Fictional Stories Reveal Human Biases:
How a Preference for Tales of Resourceful Heroes Sheds Light on the Evolution of Language

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Abstract

Storytelling, both factual and fictional, is a universal, cross-cultural phenomenon, largely characterised by one or more intentional agents interacting with unexpected events. Frequently, the protagonist achieves his or her goal, resolving the tension created by the unexpected event. The form of the story—both in conversational event reporting and fictional literature—has undergone cultural evolution to attract attention from others, and as such reflects human cognitive biases. It has been hypothesised that language evolved in part to advertise biological relevance through narrative style event reporting. Thus, it is conceivable that human language and intelligence evolved out of a need to advertise and recognise resourceful individuals. Evolutionary theories of Machiavellian intelligence in early humans support this position. The present study partially replicates Mesoudi *et al.*'s (2006) transmission chain study, which showed that participants more accurately remember stories about social interactions than stories about individual agents. It was concluded that humans have an evolved bias for social information, but not specifically gossip-like information. The present study hypothesised that the individual information did poorly because its protagonist failed to achieve her goal, while she was unexpectedly successful in the social narratives. While there was no significant difference discovered between successful and unsuccessful individual stories, there was also no clear distinction in recall accuracy between social and non-social stories, and gossip was recalled with far greater accuracy than the social story. These results suggest that while humans most likely do have a social bias, other narrative factors such as unexpectedness and high-stakes vs. low stakes scenarios also come into play.

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'There is no greater agony than bearing an untold story inside you'
- Maya Angelou

1. Introduction

One major focus in the study of the evolution of language is the investigation of the social and cultural dynamics that initiated and shaped the emergence, form, and function of language. If we examine the ways modern humans use language to attract the attention of others, we can discover what elements of social living the human brain has evolved to pay attention to. One crucial resource for examining the social complexities humans consider worthy of communicating about linguistically is narrative: both narrative-style event-reporting in conversation and fictional storytelling in all mediums. Both pervade human culture and social interaction, and have evolved through a lengthy process of cultural transmission to reflect human cognitive biases.

1.1 Cultural Evolution and Transmission

Modern-day cultural phenomena do not spring into being overnight. Instead, they have been transmitted from generation to generation through the process of cultural transmission. Knowing this, through empirical studies of cultural transmission we can extrapolate back to hypothesise about early human behaviour (see Mesoudi and Whiten, 2008, for a review). Cultural evolution is a process of social learning. Individuals pass information down through generations, using social learning mechanisms such as language. Languages, religions, and social norms and practices are all transmitted this way. It has been convincingly argued that culture evolves in ways directly analogous to Darwinian biological evolution. Mesoudi *et al*. (2004, p.1) provide evidence that culture shows 'variation, competition, inheritance…accumulation of successive cultural modifications over time…adaptation, convergence, and the loss or change of function', which are all key Darwinian processes. Human cultural practices are unique because they are cumulative; each generation adds useful modifications to an already established practice, with very little loss of important elements (Tomasello *et al*., 1993).

Cultural transmission allows for the social ideas, tools, values and beliefs within a society to be highly relevant, since for the most part, only the most effective concepts will be considered memorable, teachable, and worthy of being transmitted to the next generation. The information being transmitted owes its content purely to the

properties of the learners. Cultural traits that command significant attention will survive generations of transmission intact, as the information transmitted must—through what Boyd and Richardson (1995) label *persistence*—be preserved in one generation until it is time to be passed on to the next. Language and cultural practices are so highly refined today because they have undergone generations of cultural transmission, which has tailored them to reflect human needs and desires.

Of course, humans can and do easily express a great deal of non-memorable, mundane information with language. However, when it comes to capturing another's attention through a story about an event, real or imagined (which humans do frequently and universally), humans are restricted to a specific, culturally refined structure if they want to command attention.

The present paper is concerned with once particular cultural practice that has undergone countless generations of transmission and refinement; the production and reception of fictional narratives. As Tooby and Cosmides (2001, p.7) note, 'involvement in fictional, imagined worlds appears to be a cross-culturally universal, species-typical phenomenon'. Human culture is saturated with fictional narratives (Dunbar, 1996, pp. 5, 102); fictional worlds exist in movies, books, plays, television shows, advertisements, billboards, and songs (Cook, 1996, p. 228). Narrative perception is built into the way we see the world, even static images (Abbott, 2008). Fictions are nearly as intrinsic to human culture as language itself, and as a result, there is an ongoing quest to determine a biological explanation for the prevalence and the pleasure of stories. Humans devote a significant amount of mental time and energy to narratives. Narratives are records of what humans find to be worthy of attention, memory, transmission, and linguistic expression.

1.2 Narrative Conversation

In the language evolution literature, the evolutionary implications of the presence of non-fictional, conversational narrative has received more attention than the implications of the popularity of fictional narratives. Many theorists argue that one of the primary modes of human language and cognition is narrative (Bruner, 1990; Schank and Abelson, 1995). Humans use narrative to encode, organise, and understand human action and interaction (Bruner, 1986). Narrative makes up a large component of human culture and conversation. According to Dessalles' (2008) corpus, narrative in conversation (characterized as reporting on situated events) makes up 26% of

conversation time, while Eggins and Slade's corpus (1997) found that it makes up 44.3%. Although there is some discrepancy between the two results, both percentages demonstrate that narrative speech is an integral component of spontaneous human communication (Dessalles 2008, p. 93). Adult discourse is often characterised by a narrative style of event reporting when people talk about their actions (Harvey *et al.*, 1990), successes (Baumeister and Newman, 1994), and particularly emotionally salient events (Rime *et al.*, 1992).

The universal, spontaneous desire to report on unexpected and emotional events has begun to generate evolutionary hypotheses. Dessalles (2000, 2007) is at the forefront of this exploration, postulating that language evolved to establish cooperation within coalitions, wherein individuals align themselves with those who have gained status through relevant, novel event reporting and hence receive status by association. Therefore, humans have evolved to pay attention to narratives (and those that tell them) that revolve around high-status, competent individuals successfully navigating unexpected situations.

1.3 Function of Fiction

Dessalles steers clear of discussing how fictional narrative fits in with his theory. This project will propose that Dessalles' theory, with its emphasis on the social value of novel information and problem-solving, helps explain (and in turn is strengthened by) the universal human attraction to fictions. An examination of the essential underlying structure of fictional narratives, the emotions fictions provoke from audiences, and the elements people remember and transmit in transmission studies reveals that fictional narratives mirror non-fictional event reports in both structure and reception. This suggests that language and the human desire to advertise high-status and associate with high-status individuals are intimately connected.

At first glance, fictional narratives would seem irrelevant to this discussion, given that the information they present is technically false, in that it does not *directly* correspond with real-life events. Pinker (1997) argues that human engagement in the fictional experience is an accidental and functionless by-product of other adaptations. Tooby and Cosmides (2001, p. 20) argue that the human mind 'preserves storehouses of information whose truth value is suspended' that can be 'tapped to make inferences (such as about what others think) or regulate behaviour whenever the organism finds itself inside the scope of the conditions where such information applies'. So, while

information gleaned from fictional accounts can be useful, Tooby and Cosmides are firm in their belief that the brain clearly designates fictional information as *false.*

However, there is a wealth of empirical evidence suggesting that humans respond cognitively to fictions in ways that are strikingly similar to the ways they respond to real life events. When reading literature, people process and interpret the works based on their own remembering of autobiographical life events in which they were active agents (Halasz, 1991; Larsen and Seilman, 1988). Many theorists see fictions as true, but at a different conceptual level from the everyday, in the sense that they are models (where a model is defined as 'an approximation with necessary simplifications that yields useful predictions of complex environments' (Oatley and Mar, 2005, p. 182)). Fictional narratives contain elements that are highly relevant to navigation of the individual and social world, including specifics on character interactions (Propp, 1968), and psychological states (and how they relate to a character's goal-directed activities and social interactions) (Greimas and Cortes, 1976). Thus fiction is a useful 'simulation of selves in the social world' (Mar and Oatley, 2008, p. 173), which allows humans to continually hone their comprehension of the social world. Fictions share the same basic characteristics with conversational narratives, and provoke similar cognitive responses. Fictions can thus be viewed as tools for practicing and refining the human ability to interact in a complex social environment (Boyd, 2009). Therefore, the basic structure and elements underlying the majority of the world's fictions has likely been designed, through generations of transmission, to effectively engage humans in this cognitive endeavour.

1.4 Focus of the Current Paper

In the course of this paper, I will expand upon the argument that fictions have evolved through cultural transmission to engage us in the same way as real-life event reporting, and that the universals present in fictions can reveal human cognitive biases that contributed to the evolution of language. I will argue that Dessalles' theory of narrative as a tool of advertising and attaining social capital is strengthened by the fact that universally, fictions revolve around resourceful heroes who achieve their goals when faced with unexpected situations, which implies that humans have a strong bias for hearing the narratives of high status, competent individuals. To test this theory empirically, I have partially replicated the study conducted by Mesoudi *et al.* (2006), which presented participants with a series of short narratives. Each participant's

memory of the original stories was passed to the next participant through a transmission chain. The resulting recall data suggested that humans have a bias for social information over information about an individual or the physical environment. The current study expands upon this, testing to see if humans have a bias for narratives centred on goal-achieving individuals, irrespective of whether the narratives are social or individual in nature. The current paper builds off my work on a short review of Mesoudi *et al.* (2006), submitted as assessed work for the module Current Issues in Language Evolution. The review featured a very brief summary of their study and suggested that they did not fully consider narrative confounds. Thus, a few of the concepts present in this paper have appeared in that review.

