser, 2002; Feigenson & Carey, 2003, 2005; vanMarle, 2013) and in both captive and free ranging (untrained) rhesus macaque monkeys in ‘violation of expectancy tasks’ (Hauser, Carey & Hauser, 2000; Hauser & Carey, 2003). In all cases, the subjects were able to discriminate between groups containing 1, 2 or 3 objects, though with a higher time slope than in adult humans, but failed when the number was increased to 4 or greater. Hurford (2003) accounts for this human~primate shared capacity for subitizing by identifying its origins in evolutionarily ancient visual systems (macaque monkeys have a LCA with hominins approximately 25 mya), while Piffer et al. (2012) demonstrated that basic subitizing exists as an independent ability, in contrast to large number analog estimation in guppy fish (*Poecilia reticulata*). Hurford claims that ‘an ape’s mental traffic with the world is in terms of two broadly noninterconvertible ontological categories, object and property’ (ibid: 272). Two pathways from the primary visual cortex are engaged in the visual recognition of objects. The first involves a dorsal stream which provides rapid temporary information concerning the ‘where’ of objects in relation to the self. The second is a slower, ventral stream that delivers ‘what’ information i.e. the properties of the objects. As Hurford explains:

‘information from the dorsal stream alerts the organism to the fact that something of potential interest or importance is out there. Thereafter, it plays no direct role in cognition .... The ventral stream carries richer information to (more or less) where concepts are stored. A match is made, or not, as the case may be’ (309).

Trick and Pylyshyn (*ibid*) identify the first stage of visual recognition as pre-attentive and as a result of which ‘object files’ or ‘FINgers of INSTantiation’, FINSTs, are assigned to objects which then act as reference tokens or pointer variables. The limits of subitizing are determined by the



number of FINSTs available; in adult humans this is generally the figure 4.

Hurford (2003) detects in this two-way system of object recognition the basis of prelinguistic predicate argument structure shared by all higher animals:

PREDICATE (x)

in which (x) is a variable, prelinguistic argument (drawing on the dorsal stream) and PREDICATE specifies some property(s) of that object (corresponding to information provided by the ventral stream); according to Hurford, the structure of a single thought 'is derived from the limits of our ancient visual attention system' (2007: 95). This is reflected in natural language and can be seen in clause structure in which a maximum of three arguments, one external and the others internal, though, for the most part, only two (subject and object) are linked through a predicator (Juarros-Dausa, 2010). Hurford (2003) also draws attention to sign language anaphora in which different arguments may be allocated different physical spaces in relation to the signer, as with dorsal stream information. Furthermore, he points out that the number of deictic contrasts available in natural language, for example 'here' and 'there' (2), 'yesterday', 'today' and 'tomorrow' (3), very rarely reach 4 and there is no clear evidence that this number is ever exceeded. Whilst there is little experimental research on the relation of subitizing and language, one short study was carried out by Nelson and Stojanovik (2002) in which they tested four children aged 9 – 11 who had a specific language impairment that impeded the decoding of argument structure. The subjects were tested for Subitizing ability and also given a range of tasks testing the processing of linguistic argument structure, and although the results were not fully conclusive, the researchers concluded that 'the initial results may support a neural (and therefore evolutionary) link between the processing of argument structure and the ability to subitize' (131).

As Hurford notes, this simple PREDICATE (x) formula is 'the first,

lowest-level, step in the construction of complex hierarchical semantic structures' (2003: 267). While all unimpaired humans are clearly capable of engaging in complex mental activity beyond this first step, there is no evidence for similar capacities in other animals and certainly no trained primates have ever been shown to communicate anything other than simple (uniclausal) propositions. We argue that this restricted cognitive, and concomitant communicative, ability was also the case for *H. erectus* (and other descendant species in the million plus years from the appearance of *erectus*) and that this accounts for the general lack of innovation that characterises the period of stasis. Earliest *Homo* may have been far more cooperative than its ancestors, but their general cognition was not significantly, qualitatively enhanced. This suggests to us that they had developed a basic communication system of an initially multi-modal and later predominantly vocal, protolanguage (e.g. Tallerman, 2012), but just did not have a significant quantity of novel, complex thoughts to communicate; more innovative than chimpanzee cognizance certainly, but still very restricted and of limited instrumental use to conspecifics. The breakthrough that resulted in modern humans is a far more recent phenomena as we outline in the next section.