1.5 Outline

Chapter 1 outlines Dessalles' specification for successful conversational narrative, as well as his hypothesis that language evolved as a mechanism for forming coalitions around biologically relevant leaders. Chapter 2 argues that fictional narratives universally conform to the same strict rules regarding content and structure as conversational narratives, drawing evidence from studies on cross-cultural narrative universals, child storytelling, and the most memorable elements of fictional narratives. Chapter 3 expands upon the ways humans respond to fictions; in particular, the way the human brain personalises stories about fictional characters and situations in order to ensure that they are maximally relevant to each individual. Evidence is presented for the idea that fictions have evolved through cultural transmission to be effective at giving the receiver the illusion of common ground, and that engaging emotionally with fictions is a safe space for mentally working through difficult social dynamics. Chapter 4 turns to ways to replicate the emergence of story elements over generations of cultural evolution through the use of transmission chains, focusing in particular on the study by Mesoudi *et al.* (2006) that revealed a human bias for social information. Chapter 5 presents possible narrative confounds present in Mesoudi *et al.'s* materials. Chapter 6 outlines a partially altered version of their study, Chapter 7 discusses the results of the current study and the implications they have for the evolution of language and storytelling. Conclusions are drawn in Chapter 8.

2. Narrative Behaviour in Conversation

In this section, I summarise Dessalles' argument that language evolved as a way to advertise status and recognise higher status individuals, through the use of event

reporting. Dessalles begins with an in-depth examination of the properties of effective conversational narrative, arguing that storytelling in human conversation is subject to strict rules in order to be considered worth listening to and socially acceptable.

2.1 Novelty

The first requirement for storytelling, Dessalles notes, is to include a salient, novel point. Otherwise, they resemble the simple declarative observations made by infants and are seen as redundant and pointless. This novelty must be 'about an unusual state of affairs or present some stake' (Dessalles, 2000, p. 64). Novelty is valuable; the first person who notices or exploits a novel situation will inevitably be viewed as highly relevant, and thus highly biologically relevant (2007, p. 319). The ability to spot unusual events or to anticipate desirable or undesirable outcomes is a reliable indicator of potential success. This novel point is often characterised by highly positive or negative emotion.

2.2 Unexpectedness

The second requirement for storytelling is unexpectedness. Unexpectedness takes into account the proximity of the event, the time that has lapsed since the event, and the degree of common ground between the teller and the listener. Dessalles argues that maximally reportable unexpected situations can be characterized by 'the contrast between the expected and the actual complexity of the situation' (2008, p. 94). He gives the example of running into a close friend (which is maximally simple) in a faraway town (which, due to its remoteness, is complex), which displays significant enough contrast to make for an interesting story.

2.3 Evolutionary Hypothesis

In Dessalles' view, the fact that humans spend so much time willingly and spontaneously providing emotional accounts of unexpected, novel events to others poses a paradox for evolutionary accounts of language. Freely sharing novel information *should* result in a loss of benefit for the teller, since she quickly loses her hold on important, coveted information. Similarly, if every individual passes on every biologically valuable piece of information, a population should eventually stop seeking out information, 'bring[ing] about its own negation' (Dessalles 2007, p. 320). Inquisitiveness can also be risky and therefore costly. Together, these factors demand a workable evolutionary model for the human narrative instinct.

The narrative component of conversation poses problems for cooperative theories of language evolution. If language were cooperative, Dessalles claims, conversation would consist of 'I tell you something of interest to you, you tell me something of interest to me, at which point conversation comes to an end until the next exchange' (2007, p. 327). This is not realistic. Instead, Dessalles proposes a coalitionary model, building off the fact that coalitions are important to the social dynamics of our close primate relatives (de Waal, 1982).

Integral to Dessalles' argument is the role of the interlocutors in a conversation who receive, evaluate, and respond to stories. He argues that listeners are just as constrained as storytellers. When faced with a story, they will either, a) reinforce, b) trivialize (by contributing an even more unlikely story, leading to a series of 'story rounds' (Tannen, 1984)) or c) correct or criticize the speaker for incorrect information. Therefore, by freely communicating maximally unexpected information, storytellers gain a sort of 'social kudos' from listeners. The more unexpected and emotionally-charged the story, the more biologically relevant the storyteller will appear to be, as she has shown an ability to seek out and deal with a difficult situation. Furthermore, by vocally assessing these stories, interlocutors benefit from similar social esteem for being relevant. Thus, Dessalles hypothesises that relevant information replaced physical strength as the determining factor in the decision to join a coalition and to remain in it. He provides evidence from modelling that shows that the coevolution of status and language is a plausible scenario (2000).

In sum, narrative in casual conversation must be relevant to the interlocutor, contain a salient point, and be significantly unexpected. It is likely to involve emotions, both positive and negative. Interlocutors have a choice to correct any misinformation, affirm the story, or trivialize it through increasingly unexpected and/or emotional stories of their own. Crucially, interlocutors do this vocally and publicly, without any prompting. On a larger social scale, people assign high status to those who narrate well, and in turn attain status for themselves by associating with and responding to these individuals relevantly.

3. Narrative Universals

An analysis of literary universals and the characteristics of narrative-style event reporting reveals several commonalities in form and content, which are outlined below.

3.1 Emergence of Storytelling in Children

Around age 3, children begin to show an ability to produce and understand stories. Initially, the stories lack a traditional structure, but they do consistently star striking characters and counterintuitive events. Boyd (2009, p.183) gives an example from a 2 1/2 year old which includes the lines, 'choo choo train in the sky, the train fell down in the sky, I fell down in the sky in the water'. As he notes, while this is not a structured, developed story, the boy 'seems to intuit the need to surprise' (p. 184). This instinct characterises the play of children that age, who routinely use fantastic characters and events in an attempt to catch attention (Sutton-Smith, 2001).

By age 6 children are well versed in the basic structural schema of a simple story, which consists of a beginning (the initiating event), a simple reaction by the protagonist, a goal (the way of dealing with the initiating event), the attempt to achieve said goal, the outcome, and the ending (Mandler and Goodman, 1982). As children age, their conception of stories increasingly revolves around intentional understanding of human action in terms of feelings and thoughts that depend on personal history and character traits (McKeough and Genereaux, 2003). Furthermore, the heroes of these stories become more active and resourceful; they begin to overpower the dangers that hinder them and achieve their goals (Boyd, 2009; Sutton-Smith, 1981).

3.2 Breaches in Normality

Like conversational narrative, fictions are born out of breaches of conventionality. Typical stories are made up of the interactions between actors, actions, goals, intentions and/or scenes, and when an imbalance arises between two or more of these components, a breach in normality results and a gripping narrative is triggered (Bruner, 1986; Lucariello, 1990). Lucariello's (1990) study shows that this imbalance elicits attribution of consciousness to an actor in order to explain motive. This imbalance has its origins in the unexpected, reportable events of real life: Dessalles (2007) gives the example of two people sitting in a Paris café as a stark naked pedestrian passes by. This is a classic breach of normality, and as Dessalles points out, it is highly improbable that the café-goers will not immediately launch into a discussion of the event.

3.3 Counterintuitive Elements

Studies also show that stories containing 'evocative minimal counterintuitions' are remembered and transmitted better than those that do not (Boyer

and Ramble, 2001; Norenzayan *et al.*, 2006, p. 549). Counterintuitive concepts are defined as 'a member of a particular category (e.g., animal, artefact)' that 'possesses a feature that violates intuitive expectations that are regularly acquired by children in any cultural setting' (for instance, ghosts, who appear human but can walk through walls) (Barrett and Nyhof, 2001, p. 72). These minimal counterintuitions possess just enough of an element of surprise to catch attention, but not so much that they are entirely alien.

This evidence suggests that fictional stories, like conversational narratives, have been socially moulded to maximise attention through the use of a salient point (the goal the hero must attain) and unexpected events (the precipitating event, counterintuitive elements), which suggests that humans have a bias for unexpected content. Furthermore, as I will illustrate below, studies on narrative universals suggest that the resolution of conflict and achievement of the goal by the protagonist is a statistically significant presence in fictions across the world.

3.4 Conflict/Resolution Universals

3.4.1 Folktales

Propp's *Morphology of the Folk Tale* is a highly influential structural analysis of tales. 'Morphology' is defined by Propp as 'a description of the tale according to its component parts and the relationship of these components to each other and to the whole' (1968, p. 8). It is a systematic analysis of how the 'functions' (acts) of characters determine the course of the story's action. Functions, Propp argues, are fundamental components of a tale, and always present themselves in the same order. While it is important to remember that Propp analyses the structure of one type of story—the Russian fairy tale—this does not necessarily diminish the relevance of this study for the examination of universal human biases. Propp makes no claims about any other folk-tale structure or a universal story structure. However, as Dundes (1968) notes in his introduction to Propp's work, there is evidence for an application of Propp's morphology to African tales and Native American tales (Dundes 1964; Paulme, 1963), which gives some credence to the notion that this structure is consistent in non Indo-European tales as well.

Although specific incidents (such as 'XII: The hero is tested, interrogated, attacked, etc. which prepares the way for his receiving either a magical agent or helper' (Propp, 1968, p. 24)) may be, in part, specific to the Russian fairy tale structure, many of the functions outlined by Propp conform to a universal story structure (Hogan, 2003).

The morphology clearly outlines a moment of destabilisation at the beginning ('VIII. The villain causes harm or injury to a member of a family' (p. 17)) which leads to a specific goal ('IX: Misfortune or lack is made known; the hero is approached with a request or command; he is allowed to go or he is dispatched' (p. 22)). Along the way the hero encounters various helping and hindering agents, eventually engages in direct combat with the villain (wherein the villain is defeated). The hero then achieves his goal ('the initial misfortune or lack is liquidated' (p. 35)) and is rewarded ('the hero is married and ascends the throne' (p. 43)). Propp notes that 'a large number of functions are arranged in pairs (prohibition-violation, reconnaissance-delivery, struggle-victory, pursuit-deliverance, etc.' (p. 44). As discussed in the next section, this conflict-resolution dynamic is a universal aspect of fictions. Even if some of Propp's functions were found to be specific to Russian fairy tales, Propp's examination would remain valid to this discussion because it reveals the elements of story that Russian society society deems attention-worthy.