#### **4.2 Dual Processing and the emergence of human type-2 cognition**

Around 800 kya there was again a period of rapid and dramatic climate change and the evidence shows that by 500 kya the hominin brain was undergoing a second rapid increase in size and that by at least 200 kya modern *H. sapiens* in Africa had evolved brains with an average 1350 cc (Stringer, 2011). A separate species, *Homo neanderthalensis*, which arose in Europe, had a greater gross brain capacity than *H. sapiens*, though it has been argued that taking into account its larger body mass and structure, it actually has a lower EQ than humans (Kappelman, 1996). Whether or not this is in fact the case, there are significant differences in brain morphology

between Neanderthals and modern humans, in particular the latter has a reduced visual cortex and enhanced pre-frontal cortex (Bookstein, 1999; Lieberman et al., 2002). Between 700 and 200 kya, there is also an increase in the size of the human posterior parietal cortex which plays a major role in abstract, conceptual thought (Wynn et al., 2009). Given the deleterious effects of large brains noted above, we again must account for this increase via some strong selective pressure, and evidence from psychology, in the form of Dual Processing Theory (DPT), is able to shed light on this.

Unlike other animals, unimpaired humans are able to cope with numbers way beyond the limits of subitizing. The existence of these two separate capacities for dealing with numbers is accounted for in DPT which has advanced in main-stream psychology since the 1980s, based on the premise that ‘there is a fundamental duality in human reasoning’ (Frankish, 2009: 105). It is now well understood that humans process information, and take action, based on two entirely distinct systems for mental processes, which may sometimes be in conflict with each other – most vividly illustrated in ‘alien hand syndrome’ in split brain patients (Eagleman, 2011). In addition to an evolutionarily ancient, preconscious System 1 that is underpinned by the cognitive architecture grounded in subitizing and shared with other animals, we also have a recent, controlled, reflective System 2<sup>4</sup>. The main features of each are outlined in figure 1 below.

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<sup>4</sup> Eagleman (2009) adopts the terms ‘emotional/zombie’ for System 1, and ‘rational’ for System 2; something similar was discussed by Bickerton (1995) in his ‘on-line’ and ‘off-line’ thinking. We are grateful to an anonymous reviewer for the Journal of Cognitive Science who points out the similarity to ideas presented in Kahneman (2011)

<b>SYSTEM 1</b>	<b>SYSTEM 2</b>
Evolutionarily old	Evolutionarily recent
Unconscious, preconscious	Conscious
Shared with animals	Uniquely (distinctly) human
Implicit knowledge	Explicit knowledge
Automatic	Controlled
Fast	Slow
Parallel	Sequential
High capacity	Low capacity
Intuitive	Reflective
Contextualised	Abstract
Pragmatic	Logical
Associative	Rule-based
Independent of general intelligence	Linked to general intelligence

*figure 1 from Evans (2009) p.15*

The existence of the two systems can be seen in a range of phenomena including the Stroop Effect (Eagleman, 2011), syllogistic reasoning biases (Klauer et al., 2000), belief biases (Evans et al., 2010), and a range of problems such as Monty Hall, the Wason selection task and so on (Franco-Watkins et al., 2003; Evans, 2010). Much work has also been undertaken to identify neural correlates of dual processing, though there is insufficient space to review that literature here (see Libet et al., 1983, Haggard & Eimer, 1999, Blankertz et al., 2003, Lieberman, 2009).

System 2 is also evident in a second stage in the development of hominin cooperation. By 400 kya there is evidence of sophisticated cooperative hunting of large fauna of a type undertaken by modern hunter gatherers. Following a successful hunt, the consumption of the prey was delayed until the meat could be brought back to the dwelling area at which point it was processed by butchery and cooking and then shared among the group

members (Stiner *et al.*, 2009). Tomasello *et al.* (2012) note that these archaic humans had begun to live in far larger group sizes and that this necessitated two behavioural modifications: those of cultural group identification, and the conventionalisation of reputation and punishment as social norms. The evolutionary account of the emergence of sophisticated cooperation is grounded in the fact that, unlike other primates where typically one gender leaves the group at maturity and migrates randomly to other groups, there is no evidence for such behaviour in early *Homo*. Stable group variation was more likely the norm for hominins at this time resulting in a propensity for selective migration and assimilation to successful groups (Boyd & Richerson, 2009; Kolodny *et al.*, 2015). Cooperation, and its concomitant features of coordination, and cheat detection and punishment, spread accordingly among hominins by the era of *Homo heidelbergensis* around 500 kya (Dubreuil, 2010).

The evolutionary rationale for two systems is that System 2 type processing places far higher nutritional demands on the body than System 1, so as much as possible is relegated to the cheaper system while at the same time enabling the self-conscious, reflective system to intervene to deal with novelty, anticipate the future and make complex inferences and save the organism from costly harmful intuitions (Sloman, 1996). In relation specifically to dealing with numbers, we don't use the counting process to count both large and small number, because:

‘The subitizing process is fast, accurate, and effortless; the counting process is slow, effortful, and error-prone. It would make sense to use a rapid, effortless process when possible, especially if there are time pressures. Nonetheless, it is possible to go through the exercise of using the counting process to enumerate three clearly defined items one-by-one. It is just a waste of time.’ (Trick & Pylyshyn, 1994: 88 fn. 10)

The counting process, a **system 2** phenomenon, is only instigated when the

number of objects exceeds the number of available object files, which, as we have seen, is generally around 4 in modern human adults. The precise implications of subitizing and DPT beyond numerosity, and in particular for language, are considered in the next section.

## 5. The emergence of complex language

While there is vast cross-linguistic diversity at every level of all languages in terms of phonology, morphology, syntax and semantics (see Evans and Levinson, 2009), one universal which they all share appears to be a clause consisting of a predicate with a limited number of core arguments and optional adjuncts. Two major clause types appear to be attested in all known languages; these are generally referred to as intransitive with a single argument which functions as a subject, and transitive with an additional argument that acts as an object. Languages may also permit predicates with a null valency in which an item occupying a canonical argument position has no semantic (or theta) role (such as so-called ‘weather’ verbs in English which express a temporary property of the immediate environment without the role of any agent or experiencer as subject) and extended transitives in which there is a third<sup>5</sup> core argument. And yet humans are able to record and recount extended narratives with multiple participants and events, marked by extensive displacement, including through the recursive embedding of single clauses in which simple propositions are encoded. We argue here that the development of System 2 thinking coevolved with our capacity for memory and a linguistic system for the external representation of mind internal thought, or what we call a *Narrative of Thought*, which will be discussed in section 6 below.

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<sup>5</sup> certain analyses of (especially agglutinating) languages have rare instances of four-place predicates for applicatives and causatives (see e.g. Lomashvili, 2011)

### **5.1 Subitizing, protolanguage and the Narrative of Thought**

There are several functions that language serves. Dixon (2016) assigns 8 essential universal roles to language of which the first 5 (the process of belonging, basic cooperation, position in a social hierarchy, display of emotions and the communication of basic information) are all functions that are attested, if only to a very limited extent (especially in terms of cooperation), in other animal groups, certainly in primates. We can therefore assume that the earliest form of language, a protolanguage, of concatenated symbols and then simple protopredicates was sufficient for ancient hominin communication systems based on categories such as these. It is rather Dixon's last 3 roles – aesthetic expression, complex reasoning and persuasion (all of which involve the creation and representation of narrative) – that are distinctive in terms of abstract, apparently unbounded, creativity that is characteristic of modern human cognition. Humans have a remarkable ability to deal with, and create, novel scenarios involving a large number of participants, displaced both temporally and spatially (and indeed existentially).

As noted in the introduction, in the ensuing discussion we adhere to a computational theory of mind (e.g. Fodor, 1975; Pinker, 1997; Chalmers 2011, 2012) in which mental processes are executed (almost) entirely detached from any spoken language in which the outputs may subsequently be represented. Furthermore, although the notion of linguistic determinism has long been discredited, there are still adherents to a weaker form of this hypothesis in all branches of linguistics. A degree of linguistic relativity is central to the school of Cognitive Linguistics (e.g. Pedersen et al., 1998), but some generative linguists also maintain that there is only one language, used for both thinking and communicating (though this involves a high degree of abstraction) (Hinzen and Sheehan, 2013; Sigursson and Maling, 2010). However, the evidence is convincing that we engage in mental

processes in one system and communicate in an entirely different one. For example, there is the condition of anomia in which patients are aware of the thought they wish to express but are unable to locate and employ the necessary linguistic forms (Dronkers and Baldo, 2009). In addition, there are the cases of feral children and others who do not have a full language to draw on, such as home signers, but who are nevertheless able to form, and later recall, complex episodic memories (see discussion in Tartter, 1998). Furthermore, thoughts can be translated from one language to another, despite the enormous variation in the world's languages (Evans and Levinson, 2009). And, finally, there is the fact that spoken languages are full of ambiguity which can only be resolved by parsing into different mental representations. While we are therefore committed to the existence of mind-internal systematic structuring of a conceptual array, we note, without binding ourselves to a particular theory, the range of hypotheses that are discussed in the literature including 'language of thought' (Fodor, 1975, 2008), 'mental symbols, the units of thought' (Carey, 2011), 'category detectors' (Harnad, 2010), 'folk mechanisms and category three, complex, abstract thought' (Wyn et al, 2009).