3.4.2 Cross-Cultural Desire for Happiness

Hogan (2003) has conducted the most extensive study of cross-cultural narrative universals to date. He has examined the literary and oral canons of every major culture in search of absolute universals. Universality here means 'recurrence across a higher percentage of genetically and areally distinct traditions than would be predicted by chance (p. 44). This does not mean that universal features must appear in *every* work of a given culture. An absolute universal is one that occurs in the canonical and popular narratives in all traditions, regardless of the fact that there are narratives in every tradition that do not conform to the 'universal' template. Of course, not every story will be a prototypical (or 'paradigm' (p. 5)) story, but it is the paradigm stories that engage our emotions most effectively, and thus it is the paradigm stories that are valued enough to be retold through generations.

These paradigm stories recount pursuit of a goal and they are 'necessarily organised by reference to the eliciting conditions for one outcome emotion, happiness, since happiness is the aim of action' (p. 92). Hogan divides these paradigm narratives into two broad universal types; romantic and heroic tragi-comedy, which are 'derived respectively from the personal and social prototypes for happiness' (p. 98). Hogan identifies a universal structure of prototypical narratives that closely mirrors the organisation of Propp's functions: 'social conflict → deprivation of the object and exile

→ social extension of threat → defeat and punishment of the antagonist (often aided) → split and reconciliation → reacquisition and return home (symmetrical).' (p. 232). It is important to note that these stages are inherently social, but also that they are characterised by the desire for a goal, struggle to achieve that goal, and eventual success in achieving the goal. This is, according to Hogan, because we have a cognitive craving for actions and events to end happily.

Furthermore, prototypical narratives increase the impact of the final achievement of happiness by first creating a corresponding negative scenario: 'the prototype conditions for happiness are preceded by the prototype conditions for sorrow' (p. 228). By making ultimate happiness more difficult to achieve, prototypical narratives ensure maximal emotional payoff.

These universals point to a possible human cognitive bias for stories wherein the main character is resourceful in dealing with novel, unexpected situations and ultimately achieves her goal. I argue this is because humans respond to fictions as tools for reasoning about their social world. We take cues from the fictional situations we engage with and apply them to real-life situations. I outline this argument in the next chapter.

4. Human Cognitive Responses to Fictions

Fictions have been crafted through cultural evolution. Fictions affect the receiver the same way that casual narrative discourse about true, situated events does, and endure as cultural phenomena precisely because they provoke the receiver into a similar status-granting response.

Firstly, it is important to assert that fictions are not 'false' in the sense that despite being technically untrue, they are intimately connected to emotional responses to real-life events. Fiction simultaneously maintains realistic grounding in the world and manages to be, at times, completely impossible within real-world constraints, and thus exist as 'extension[s] of our existing knowledge' (Searle, 1975, p. 331). While we know that fictions are not reports on real, situated events, we nevertheless react to them in very real ways (Walton, 1978; Skulsky, 1980; Gerrig, 1989), while the expansion beyond real-world constraints allows us to apply the knowledge we glean from fictions to a wide array of potential situations.

4.1 Common Ground

Fictions appeal to people in the same way that a highly relevant narrative in conversation does because, to a certain extent, they bypass the issue of common ground. Despite being about people the reader has never met, fictional stories create an illusion of personal relevance. They do this by presenting a 'subjunctive reality that denotes a possible but not certain reality' that is 'partially determined by the listener' (Astington, 1990, p.159). Long *et al*. (1989) point out that specific devices in narrative fiction (i.e. analogies, descriptions of emotion, etc.) evoke mental imagery more so than other types of text. Mar and Oatley (2008) argue that imagery relies on personal memories to fill in suggested textual experiences. Their previous research found that 'narrative text was more likely to prompt vivid autobiographical memories in which the reader was an actor or active observer of scenes rather than more abstract conceptual memories' (2008, p.178). Since the researchers controlled for all other variables except for the narrative versus expository genre of the text, this suggests that receivers of a fiction – no matter what the content – will connect to the fiction on a subjective level.

Similarly, Tannen (1979) found that a film triggered subjective interpretations from her participants, depending on their expectations about the real world. Participants in her experiment were shown a film, lacking in dialogue or emotional displays, of several people interacting with each other in different ways. Tannen found that 'the events, objects, and people depicted in the film trigger expectations about similar events, objects, and people in the real world and their interrelationships' (p. 146). Participants interpreted the simple act of picking pears as philosophical, melancholy, idyllic, etc., as though this film created the illusion of common ground by allowing the viewers to supply their own emotional interpretation. This process is what Chafe (1990, p. 82) calls 'discrepant modelling of physically identical input'.

4.2 Social Interaction with Fictional Characters

A story involving one individual not interacting with other agents may still be social by virtue of the fact that readers are interacting 'socially' with the fictional protagonist, as their sympathies are aroused by the protagonist's desire to achieve a goal (Boyd, 2009). This theory drives much of the literature on the human cognitive desire to both receive and create fictions, and has significant empirical support. Mar and Oatley (2008) champion this idea that narratives communicate social, as opposed to general knowledge. They argue that we attend to fictional characters in the same way that we

understand that others direct their attention towards relevant objects, and by following their gaze we engage in a shared experience. Oatley and Mar (2005) supply empirical evidence suggesting that understanding people and understanding characters in fictions involves similar cognitive processes. For instance, it has been found that readers form trait-based character models of individual characters in fictions, which are constantly updated when new information that does not fit the current model is revealed (Rapp and Gerrig, 2001). A similar process happens in real-world character judgements (Park *et al*., 1994). There is a proposed 'shared neural basis for attempting to make sense of real people and for processing fictional representations of persons' (Mar and Oatley 2008, p. 180; U. Frith and Frith, 2003; Lieberman, 2007; Saxe and Wexler, 2005).

4.3 Fictions as Practice and Play

Fictions likely serve as a practice ground for understanding others' beliefs and emotions in order to work out new ways of dealing with problems in our own lives (Keen, 2006; Mar *et al*., 2006; Cook, 1997; Zunshine, 2006). In this view, fictions are simulations of the real world with which we are allowed to practice cognitively for real-life social situations. Evidence for this theory comes from studies that show children use stories to judge what sorts of emotions are ideal in their culture (Tsai *et al*., 2007), and that reading (and being mentally transported into) a story coincides with readers having beliefs and attitudes which are consistent with the beliefs in the story (Green, 2004, Green and Brock, 2000).

Similarly, Boyd (2009) asserts that engaging with fictions serves a similar purpose as animal play; it refines our social minds to allow us new levels of control over problems of cooperation and status, especially those that are significantly unexpected or complex. By over-learning these skills every time we engage in stories, we refine them. We are attracted to and sympathise with 'exceptional heroes' who pursue 'a goal central to life' (pp. 224-225) because we are social animals, evolutionarily inclined to take notice of status and notice others behaviour in an attempt to be more resourceful ourselves.

4.4 Stories Have Evolved Through Cultural Transmission

The fundamental story structure we respond to today represents a culturally selected, maximally relevant formula that is engaging, memorable and transmittable. We respond to fictions that fit this formula because our cognitive abilities have shaped them through generations of transmission and refinement. Thus, the universals we see

today are the aspects that, for the most part, humans find the most attractive and attention worthy. In his analysis of the cultural evolution of fairy tales, Zipes (2006) argues that the fairy tale formula, which is characterised by disorder, followed by resolution and renewed social order, serves as a survival mechanism to instruct individuals on how to adapt to unexpected situations. This formula, he argues, has endured so strongly in human culture because the themes remain relevant to human survival. The attention-worthy properties of certain ideas likely represent the proximate mechanisms for evolved biases. Potential evolved biases may include a social bias, and a bias for novel, unexpected events and solutions to problems.

If fiction is indeed a tool to hone social skills, then the universal elements found in fictions (and the ways in which people react to these elements) should provide a clue as to what contributes to stable social groups, both in the present day and in our evolutionary history. It has been empirically shown that people respond to fictions in very real ways. Therefore, proving that humans have an evolved desire to grant status to (fictional) resourceful individuals who encounter unexpected situations and survive would serve to bolster Dessalles' coalitionary theory of language evolution.

5. The Empirical Study of Cognitive Biases: Transmission Chains

5.1 Benefits of Empirical Tests

Many cultural traits that endure do so because humans have cognitive biases for specific content and form (Mesoudi and Whiten, 2008, Sperber, 1996). Conducting experimental studies on cultural transmission allows us to identify these cognitive biases and explain the presence of wide-spread cultural trends. By creating a simplistic microcosm of cultural transmission processes in the lab, experimenters can identify biases which may not be apparent in just one individual's learning patterns. As the information passes from one individual 'generation' to the next, these biases become magnified.

5.2 The History of the Transmission Chain Method

Any introduction to the study of cultural transmission in the lab inevitably begins with Bartlett's (1932) serial reproduction studies. Bartlett used a linear transmission method, wherein material is passed along a linear chain of participants.

The methodology is essentially a controlled version of the game colloquially known as 'Chinese Whispers' or 'Telephone'. The first participant in the chain is given some material and asked to recall it as best he or she can. The output from the first participant is passed to the next participant, who repeats the process, and so on. By analysing the transformations in the material as they travel along the chain, one can deduce what types of information are likely to spread through cultural generations, and what biases people have that influence what they remember, or *believe* they remember. Bartlett used this method to test the transmission accuracy of folk tales. He found that participants tended to change the material to fit their pre-existing knowledge of familiar events. Folk tales, however, were transmitted much more accurately than other types of material, which Bartlett argues was because people have story schemas that conform to the traditional structure of folk tales.