One of the most important aspects of System 2 cognition in relation to human language is the capacity for recursion (for extensive discussion in relation to language see van der Hulst, 2010, and papers therein). Although recursion is not easily defined, it has two generally accepted characteristics. Firstly, (and particularly pertinent to language) is the requirement that a recursive operation should enable the embedding of any object of type X into another object of the same type in the manner of matryoshka dolls, or in relation to language, a noun phrase may be embedded in another noun phrase, a clause inside a clause etc.

The second oft discussed feature, which we take to be central, is the quality that the output of one stage constitutes the input to the next, such as the Fibonacci series and possessives in (1) as opposed to the unordered



iterative concatenations in (2):

(1) a) 1, 2, 3, 5, 8, 13, 21, 34

b) Karl's brother's friend's uncle

(2) a)  $3 + 5 + 8 + 4 + 6 = 26$

b) Karl and his sister and his friend and his uncle

As Hurford (2011) notes, in series such as these in (1) the next step involves the need to keep track of what has gone before, as of course is essential in constructing or processing narrative.

In relation to cognition, note that a multi-order intentionality is generally seen as an archetypal example of recursion (see discussion below), and, as O'Grady et al. (2015) demonstrate, such embedding of up to at least seven levels is far easier to process, and thus more common, than was once assumed. As Oesch & Dunbar note, 'when natural selection favored higher-order intentionality, it necessarily also favored recursive thinking, as it is logically necessary to represent the content of another's mental state within the embedded structure of one's own mental state' (2017: 97). Thus you may have multiple cognitive representations of others' mental states each embedded as a fully formed proposition inside each other:

3) I believe that [you intend [John to understand that [Mary thinks that [Peter doesn't love her]]]]]

In complex System 2-type cognition, simple propositions, bounded by the limits of subitizing, are recursively embedded in narrative thought. As noted in the introduction to this section, languages are constrained in the number of core arguments (maximum three) that may occur in any single clause. However, there is no *a priori* reason why this should be the case;

it is perfectly possible to conceive of languages with complex predicates and six, seven or more arguments. The explanation for this, we suggest, is that language evolved to externally represent mind-internal narratives, a relatively recent evolutionary development, and these are structured as recursively embedded simple propositions which take their fundamental structure from the evolutionary ancient ability to subitize.

A narrative cognition confers a number of advantages for individuals so endowed. It is through narrative that we are able to progress our understanding of the world beyond just noting associative phenomena, and begin to construct hypotheses based on accounts of cause and effect. It is through creating such narratives that we are able to predict the consequences of actions and evaluate potential outcomes. Planning is only made possible through the construction of rudimentary narratives. Having undergone these cognitive processes, we are able to transmit the outcomes to our conspecifics, without losing anything in the act of transmission: by sharing my knowledge of the world I do not deplete my own knowledge resource. We are then in a position to benefit when our companions gratefully recall our contributions and reciprocate. Beyond such basic instrumental exchanges, sharing more complex narratives, as stories, also has a social function and this is taken up in section 6. Our view of the Narrative of Thought, and its representation in stories, is therefore not dissimilar to Dor (2015) who argues that language is a ‘collectively-constructed communication technology’, which evolved for the ‘instruction of the imagination’ and allows ‘communicators to communicate directly with their interlocuters’ imaginations’ (Dor, 2017: 108)

The earliest cognitive proto-narratives emerge as simple scenarios involving two or more events in which a topic is established, there are agentive participants, the events are sequenced, and the narrator adopts a particular perspective (Bruner, 1990). Such simple narratives can be, and often are even today, represented in a variety of modalities (including