Since Bartlett's study, transmission chains have been used to uncover a number of cognitive biases: Bangerter (2000) discovered that transmitted information converges upon pre-existing gender stereotypes. Lyons and Kashima (2003) found that stereotype-consistent information was transmitted more faithfully that stereotype-inconsistent information in a story about a member of a small fictitious tribe. Barrett and Nyhof (2001) discovered a bias for stories with counterintuitive elements, while Norenzayan *et al.* (2006) refined this to show that the counterintuitive elements must be minimal to be remembered accurately. Mesoudi and Whiten (2004) found a 'hierarchical bias' where participants impose a hierarchical structure onto descriptions of everyday events. Most relevant to this study, Mesoudi *et al.* (2006) discovered a bias for social accounts over non-social ones.

5.3 Iterated Learning and Language Evolution

Transmission chains have also been used extensively in language evolution studies, though the model is referred to as the Iterated Learning Model (ILM) (Kirby, 2001). The ILM is structured identically to the transmission chain model; there is a vertical chain of agents whose output depends on what they have learned from the previous agent. The ILM seeks to lift the pressure off of the 'innate language organ' hypothesis touted by Chomsky, and instead study language phenomena as they arise from cultural processes and pressures, without input from biological mechanisms. Researchers have used the ILM to discover that bottlenecks of cultural transmission lead to compositional language (Smith *et al.*, 2003), that the number of cultural parents

determines the size of a grammar and the intra-generational communicative accuracy (Smith and Hurford, 2003), and that many of the fundamental aspects of language (including compositional systems of meaning-signal mapping and stable irregularity), to name just a few studies. In these models, language features have evolved without input from biological factors or natural selection (Kirby, 2001).

As Mesoudi and Whiten (2008) note in their review of empirical research in cultural transmission, studies using transmission chains to explicitly investigate content biases are still relatively rare, yet transmissions chains are a far more informative way to discover the reasons for cultural trends than observational evidence or individual recall studies.

5.4 The Social Bias: Relevance to the Current Study

The present study takes an in-depth look at the aforementioned transmission chain study conducted by Mesoudi *et al.* (2006) on the possible social information bias, and proposes and conducts a modified version of their study.

Mesoudi *et al.*'s study is relevant to an analysis of the cultural transmission of fictions and the corresponding implications for the evolution of human language and intelligence for several reasons. Firstly, Mesoudi *et al.*'s study lends credence to the hypothesis that human intelligence evolved as a response to a need to react to complex social problems (Byrne and Whiten's (1988) Machiavellian Intelligence Hypothesis). If humans have an evolved bias to pay attention and remember information about social agents interacting with others, it would follow that fictions function as tools to practice and play with understanding and navigating the social world. However, a key component of the Machiavellian Intelligence Hypothesis is that primates engage in complex social processes in order to achieve ultimate personal gain (Whiten and Byrne, 1997). Primates take note of the actions of successful individuals and using the information for one's own benefit. Thus, information about a solitary competent individual may be just as worthy of attention as information about interacting agents. As I will expand upon below, Mesoudi *et al.* conclude from their second experiment that 'narrative coherence' is not responsible for the memorability of social information over non-social information. However, the present study suggests that there are confounding narrative factors (principal among them, unexpectedness and resolution) that affect the poor transmission of the non-social individual material.

5.4.1 Goals

The goal of Mesoudi *et al.*'s (2006) study is to provide experimental evidence for the Machiavellian Intelligence Hypothesis (Byrne and Whiten, 1988; Whiten, 1999; Whiten and Byrne, 1997). The MIH proposes that human intelligence evolved primarily to navigate a complex terrain of cooperation and competition in large, semi-permanent social groups of long-lived individuals. This experiment is linked to the evolution of language through Dunbar's (1996) social grooming hypothesis, which argues that language arose out of a need to track the doings of others in a group and cement social bonds through gossip. Additionally, it has been shown that there is a correlation group size and neocortex size in primates (Dunbar, 1992), as well as between group size and size of vocal repertoire (McComb and Semple, 2005).This suggests that primates' large brains are a result of dealing with complex social relationships, and that the complexity of communication is related to complexity of social interactions. Mesoudi *et al.* test the transmission accuracy of social versus non-social information across chains of participants, in order to determine if humans have a particular memory bias for social information.

5.4.2 Hypotheses

Mesoudi *et al.*'s hypothesis, if the Machiavellian Intelligence Hypothesis holds any weight, is that social information—defined as 'interactions and relationships between a number of third parties' (three characters per paragraph, in this experiment)—will be transmitted with greater accuracy than non-social information (p. 407). If human intelligence evolved as a response to complex social problems, stories involving interactions with other humans should be preferred over interactions with the environment alone (an assertion made by Clutton-Brock and Harvey (1980), who discuss correlations between primate brain size and the navigation of ecological factors).

The additional, stronger version of this hypothesis follows from Dunbar's (1996) social grooming hypothesis, which claims that gossip in particular, because of its exploitative content, will be even more memorable than ordinary social interactions.

5.4.3 Background

Mesoudi *et al.*'s experiment is an adaptation of Owens *et al.* (1979). Owens *et al.* tested participants to determine how knowing the motivation behind a character's

actions affected recall of those actions. One group of participants was given a series of vignettes involving Nancy engaging in boring tasks like making coffee, attending a lecture, and going to the doctor. The second group was primed with Nancy's dramatic back-story before reading the vignettes (Nancy worries she may be pregnant with her professor's child). Owens *et al.* found significant evidence suggesting that knowing a character's motivations aids quality and quantity of recall. They hypothesised that if Nancy has a goal, the episodes involving her going to the doctor and attending a lecture become urgent and goal-relevant, and thus more memorable. They also suggested that these separate events were integrated into a coherent whole in the participants' minds when motivation was introduced, allowing participants to string the episodes together as 'a day in the life of Nancy', which provided them with a structure (a 'goal oriented scheme') to aid in recall of the order of events (p. 90).

Mesoudi *et al.* consider Owens *et al.* relevant because gossip was found to be more memorable than everyday events, which could lend empirical support to the Machiavellian Intelligence Hypothesis. Mesoudi *et al.* alter Owens *et al.*'s study in two ways. One, they test chains of people, as opposed to individual memory, and two, they expand upon the definitions of 'social' and 'non-social' information in order to make their experiment a more explicit test of the MIH.

Mesoudi *et al.* use the transmission chain method (Bartlett, 1932) in order to reveal 'cumulative and systematic biases in recall' (p. 406). They test ten chains in total, with four participants per chain, and then treat each chain as an independent unit of analysis, as opposed to each participant. This is done in order to best gauge the changes in the material instead of individual recall. Seeing as Mesoudi *et al.* are testing for a bias that has presumably evolved out of increasing social and cultural pressures within primate groups, testing the effects of transmission is the most appropriate way to discover what sort of information has come to be privileged in human memory. This transmission chain method also allows the authors to extrapolate their findings to society over-all.

5.5 Experiments

5.5.1 Experiment 1

Mesoudi *et al*. conducted two experiments. Experiment 1 tested the ability of participants to recall a) social gossip b) individual information, and c) physical information, hypothesising that the gossip would be better recalled than the individual and physical information. The first participant of each chain was given three short paragraphs to read, then was instructed to write down as much as he/she remembered. This recalled material was then passed on to the next person in the chain by the experimenter, etc. etc., until it reached the fourth person in the chain.

Gossip-like information was defined as 'particularly intense and salient social interactions and relationships' (p. 407), and closely resembled Owens *et al*.'s pregnancy scenario:

> Nancy is having an affair with her married college professor. She has been lying to her friends about seeing him. Nancy recently became pregnant with the professor's child. The professor promised Nancy that he would leave his wife, but since she told him she was pregnant, the professor has refused to see her. Nancy is threatening to tell his wife about the affair (p. 422).

Non-social (individual) information was defined as 'a single individual's interactions with the physical environment' (p. 407):

> Nancy is a 22-year-old college student studying history at the University of Denver. Her father works as an accountant and her mother is a teacher. At weekends, she works part-time in a book-store. When she finishes her studies, Nancy plans to travel abroad before pursuing a career as either a novelist or a Journalist (p. 422).

Finally, non-social physical information was defined as 'information solely concerning that physical environment' (p. 407):

> Denver is the state capital of Colorado, located in the western United States near the Rocky Mountains. An early stopping place for Indians, Denver was settled permanently after the gold rush of 1859. Its main industry is agriculture. Denver is a major centre for winter sports, and also contains a branch of the US mint, which produces most of America's coinage (p. 422).

Like Owens *et al.*, Mesoudi *et al.* employed a 'propositional analysis' (modelled after Kitsch (1974), where a proposition equals a predicate plus a series of ordered arguments) to determine the proportion of directly recalled propositions and

thus the gross cumulative changes between the original material and each generation's memory of it. Mesoudi *et al*. found significant differences in recall between gossip and individual and gossip and physical, but not individual and physical. Therefore, they concluded from Experiment 1 that the data supported the strong MIH that gossip material is transmitted in greater quantity and more accurately than non-social material.

5.5.2 Experiment 2

Mesoudi *et al*. then conducted a second experiment to rule out the possibility that the gossip information was recalled with greater accuracy because it had a coherent narrative centred on Nancy's pregnancy, while the other paragraphs were lists of unconnected facts. Mesoudi *et al*. label this possible confounding factor 'narrative coherence' (p. 417). As Bartlett (1932) proposed, stories are remembered and transmitted so well because they contain an overarching hierarchical structure. For the purposes of this experiment, the authors define narrative coherence as 'a linear chain of events linked causally and temporally' (p. 414) because they argue that a more complex hierarchical structure is unlikely to exist in a narrative of 60 words.

Experiment 2 was designed essentially the same way as Experiment 1 (10 chains of 4, etc.). It contained four paragraphs; gossip, non-gossip social, individual and physical. The gossip, individual, and physical materials were altered so that the events within them were causally and temporally related to each other, in an attempt to make them equivalent in narrative coherence to each other and to the gossip material of Experiment 1.

The gossip material had its conclusion changed, removing Nancy lying to her friends because that did not fit with the single linear chain of events:

> Nancy is having an affair with her married college professor. Nancy recently became pregnant with the professor's child. The professor promised Nancy that he would leave his wife, but since Nancy told him she was pregnant, the professor refused to see her. So Nancy told the professor's wife about the affair. The professor's wife was so upset that she left the professor (p. 422).