modern digital technologies) (see Bruni and Baceviciute, 2014). However, as the capacity for narrative evolved, culminating in series of recursively embedded events, with multiple participants and manifold displacements of time and place, spoken language became the dominant medium (see discussion in section 2 above) and the practice of communication in simple combinations of conventional symbols that constituted protolanguage was expanded to represent recursively generated thoughts; the nature of that representational system being determined by the nature of the mind-internal narrative it represents. As Kinsella points out, this recursive property in cognition may be the source for the apparent recursion in language: ‘a reasonable evolutionary conjecture is that recursive language was a response to the requirement for an optimal solution to expressing recursive thought’ (2009: 152; see also discussion in van der Hulst, 2010). Thus complex thoughts, and their communication in language, are not to be understood as single complex predicates with multiple core arguments, but rather, as Hurford argues, ‘it is more reasonable to suppose that the grammatical structure of ... embedded natural language clauses reflects a mental structure involving a nesting of separate propositions, each with its own simple predicate expressing a relation between just two arguments (which may be shared with other predicates)’ (Hurford, 2003: 278). Through recursion we are not limited to (uniclausal) propositions, but are able to cognitize scenarios involving multiple participants and events, and include numerous temporal and spatial modifiers through adjunction. Communication of these coherent narratives is made possible through the evolution, out of protolanguage, of complex language with its range of cohesive devices such as anaphora (and cataphora) and deixis for keeping track of participants and events, and systems of modality for expressing attitude, and so on. One way of understanding how these syntactic categories arose is through grammaticalization in which content words are exapted for grammatical functions (see e.g. Heine and Narog,

2010). All extant languages are understood to undergo the process of grammaticalization, and, as Bybee notes, there is good reason to suppose that whatever the ‘original’ grammar of human language was, it evolved in the same way’ (2012: 533). However, there are many ways in which cognitive structure may be represented in linguistic form and it is to be expected that we would have a great diversity of conventional systems for representation (as argued in Burton-Roberts’ ‘Representational Hypothesis’ e.g. 2011; see also Pinker & Jackendoff’s notion of a ‘linguistic toolkit’, 2005).

One possible objection to our hypothesis might be founded on the well-known, though controversial, claim that there is at least one language, Pirahã, in which there is no recursion (for alternative views of this see exchange between Everett, 2009, and Nevins et al., 2009a, 2009b). Recursion in the Pirahã debate revolves only around the issue of embedding, whereas the second feature described above (output becomes input), which marks a distinction from simple iteration, is as characteristic of Pirahã as of any other language. Furthermore, no-one contends that Pirahã is in any way deficient or, with its rich agglutinating morphology, lacking complexity. And, as Everett notes (2008), in the stories the Pirahã tell, the mental narratives they represent in their language, recursion is evident in abundance. That a language should lack the means for expressing recursive structure at the phrasal and clausal level (if indeed that is the case) is perhaps odd, but as Stapert (2009) observes, linguistic systems are likely to occur in a normal distribution with some very rare outliers distinct from, but no less effective than, more common language types.

Taking this argument to its logical conclusion, we suggest that recursive thought is therefore structured according to narrative principles: A *Narrative of Thought* (after Fodor, 1975). Human language represents that structure in observable form; in the shape of stories we tell to ourselves and to others, which in their modern form are complex linguistic events.

These ‘events’ come to constitute our knowledge of ourselves and others within the world and thus our autobiographical memories and biographical memories, and it is to this relationship between evolution, memory and narrative that we now turn.

## **6. Evolution, Memory and Narrative**

### **6.1 Memory, narrative and a conscious knowledge of the self**

In order to appreciate how narrative came to evolve, we need to consider how our memory systems developed in evolutionary terms. As noted above, there is some evidence that species other than *Homo sapiens* have episodic memories (also known as ‘what’, ‘where’, ‘when’ memories, Tulving, 1972)<sup>6</sup>. For example, rats are able to find their way around a maze (e.g. Zhou and Crystal, 2011) and have been shown to have some recall of events and timing; however, one of the researchers in this case accepts that this could be a training effect and tentatively concludes that ‘it is possible that rats exhibit a precursor to planning only in a limited sense’ (Crystal, 2013: 47). Chimps and orangutans can remember where tools were hidden up to 3 years previously (Martin-Ordas et al, 2013). De Lavilleon et al. (2015) also showed how spatial memories in animals are consolidated during sleep, and they were even able to manipulate memories during sleep in mice. Additionally, it has been known for several years that animals such as scrub-jays (*Aphelocoma coerulescens*) have some form of episodic memories of caching different food items, and it has been demonstrated that they can remember where and when they stored either peanuts or worms (see classic experiment by Clayton and Dickinson, 1998). More recently (Lewis et al., 2019), it has been demonstrated that a number of Great Ape species display more complex episodic memories even recalling participants when

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<sup>6</sup> The hippocampus appears to play a key role here in which place cells are seen to be responsible for mapping representations of space (Moser et al., 2015).