Individual:

> One morning, Nancy's alarm clock broke and she overslept. When she woke up, she realized that she was late for an important lecture. She got dressed as quickly as she could, left the house and ran to the lecture theatre. When she got there, the lecture theatre was empty. Nancy had missed the lecture (p. 422-423).

Physical:

> The weather in Colorado gets hot and dry in the summer. This removes moisture from the soil and dries out the plants that grow there. The dry vegetation catches fire easily, leading to frequent forest fires. These fires release smoke containing carbon monoxide into the atmosphere. This smoke contributes to global warming, increasing temperatures further (p. 423).

Finally, in Experiment 2, Mesoudi *et al.* included non-gossip *social* information, which is defined as 'a series of social interactions...containing the same number of agents as the gossip, but without gossip-like content' (p. 415):

> Nancy enjoys swimming. Nancy was going to the swimming pool but got lost, so she asked an old man waiting at a bus stop for directions. The old man could not give her directions. A bus arrived at the bus stop and the old man asked the driver for directions. The driver gave Nancy directions to the swimming pool, so Nancy was able to go swimming (p. 423)

In Experiment 2, Mesoudi *et al.* found that the social and gossip materials were transmitted with greater accuracy than the individual and physical materials, but that there was no significant difference between social and gossip material, indicating that the gossip element is not necessary for recall. Therefore, the strong version of the MIH was not supported. Furthermore, they concluded that narrative coherence did not account for the memorability of the social materials, as it failed to increase the memorability of the non-social materials.

5.6 Conclusions

From the results of these two experiments, Mesoudi *et al.* concluded that there is a biologically evolved social bias in humans, such that we more accurately recall information involving humans interacting with each other, but no bias towards particularly exploitative or negative gossip-like information. The authors tentatively suggest that this bias can be extrapolated to the population level in order to explain the prevalence for popular culture narratives, particularly 'to explain the popularity of socially oriented mass media such as gossip magazines and television soap operas over non-social or factual journals and television documentaries' (pp. 418-419).

6. Critiques

6.1 Social Bias

First and foremost, I do not dispute the essential point that humans may have a social bias (possibly as a result of language evolving to aid social dynamics), which leads us to prefer, remember, and transmit information involving the interactions of various individuals. As illustrated in the previous chapters, most of the literature surrounding the evolutionary basis for human storytelling is rooted in the hypothesis that stories appeal to us because they reflect the social complexities we concern ourselves with. Stories employ psychological familiarity, maintaining 'verisimilitude with respect to human emotions and interpersonal interactions' (Mar and Oatley, 2008, p. 185). Fictions abstract, simplify, and compress social issues and complex problems into models of life that promise relevance by virtue of their existence (Oatley and Mar, 2008, p. 173). The social aspect of stories is psychologically effective and universal, affecting the human brain much in the same ways that real social situations do.

From this point of view, it makes perfect sense that the social materials would be better recalled than the non-social materials in Mesoudi *et al.*'s study. However, a closer examination of the materials in Experiment 2 reveals a possible additional difference between the social and non-social materials that could represent a confounding factor. This factor has repercussions for Mesoudi *et al.*'s wish to extrapolate their findings to explain the social nature of popular media.

6.2 Methodological Issues

6.2.1 Narrative Form: a Confounding Factor?

In Experiment 2, the gossip and social materials contain a plot structure that the individual material does not. Even within the field of narrative study (in which a slew of different characteristics are touted as the defining feature of successful stories, with little agreement) most theorists concede that a goal/counter-goal, conflict/resolution story template is universal, successful, and aids transmission (Hogan, 2003; Abbott, 2008). In Experiment 2, the social materials have all the elements of a universally prototypical story; a hero, a goal, a counter-goal, conflict, and resolution. As noted by Hogan, the greater-than-chance inclusion of these elements in the world's literary and oral narratives reflects human emotional biases (specifically, a desire for a resolution that brings happiness). These elements endure so prominently because they

have been culturally selected for across generations as the most effective method to arouse attention and elicit emotion (Bruner, 1986; Lucariello, 1990).

6.2.2 Story vs. Narrative

Brewer (1984), in his highly influential analysis of the story schema, differentiates between a narrative and a story. A narrative can technically be any sequence of events arranged in temporal order. A story, on the other hand, must have an initiating event and outcome, a critical event and resolution, or a significant event and resolution. A sequence of events without one of these three pairings, according to Brewer, cannot be considered a story, only a narrative (p. 9). As noted previously, Propp found that fundamental components of folk tales are arranged in similar pairs. The incredible endurance of folk and fairy tales speaks to the multi-generational relevance and memorability of this conflict-resolution pattern (Zipes, 2006).

What Mesoudi *et al*. have done in Experiment 2 is confuse story and narrative (as defined by Brewer); as a result, the social materials are stories and the individual material is a narrative of connected events without any resolution. In the social material there is a disruption of normality that engenders a conflict (Nancy is lost), a goal (getting to the pool), counter-goal (being lost, encountering unhelpful agents) and again, resolution through the heroine's action (finding someone who knows where the pool is). Similarly, in the gossip material there is a conflict (unwanted, awkward pregnancy) a goal (get the professor to leave his wife) counter-goal (the professor refuses to), and finally, resolution through the heroine's ingenuity (Nancy tells the wife, so the professor leaves her). Both of these stories involve a successful resolution, thanks to Nancy's competence, and leave the reader satisfied.

In the individual narrative, however, the only tension arises from Nancy's lateness, but despite her best efforts, nothing is resolved. Her goal is to make it to the lecture on-time, but she fails to achieve this goal. A story of someone being late, knowing they are late, and eventually failing to make their appointment on time would likely stand less of a chance at transmission in a non-experimental environment. However, if the individual narrative was reformulated to include Nancy applying a resourceful, novel solution to the problem of her lateness and thus succeeding against all odds to make it to the lecture on time, it may be remembered more accurately by participants. The inclusion of a novel method for success would increase the

unexpectedness of the story, which as Dessalles notes is the primarily goal of storytelling in conversation.

6.2.3 Causal and Temporal Relation

While events within stories certainly need to be temporally and causally related, it is noted—even within the language evolution literature—that this is not enough. After all, narrative form is a culturally evolved construct that has been crafted by generations to be maximally engaging, Successful stories do not usually look anything like the narrative that Jackendoff (2003) supplies to illustrate this exact point (worth quoting in whole):

> Once upon a time there was a little duck who lived with an armadillo in a burrow underneath a stop sign, next to a big purple fire station. In the fire station lived a dog named Spot who had been born on a farm in Florida. His parents belonged to a man named Harry Thistlethwaite who grew tobacco for cigars. One day Harry was out walking when a he spied a little girl walking down the street. The girl's name was Monica, and she was 10 years old. She owned three umbrellas, one of which was manufactured by a company in Singapore that went bankrupt four years later. Its owner was so distressed he went to Las Vegas and drowned himself in a swimming pool...(p. 421)

As Jackendoff notes, this sort of story is unacceptable as a paradigm story. We expect characters to be narratively significant and that threads will eventually be tied up in meaningful and interesting ways. Stories are built around a breach in normality and the hero, the hero's goal, and the obstacles that stand in the way of said goal (Hogan, 2003). Of course, not every story will subscribe to a neat conflict-resolution structure. As Abbott (2008) notes, Franz Kafka is a frequent offender, preferring open-ended conclusions. There are gradations to the amount of closure to be found in stories, but extreme examples like Kafka's works usually impact the reader because a) they defy a human need for resolution, and are memorable precisely because they are frustrating taboos, and b) they raise un-answered questions and curiosities in the reader, which something as straightforward as Mesoudi *et al*.'s individual narrative fails to do.

The fact that universally, fiction illustrates imbalances being righted and goals being reached by heroes and heroines speaks to a preference for resourceful protagonists, which ties in closely with Dessalles' (2007, 2008) theory of language evolution.

6.3 Quality of Discussion

An additional weakness that Mesoudi *et al.*'s study suffers from is a failure to include or discuss any of the material provided by the individual members of the transmission chains. It would have been informative for Mesoudi *et al.* to have included the material produced by the final members of the chains, to see if/how the narrative structure was retained. This would be especially beneficial given that the stories lack so much of what makes for a memorable story in the real world. They are relatively mundane and lack any real element of surprise or unexpectedness (except for the gossip material, which will be discussed further). For example, perhaps participants altered the individual material in ways that made it conform to a more interesting narrative, sacrificing their accuracy score. Examining the changes in content and wording along the transmission chains may indicate biases towards changes in narrative structure. Therefore, almost any change to the stories, whether it be omission, change in the order of events, or outright inclusion of new details participants firmly believe they have remembered would be useful to examine in order to deduce what sorts of biases humans have, and how these biases determine what they deem to be attention grabbing in a story.

6.4 Construction and Coding of Material

Mesoudi *et al.* create paragraphs that are matched for number of propositions (14), where a proposition is defined as 'a predicate plus a series of ordered arguments. A predicate is a verb, adjective or other relational term, while an argument is the complementary noun(s)' (2006, p. 411). They code the proposition recall by both the amount of correctly recalled propositions and total amount of recalled propositions, irrespective of accuracy.

According to Mesoudi *et al.*'s coding procedure, things such as 'he would *leave* his wife' being recalled as 'he would *divorce* his wife', or 'refused to *see* her' being recalled as 'refused to *meet* her' would be coded as incorrectly recalled, despite having the same basic meaning. Additionally, any relational term, such as 'old man' or 'married college professor' would be considered a proposition. For the purposes of this study, I am primarily concerned with the correct recall of the events (goal, counter-goal, resolution, etc.) and the form that those events create, and less concerned with exact wording, so long as the gist of each clause is recalled accurately (a clause being here defined as a segment containing a verb). This method of coding has support from

various studies of story transmission, as well as from literature discussing what should be considered the basic unit of packaged meaning in human speech.

Several studies testing aspects of story recall in transmission chains code propositional output in a similar manner. Bangerter (2000) tested the changes in sentence structure and content in a paragraph describing the biological process of fertilisation, finding that descriptions of the sperm and ovum were increasingly personalised and sex-role stereotyped by participants. Bangerter prepared each of his texts for analysis by segmenting each sentence into propositions containing only one verb, as he was primarily concerned with the events and whether they were recalled as being active or passive.

Kashima (2000), Lyons and Kashima (2003), and Eriksson and Coultas (in press), each constructed and coded their story materials using clauses. Kashima (2000) conducted a serial reproduction study using a narrative about a man and a woman hosting a dinner party, in order to show that stereotype-consistent information is better maintained through transmission chains than stereotype-inconsistent information. Kashima divided the story into propositions, where a proposition was considered to be 'expressed in phrases clauses, or sentences' (p. 597). Therefore, clauses such as 'Sarah also works as a highly competent personal assistant', and 'That morning, James also cleans the house' were each considered to be one proposition (pp. 602-603). Lyons and Kashima (2003), who used transmission chains to discover that the shared nature of stereotypes is an important contributor to the increasingly stereotypical nature of a stereotype-relevant story, divided their story up in the same way. Both studies coded the participant output the same way, by dividing each reproduction into clauses, and considering a proposition to be accurately reproduced if it contained the basic content as the proposition in the original story. Importantly, this reproduction did not have to be verbatim. Eriksson and Coultas tested the retention of story elements with both traditional transmission chains and chains with two, instead of one, cultural parents. They also replicated this method of construction and coding. Thus, in practice, dividing stories up into clauses containing propositional content and coding accuracy according to gist of meaning, as opposed to verbatim recollection is an accepted and effective procedure for uncovering biases in story transmission.

Dividing the basic units of meaning and propositional content into clauses is also in line with many current theories that human speech is planned and should be analysed by looking at clause-sized packages of meaning. The definition of a

proposition as used by Mesoudi *et al.* assumes that humans encode meaning according to the smallest relational elements in a given phrase. However, a number of theorists have argued that meaning is more naturally encoded in clause-like units. This argument, that the 'common currency of spoken linguistic dialogue' is clauses with propositional content is outlined in Hurford (in press, p. 135), who outlines arguments that speech is planned out clause by clause. For instance, it has been noted that there is a close similarity in size between the action units that humans perceive (which usually clock-in at around 1-4 seconds (Schleidt and Kien, 1997)), the intonation units in speech, and basic clauses (Fenk-Oczlon and Fenk, 2002). The fact that humans package up their perception of events into units of the same size as a basic clause suggests that examining clause-like units is a more appropriate method in ascertaining whether or not someone internalised basic meaning-elements of a story.

7. The Present Study

The present study takes these various critiques into account, and through the creation of two additional stories about Nancy, seeks to determine whether or not stories about unexpected individual success are more memorable than those about individual failure. The individual is considered to be unexpectedly successful if she ultimately achieves her goal, despite the various obstacles placed in her way. This study responds in part to a number of possibilities for replication studies suggested by Mesoudi *et al.* Acknowledging that the conclusions drawn from their study are dependant on the materials they used, they called for a replication with alternative examples of their narratives. Secondly, they suggested a replication that takes into account a more formal look at the form of narrative and how it may affect memory.

7.1 Hypotheses

If fictions function as safe play spaces for humans to refine their Machiavellian Intelligence, it is hypothesised that even when Nancy does not interact with other intentional agents, as long as she displays the desire *and* ability to achieve a goal, despite significant obstacles, the reader will engage on a social level with her and recall her story more accurately than the participants in Mesoudi *et al.*'s study did the unsuccessful individual material. The reader may cognitively engage with Nancy as though she is a human agent and decide whether she is attention-worthy or not, based on her behaviour and responses to life problems. A story involving one individual not

interacting with other agents may still be social by virtue of the fact that readers are interacting 'socially' with the fictional protagonist (provided that the protagonist offers examples of her high status and capability to problem solve). The literature on the Machiavellian Intelligence Hypothesis would seem to agree with this position. Whiten and Byrne (1997) cite evidence about primate social complexity to bolster their argument for the Machiavellian Intelligence Hypothesis, noting that primates chose allies based on their competitive value, and pick up small cues from others' behaviour in order to locate objects in their environment (pp. 4-5). Primates are attuned to pay attention to competent individuals, a fact that is clearly illustrated by their hierarchical social groups.

Therefore, the first hypothesis is that the story about Nancy individually achieving her goal will be more memorable than the individual story where she fails to achieve her goal.

Additionally, a second hypothesis is that the gossip material, which showed a trend of quality of recall in Mesoudi *et al.*'s study, will be transmitted with greater accuracy than all other stories, because it is by far the most unexpected and emotionally salient, and because it represents one of Hogan's universal paradigm narratives (romantic). The gossip material presents the highest stakes and *ultimate* goals that transcend the fleeting, situational goals of the other narratives in this study, and also represents the most jarring social-upset as its instigating event.

7.2 Materials and Methods

7.2.1 Design

A within-chain transmission chain design was used. The experiment was comprised of 10 chains of 4 participants, or 'generations'. The first participant in each chain was given five stories containing information representing five categories: gossip, social, physical, successful individual, and unsuccessful individual. Half of the chains received Mesoudi *et al.*'s individual material and a new individual story with a successful resolution, while the other half were given an original individual story without resolution (modelled off of Mesoudi *et al*'s version), and an altered version of Mesoudi *et al.'s* individual story *with* resolution. This within-chain design reduces random between-chain variation and allows for better detection of differences between materials.

The independent variables were the transmission generation (four generations: F1-F4) and the story-type. The dependent variable was the total number of propositions accurately recalled.

It was predicted that the successful individual story would be transmitted with greater accuracy than the unsuccessful individual story, thus narrowing the recall gap between individual and social/gossip materials. Furthermore, it was predicted that the gossip story would be most accurately transmitted.

Mesoudi *et al*. treat each chain as an independent unit of analysis, in order to focus on changes in the material, as opposed to the recall abilities of individual participants. They also note that chains of 4 have been shown to demonstrate effects while still being of a practical length. Thus, the current study replicates these features.

7.2.2 Material

The material given to the first participant in each chain was composed of five paragraphs: gossip, social, physical, successful individual, and unsuccessful individual, but the participants did not receive these labels. These stories are reproduced in the appendix. Each paragraph was matched for words, sentences, and propositions. Propositions were counted based on the new coding criteria, so the original materials used in Mesoudi *et al*.'s study were altered slightly to reflect this definition of a proposition as a clause containing one verb. All of the original material was kept intact, but a few extra propositions were added to each story, so that they each had a total of 14 propositions according to the revised definition. All additions fit with the narrative, and were causally and temporally related to the preceding and following events. Each proposition contained one verb, so 'One morning, Nancy's alarm clock broke' was considered one proposition, while 'she realised that she was late for an important lecture' was two; 'she realised' (an embedded proposition), and 'that she was late for an important lecture'.

In Mesoudi *et al*.'s original paragraphs, the amount of embedded propositions varies across paragraphs. For instance, the individual material has three, while the social material has none. For the purposes of providing further uniformity to the materials, the amount of embedded propositions in each story was evened out. A few embedded propositions are unavoidable if the sense of narrative flow is to be maintained: in English, at least, 'When [blank]' and other such propositions are tools for conveying a story, and embedded propositions such as 'she wanted to [blank]', 'he

promised to [blank]', and 'she realised that [blank]' increase the emotional salience of a story and make explicit the fact that the characters have distinct emotionally charged goals (which helps to draw the reader into the story). Removing all embedded propositions would negatively alter the narrative quality of the materials, so each paragraph has 2-3 embedded propositions. This helps to avoid any effect an uneven balance of embedded propositions across stories could have on recall quantity.

The first 5 chains received the gossip, physical, and social stories that Mesoudi *et al.* wrote, with a few additional clauses so that they each had 14 propositions, as discussed in the previous section. Additionally, they received a version of Mesoudi *et al.*'s original individual material, altered so that Nancy arrived at her lecture on time. They also received an individual paragraph conforming to Mesoudi *et al.*'s unsuccessful individual material. In following with Mesoudi *et al.*'s replication of Owens *et al.*'s subject matter, this paragraph tells a story about Nancy going shopping, which was one of Owens *et al.*'s mundane day-to-day tasks. In this paragraph, she fails to achieve her goal of finding mushrooms to cook for dinner.

The last 5 chains received the gossip, physical, social and individual materials written by Mesoudi *et al.* (again, clauses were added). Additionally, they were given a successful individual story wherein Nancy achieves her goal of buying mushrooms. Testing two different pairs of successful/unsuccessful individual stories allows for an additional chance to test for an effect of a competent protagonist and a successful resolution in participant recall, minimising the chance that there was an additional unknown factor that contributed to the poor transmission of the original individual scenario.

All events in the stories were casually and temporally related to each other. The order in which the stories were presented was counterbalanced.

7.2.3 Participants

There were 40 participants of mean age 24.05 who performed the experiment. All participants were students, participated voluntarily, were compensated for their time at £6/hour, and had normal reading and writing ability.

7.2.4 Procedure

Following Mesoudi *et al.*'s adoption of Bartlett's methods, the material was transmitted by the experimenter from individual to individual, rather than the individuals directly transmitting their output. This allowed for greater control over the

materials. While Mesoudi *et al*. provided participants with a physical booklet in which to handwrite their recall, this study provided them with a computer word document instead. This saved the coder from having to transcribe handwritten materials. The first page of the word document stated: 'Please read the following text through once. When you have finished, scroll down to the next page', followed by the material. The next page instructed: 'Now, without scrolling up, please write out as best you can the text you just read. Be as accurate as possible, but don't worry if you can't remember it all. Don't worry about putting the paragraphs in the same order. When you have finished, scroll to the next page', followed by a blank area for recall. The instruction about the order was not in Mesoudi *et al.*'s instructions, but was added due to confusion voiced by pilot participants. Each participant's recall was transferred as originally written to the next participant in the chain.