these were especially salient. While non-human primate memories follow a similar forgetting curve to modern humans, it has been argued that their memories may actually be more resilient. Tello-Ramos et al. (2019) account for this by identifying 2 evolutionary beneficial strategies at either end of a continuum: strong memories with reduced cognitive flexibility, thus relying on recollection of experience in reacting to stimuli, at one end; and a high degree of cognitive flexibility compensating for a reduction in memory strength at the other. These are said to represent a trade off between each other with humans tending strongly to the latter, giving rise to an imagination of the new/novel (Fernández-Armesto, 2019). Thus involuntary memories with a similar function (albeit weighted differently) seem to be shared across species, though currently it is acknowledged that we are unable to determine whether conscious, voluntary recollection of memories is possible in non-human species (Lewis et al., *ibid.*)

Whilst this also suggests that some species also engage in mental time travel – the ability to project the self into the real or imagined past and an imagined future (Suddendorf and Corballis, 2007) - it is still controversial as to whether these travels are indeed self-conscious and if these species possess what Tulving (1985) calls ‘autonoetic awareness’, or conscious self-awareness. Corballis argues that, given that ‘words themselves have become part of memory, the emergence of language may well have expanded our capacity for mental time travels’ (2019: 6). It also seems that narrative is instrumental in generating a developed autobiographical memory, as well as a fully conscious knowledge of the self, existing at different points in time. This is evident from ontological studies examining childhood amnesia, as well as work on dynarrativia in adults, which results from some form of damage to the brain (Young and Saver, 2001 – see below for detailed discussion).

Fernyhough (2012) demonstrates that very young children are not amnesic but are unable to organise their autobiographical knowledge in

coherent ways. As he says: ‘As children become better storytellers, they become better rememberers’ (2012: 114). We might therefore say that because infant memories do not undergo the shaping which narrative and stories provide, they cannot be retained and are therefore easily lost, and once lost, they cease to exist. A study by Bauer and Larkina (2014), on memory and forgetting, found that children between the ages of 5 and 10 were able to recall clear memories of outings and events that had occurred when they were age 3, if their mothers had involved them at the time in creating narratives, by means of stories, around these episodes. Children who had not had the opportunity to engage in narrative and story making had significantly impoverished memories and recall of such earlier occasions. Extended autobiographical memories, it seems, are therefore always already dependent upon the narratives which bring them into being. Furthermore, as Bauer and Larkina’s study shows, autobiographical memory is improved when the addressee is not just a passive recipient of a tale about events relating to themselves, but co-constructs these events with another/others. In this sense, we can say that narrative forms both the organising principle and content of our autobiographical memory. By the same token, this suggests that where there is a breakdown in the ability to construct narratives, there is also a concomitant breakdown in autobiographical memory and vice versa. Studies into dynarrativia support this view. For example, Young and Saver (2001) examined four types of dynarrativia which arose as a result of damage to various areas of the neural network associated with memory. They include arrested narration (the ability to recount stories up to the time of injury only); unbounded narration (the reduced capacity to construct stories that are connected to an actual event; confabulation – what cannot be remembered is made up); undernarration (the inability to generate ‘as if’ scenarios and assess the best outcome of potential situations, so individuals will settle on the first gratifying one); and denarration (the ability to generate different narratives, but not to weigh them up emotionally). All

these types of dysnarrativia are potentially devastating for the individuals concerned, since they can impact on their daily lives in deleterious, sometimes disastrous, ways. They conclude that consciousness needs a narrative structure to create a sense of self, which can then move safely through life and that ‘to be without stories is to be without knowledge of one’s life’ (p.74). Whilst we do not go this far, we do, however, maintain that the ability to construct extended recursive narratives is essential to preserving an elaborate sense of self which persists over and through time. Without this, the self exists within a kind of perpetual present. This is made tellingly evident in Suzanne Corkin’s (2013) text, entitled *Permanent Present Tense*, on amnesic Henry Molaison, who had his hippocampi removed in an attempt to cure his epilepsy, and who was thenceforth condemned to being unable to produce new memories (or imagine a future) and therefore to living in the here and now.

## **6.2 Narrative and Theory of Mind**

Overlap between the neural networks underlying both temporal personal memories and ToM (see Spreng *et al*, 2009) also suggests that our autobiographical memory and our sense of self develops in tandem with our sense of others. ToM essentially involves the appreciation of other individuals as intentional beings with purposive mental states and independent (and therefore possibly false) belief systems (Call and Tomasello, 1999). These properties are fundamental to language in which ‘communication depends upon the ability of human beings to attribute mental states to others’ (Origi and Sperber, 2004). ToM is a notoriously difficult trait to detect in other species despite research going back at least until the 1970s (e.g. Premack and Woodruff, 1978). Call and Tomasello’s judgement in 2008 was that:

‘yes, chimpanzees do have a theory of mind. But chimpanzees probably do not understand others in terms of a fully human-



like belief–desire psychology in which they appreciate that others have mental representations of the world that drive their actions even when those do not correspond to reality.’ (2008: 191).

Since then, the authors have acknowledged that evidence does in fact support the claim that a range of Great Ape species (including chimpanzees, bonobos and orangutans) demonstrate an appreciation of others’ incongruent representations of reality, in anticipatory looking tasks. However, it remains unconfirmed whether other primates are able to make explicit behavioural choices that reflect an understanding of false belief states (Krupenye et al., 2016).

While Ernst Haeckel’s dictum that ‘ontogeny replicates phylogeny’ is no longer taken as an infallible indication of when a particular trait may have arisen in evolutionary history, it is nevertheless interesting to note the early manifestation of aspects of ToM in human infants, possibly corresponding to a relatively early emergence in the hominin line. Within minutes of birth neonates show a particular interest in face shapes (Goren et al., 1975) and within weeks are able to process features of faces and distinguish individuals (Morton & Johnson, 1991). Early in their second year, infants engage in coordinated joint attention based on gaze and pointing (Scaife and Bruner, 1975). The ability to understand false beliefs is generally thought to appear only around the fourth year, though it has been claimed that infants engage in earlier belief processing constrained by the limits of subitizing (Apperly & Butterfill, 2009). One particularly illuminating and cohesive account of the relevant stages of the semiotic development of intersubjectivity in children, is proposed in the Mimesis Hierarchy (MH) model (Zlatev and Andrén, 2009; Zlatev, 2013). The MH model outlines 5 stages of development, with each stage incorporating and building on the characteristics of the previous one: the initial proto-mimesis stage from 0-9 months is characterized by empathetic perception, followed by volitional

control and imitation (dyadic mimesis) as in coordinated (joint) attention, and generalized deferred imitation, from 9 – 14 months. The third stage is characterized by communicative intent (triadic mimesis) from 14-20 months; stage 4 (20-30 months) sees the development of a protolanguage – communicative conventional representation through ‘signs’. Finally, from 30 months onwards comes language with the use of complex sentences, discourse and the onset of narrative.

With regard to narrative development, Levy and McNeill (2015), following Vygotsky, show that children’s narrative development follows a progressive trajectory with each stage building on the language used both by the children themselves and by others around them (including telling of fairy tales and other stories) at a previous stage. Interestingly, although they have found that 2 to 3 year olds are able to recount spontaneous narratives about themselves and things they have seen which demonstrate some measure of internal cohesion and reference, other studies have shown that it is not until the age of 4-5 that children are able to recount more extensive and internally cohesive narratives which are elicited by others. It appears, therefore, that as children’s linguistic ability increases, as they communicate with others in and through language, their ToM, which entails knowing what others are thinking, also develops, since understanding what another wants to hear is key to being able to recount narratives. Hutto (2008) also suggests that it is through engaging in narrative with the support of others (particularly in folk tales dealing with beliefs and desires) that children are able to acquire folk psychological competence. Tompkins et al. (2019) concur that narrative and ToM are related and suggest that this is a fruitful area for further research.

It appears therefore, that our sense of who we are, in and through time, develops in tandem with our awareness of who others are, in and through time, and this knowledge is sustained through narrative and stories. This is reinforced if we consider that our knowledge of ourselves and our memories

can actually be generated by the stories told to us from a young age.

### 6.3 The evolution of narrative

What narrative and stories appear to do is to arrest memories for long enough for us to be able to share them with others. As shown in section 2, they can act as a kind of ‘social glue’ which helps to facilitate social bonding (Gottschall, 2012; Dissanayake, 1992). As far as we know, *Homo sapiens* is the first species to have creation myths or oral histories (for discussion of possible cultural capacity in *Homo neanderthalensis* see Lind et al., 2013) and these are still prevalent in all human societies including hunter-gatherer cultures (though see Everett, 2005, for the claim for a partial exception to this rule). These myths or oral histories start out as mobile oral narratives which change through time depending on who does the telling, but whose basic elements remain the same (Ong, 1982). Although the narratives and stories are susceptible to change each time they are recounted, they remain sufficiently stable for long enough to make it possible for larger groups to share them and to cohere around narratives of common ancestry and beliefs. Dunbar’s (1993) social brain hypothesis suggests that optimal group size was, and still is (see Dunbar, 2016), around 100-200 people.<sup>7</sup>