The participants were thanked, and then debriefed about the nature of the study. There was no distracter task and no time limit, although the participants were told beforehand that it would take roughly 10-15 minutes (which was the average time taken in the pilot study). The participants were not told before or during the experiment that it was a memory test, or that their recall had come from another participant and/or would be given to another participant. The experiment was advertised simply as a 'reading comprehension' study.

7.2.5 Coding

Each reproduced story was divided into clauses. Each clause was then compared to the original 14 propositions. A clause was judged to be reproduced accurately if the basic content was present. The recall did not need to be verbatim, and only recall accuracy, not quantity, was measured. For example, the following propositions were considered to have the same content: 'the professor refused to meet her' and 'the professor refused to see her', 'Nancy's alarm clock did not go off' and 'Nancy's alarm clock broke', and 'there's no one around to help her' and 'There were no available employees'.

7.3 Results and Discussion

7.3.1 Recall Accuracy

A 4 x 5 repeated-measures ANOVA with generation and story-type as within-groups factors was conducted. Mauchly's test indicated that the assumption of sphericity had been violated for the main effect of generation, χ^2 (5) = 13.78, $p < .05$.

Therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .495$)

There was a significant overall effect of story-type on recall accuracy, $F(4, 36) = 13.47$, $p < .001$ and of generation, $F(1.49, 13.37) = 37.94$, $p < .001$ (Greenhouse-Geisser corrected), but no significant interaction between story-type and generation, $F(12, 108) = .57$ *ns*.

Figure 1 illustrates the recall of all five paragraphs for each generation:

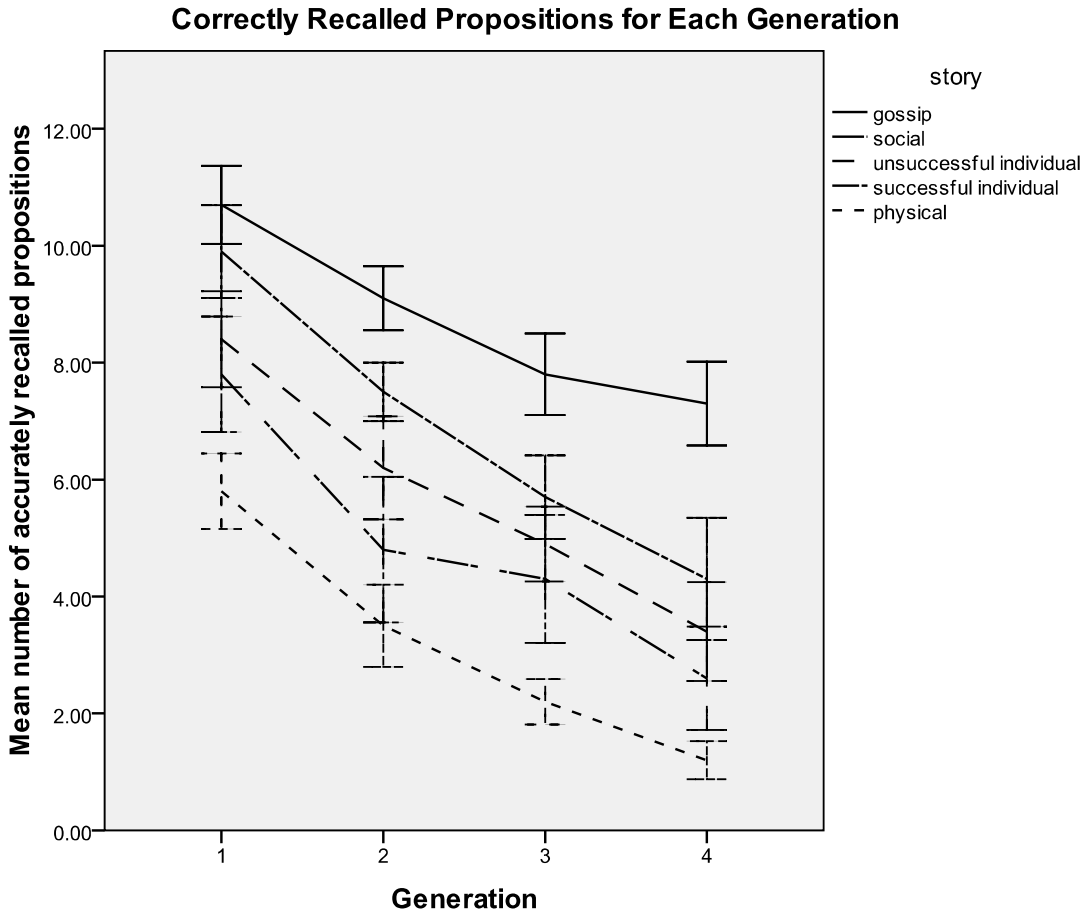

Figure 1: The mean number the propositions recalled from each story, for each generation. Error bars show standard error.

For comparison, Mesoudi *et al.*'s graph of recall accuracy:

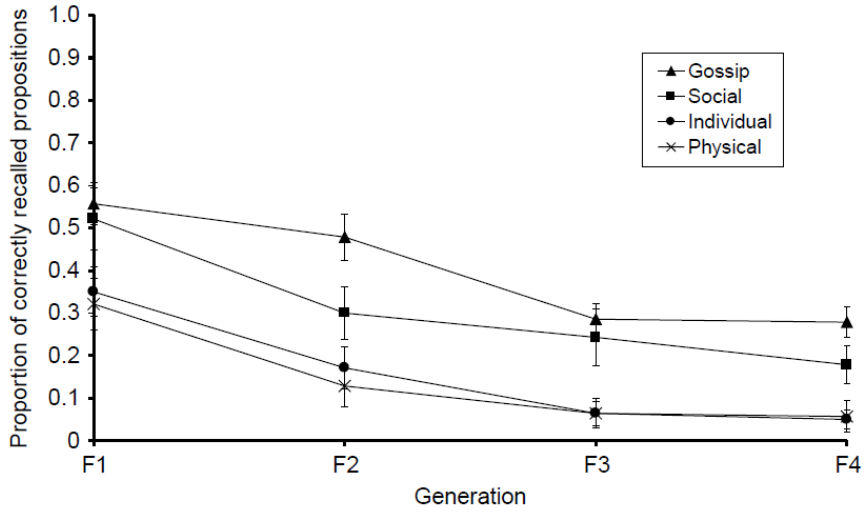

Figure 2: Mesoudi *et al.*'s graph of correctly recalled propositions. (p. 416)

Planned comparisons were made between the pairs of material types predicted to differ, using 2 x 4 within-groups ANOVAs at a Bonferroni corrected significance level of $\alpha^* = \alpha / N$ where N = number of comparisons (there are 7 comparisons, hence $\alpha^* = .05/ 7 = .007$)

Significant differences in recall were found between Gossip and Physical $F(1,9) = 79.55$, $p < .001$, Gossip and Social, $F(1, 9) = 19.90$, $p < .005$, and Gossip and Unsuccessful Individual, $F(1, 9) = 42.35$, $p < .001$, while there was no significant difference between Gossip and Successful Individual $F(1, 9) = 5.80$, $p = .039$.

There was also a significant difference in recall between Successful Individual and Physical, $F(1, 9) = 34.48$, $p < .001$, and between Unsuccessful and Physical, $F(1, 9) = 12.45$, $p < .007$. There was no significant difference between Successful Individual and Unsuccessful Individual, $F(1, 9) = 1.22$, $p = .296$.

3/40 participants forgot the successful individual stories completely; however in the cases where the stories were remembered, 84% of participants recalled the proposition that detailed the method by which Nancy achieved her goal (borrowing a bike/finding the mushrooms hidden under lettuce), even if they recalled very little else. To follow up with this observation, a 4 x 2 repeated measures ANOVA with generation and proposition type as within-groups factors was conducted to compare the recall frequency of the novel-solution proposition versus the other propositions in the successful individual stories. The amount of times the solution-proposition was recalled

was compared to the proportion of all other propositions recalled in each generation of each chain.

There was a significant overall effect of proposition on recall quantity, $F(1, 9) = 12.64$, $p < .05$ and of generation, $F(1.7, 15.3) = 7.07$, $p < .05$ (Greenhouse-Geisser corrected), but no significant interaction between proposition type and generation, $F(1.5, 13.5) = .49$ *ns* (Greenhouse-Geisser corrected). Therefore, the novel-solution proposition was retained with greater consistency across generations than the other propositions in the successful individual stories.

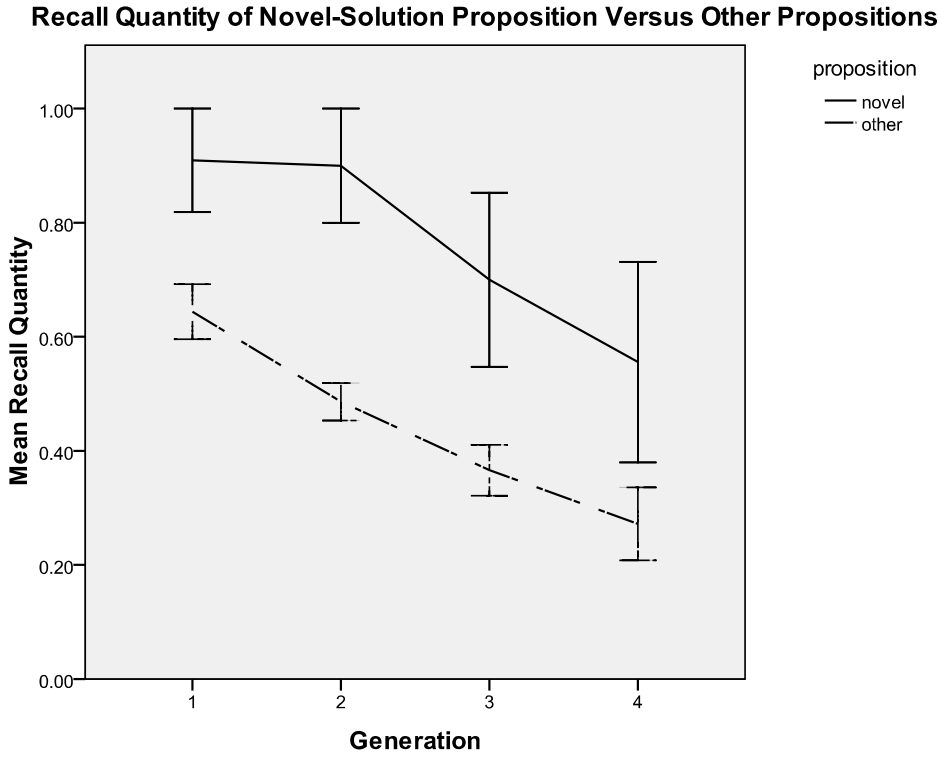

Figure 3: Recall of the novel-solution proposition versus all other propositions in the successful individual stories. Error bars show standard error.