For early humans, sharing narratives in stories and the resulting cohesion of the group meant that it was less imperative for every member to be preoccupied with immediate concerns in order to meet the basic biological needs of the whole group, constituting what Sahlins (1972) termed the ‘original affluent society’ which had access to more free time than any previous (and subsequent – Dyble et al., 2019) social organisation. This,

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<sup>7</sup> However, what might be termed metanarratives and stories enable cooperation between otherwise disparate groups, which can come together to form a larger group. Such narratives have helped disparate groups to cohere in what Anderson (1983) terms ‘imagined communities’, giving rise to, and helping to sustain, the nation states that we have today (see also Gildea, 2019). These societies can also topple when old narratives are replaced by new ones and allegiances change (Gottschall, 2021).

in turn, meant that more individuals had more time that allowed for more mental time travel (and the generation of ‘as if’ scenarios related to the past and/or future) which still underpins cultural and scientific developments; as Wiessner (2014) has demonstrated, some 85% of night time conversation in the hunter gatherer society she investigated was devoted to interaction that was not immediately utilitarian in the here and now: that is, to narrative and stories (see also Sperber, 1996; Carruthers, 2002).

## 7. Conclusion

In summary, our hypothesis that language developed for the external representation of mental narrative, which is clearly falsifiable in the Popperian sense, constitutes the best Peircean abduction that accounts for the evidence available from the various disciplines that contribute to the study of language evolution. We maintain that a little under 2 mya in one hominin species, most likely *Homo erectus*, a greater willingness to cooperate emerged resulting in evidenced behavioural developments. We suggest that though this species was cognitively more advanced than any previous, just as great apes are more advanced than other primates, which are themselves among the most intelligent mammals, its mode of thinking was not radically different and was constrained by the nature of subitizing from which it was exapted. The one major change in this period was the appearance of protolanguage as the first intentional system of communication based on concatenations of initially multimodal iconic and indexical signs, rapidly replaced with vocal symbols. There followed a period of more than a million years of stasis until hominins, and eventually the earliest *Homo sapiens*, underwent a radically altered mode of cognition: a *Narrative of Thought*. This was grounded in the recursive embedding of simple propositions and the extant mode of protolanguage was swiftly enhanced for the representation of mind-internal structured narratives.

The forms that languages assume today are determined by the properties of the cognitive structure they represent. We have proposed therefore, that modern/complex language evolved in one breeding group of hominins for the purpose of representation of narrative, which facilitated social and cultural innovations as well as greater social cohesion and enabled that group to outcompete rival hominin groups. We suggest that language coevolved with the cognition necessary for narrative, which in turn acts as a support for auto/biographical memory, and enables individuals to come together in larger groups which have greater potential of outcompeting other groups for essential resources by enabling greater social cohesion and cooperation and efficient division of labour. Narrative, and its representation in language, are thus adaptive traits which coevolved with aspects of culture and give momentum to creativity and innovation including scientific thought.

As we noted in the introduction, much of our hypothesis is informed by investigation in several different areas of research and we believe our synthesis of this body of work will be of use to researchers in these fields and provide the impetus for others to build on the ideas presented. Indeed, there remains a good deal of further research to be undertaken. For example, although there is a considerable body of work on cross linguistic argument structure (for bibliography see Levin, 2018), additional work is needed, particularly on the nature of the cognitive material that is represented and the form that representations can take. Moreover, there has only been one empirical study of the relationship between subitizing and linguistic argument structure (Nelson and Stojanovik, 2002) and further investigation in this area is required to establish the degree of correlation between the two. Further research on the relationship between narrative, story telling, ToM and memory would also shed further light on other aspects of cognition discussed above, as would additional studies into neuroscience and narrative. Another fruitful area for further research is in

the application of the comparative method on the nature of cognition in non-humans, especially in relation to the evolution of language. Finally, our conception of language as a representation of mind internal thought is radically different from that in much mainstream linguistics. Certainly it departs fundamentally from the notion of language (or at least syntactic structure) as *realisation* of cognitive derivations (e.g. Chomsky, 2015). We pursue research into the notion of language we adopt, and the nature of the content represented, in the manner of Burton-Roberts (e.g. 2011, 2013). All these research areas have the potential to provide deeper insights not only into language evolution and narrative, but also into the functioning of the human mind and our understanding of what it means to be human.

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