7.3.2 Discussion

The planned comparisons show that gossip was recalled with greater accuracy than all of the stories except for the successful individual story, so the prediction that gossip would be recalled more accurately than all other story types is partially supported.

On the other hand, the prediction that the successful individual story would be recalled more accurately than the unsuccessful individual cannot be supported. However, the successful individual story was the only story to be recalled with statistically similar accuracy to the gossip story, which contradicts Mesoudi *et al.*'s conclusions regarding the memorability of non-social information. Additionally, the proposition containing the novel solution in the successful individual story was better retained across chains than the other propositions, suggesting that novel solutions, if not the context surrounding them, are highly memorable. The physical story was recalled with similarly poor accuracy to the original study. Furthermore, the social story was recalled significantly less accurately than the gossip story, and as illustrated in Figures 1 and 2, was transmitted far less accurately overall than in the original study.

7.4 General Discussion

On the whole, these results are less clear-cut than Mesoudi *et al.*'s, and present several challenges to their conclusions.

7.4.1 The Social Story; Casualty of Methodology?

The social story performed at a poor level not predicted by either Mesoudi *et al.*'s study or the present study. In this study the social story was forgotten entirely (none of the propositions were recalled) in 11/40 instances (28%), more so than any other story. When it *was* replicated, it was done so reasonably faithfully, however the sheer number of times it was forgotten by a member of the first two generations contributed to its low quality of transmission. The exact reason for its lack of memorability is unknown. It may be been that 5 stories is simply too much of a load for the human memory, and that the social story represented a casualty of this problem. It may have been a random casualty, as a result of the number of chains being analysed. Transmission chain studies using single participant 'generations' have been found to be relatively fragile (Eriksson and Coultas, in press).

Eriksson and Coultas tested the theoretical argument made by Enquist *et al.* (2010), which proposes that culture can only be transmitted successfully down through generations if there are several cultural parents teaching and transmitting cultural material to an individual. Eriksson and Coultas tested this argument (as it relates to story transmission) in order to determine if transmission chains with two cultural parents allows for superior recall and reduction in the loss of story elements compared

to the traditional serial reproduction technique. They found that the 'two cultural parent' condition resulted in superior total recall by the end of the chain compared to the single cultural parent condition. The two cultural parent condition more accurately resembles the real-world state of cultural transmission, while single parent transmission chains suffer loss in content that may not happen in the real world, since we rarely only learn a story from one individual without opportunity for repetition. Given this evidence, it is possible that the inferior recall of the social story in the present study was a symptom of the fragility of the single-parent transmission chain.

Additionally, the social story may have been the least unexpected/ least high-stakes. The physical story, though hardly a prototypical example of a successful narrative (in that it has no personalised agents) was at least unexpected in that it was the only story not about Nancy. Even though the physical story degraded dramatically, it was most likely rarely completely forgotten for this reason. The other stories presented situations that were reasonably high stakes for a typical student. Pregnancy by a professor, missing a crucial lecture and being incapable of finding decent food may represent more threatening issues than simply being incapable of doing something mildly pleasurable (swimming).

The prediction that a story embodying the prototypical conflict-resolution format would be more successfully transmitted than a story lacking a happy resolution was not supported by the statistical analysis. However, the successful individual stories were transmitted nearly as well as the gossip story, such that there was no significant difference between the two. Also, the proposition containing the novel solution was recalled more than the other propositions in the successful individual story. This result challenges the conclusions drawn by Mesoudi *et al*.—that there is a specific bias for any information involving humans interacting with each other, which resulted in the poor transmission of their individual material. The fact that the individual stories were recalled with greater accuracy in this study suggests that when using stories as material for transmission, biases other than a social bias may come into play. The salience of unexpectedness is one such contender, as is the empirically supported theory that reading fictions is a cognitively similar experience to real-life social interaction. It may be that participants interact 'socially' with Nancy's character while reading about her various plights in such a way that they remember the elements in her individual stories that most directly relate to their own emotions and memories, and store them for later real-world usage.

Because gossip information and social information showed no significant difference in the original study, the authors conclude that there is no support for the strong Machiavellian Intelligence Hypothesis (that humans have evolved to pay attention to exploitative social interactions more so than non-exploitative ones), and theories that propose a negative function of language (Enquist and Leimar, 1993; Wilson *et al*., 2000). However, the success of the gossip story in this replication could additionally be explained by the theories outlined in previous chapters.

The gossip material is most likely the most unexpected and unbalancing story in both experiments. After all, students (hopefully) rarely find themselves pregnant with their professors' children. Though Mesoudi *et al*. do not find a significant effect of gossip material on recall, they do note that in experiment 2, there is a *trend* towards gossip material being transmitted with greater accuracy than the social material. While this may be the result of some sort of human preference for salacious, negative details about their conspecifics (or simply an experimental fluke), it may also be the result of the preference for unexpected information that Dessalles observes. The gossip story presents readers with a far more salient rupture of social norms, which a) is the hallmark of any engaging fiction and b) contains every element of the prototypical romantic narrative as outlined by Hogan. The fact that the prototypical romantic narrative exists as a cross-cultural universal speaks to the endurance of its form and content through generations. The rupture and eventual reparation of romantic relationships is relevant to most of the human population, and engagement in this type of fiction allows for crucial biologically/evolutionary relevant skills to be refined. The fact that the gossip story has *negative* information may be irrelevant to its recall power; it also has positive resolution, which is heightened by the initial negativity. Its memorability may be a combination of the saturation of human culture with variants of this exact narrative and (not unrelated), the human bias for stories about unexpected situations and the ways in which they are dealt with.

7.4.2 Discussion of Participant Output

In addition to the statistical results, it is also important to examine the specific ways in which the participants transformed the stories over the length of the transmission chains. Several interesting changes were made to the original material.

Firstly, there were numerous instances of certain elements of the gossip story being exaggerated. In particular, emotions were elaborated upon, increasing the drama

of the story. 'Nancy was having an affair' was changed at the beginning of one chain into, 'Nancy fell in love with her professor', which was then recalled verbatim by each of the following generations. Nancy turned from 'angry' to 'furious', the professor 'broke his promise', 'told her he never wanted to see her again', and 'was very angry with her'. Similarly, in over half of the cases in which the professor's wife is recalled as being emotional, she went from being 'upset' in the original story to 'angry' in the recalled versions. All of these alterations have the effect of increasing the sense of salaciousness of the gossip story.

This transformation of emotion was not unique to the gossip story. There were eleven examples of Nancy's annoyance at being unable to find mushrooms being replaced with anger. This increased the emotional stakes of the individual story, and may have been due to either a) the salience of the anger in the highly-recalled gossip story influencing the recall of other stories, or the simple need to make the individual story more dramatic.

There were some attempts to make the physical material more traditionally story-like and dramatic. For instance, one participant recalled it thusly; 'In Colorado, there are a lot of trees. One year, the weather got very dry. After the thunder, trees burnt and there was a forest fire'. Whereas the original story set up forest fires as being commonplace occurrences, and only one step in the process leading to increasing global warming, this version of the story turns the fire into a single unexpected event. In another instance, the stakes are once again raised; 'The Colorado Rocky Mountains are very hot and dry in the summer. There is little life and nature finds it difficult to survive'. Instead of orienting the story around the mechanisms of fires and global warming, this participant oriented it around the more emotionally salient theme of life attempting to survive despite the odds.

Although the social story itself did not survive transmission as well as some of the other stories, there was one notable instance of the individual stories becoming explicitly social through participant recall. One participant remembered Nancy's successful arrival at the lecture thusly: 'Nancy overslept and was running late for her lecture. Her flatmate already left for the lecture. She rushed to get there on time but when she arrived the lecturer was already speaking. She explained to the lecturer that she was late because she had problems with her bike'. By the final generation, the story has become 'Nancy left for a lecture. Her friend was already at the lecture. She was late for the lecture and told the lecturer it was because of her bike'. This version of the story

includes both a direct reference to a friend and a direct interaction with another agent (the lecturer). One interpretation of this alteration is that it achieves more of a successful emotional resolution than the original story. Nancy is able to explain why she was nearly late to the lecturer, thus ridding herself of any guilt about the event and fully resolving the tension that was created by her initial inability to wake up on time.

Aside from these changes, the recalled stories closely resembled the originals, although by the end of each chain the material was severely degraded in all cases. This degradation was also found by Mesoudi *et al*. and Bartlett (1932). Bartlett, observing this loss of detail, hypothesised that recall is a reconstructive process by which the gist of any given material is rebuilt around pre-existing knowledge schemas. Interestingly, Eriksson and Coultas (in press) found that when transmitted orally, the propositional content of stories changed, but did not degrade, such that by the end of the chain, the stories were just as long as the originals.

8. Conclusion

The aim of the present study was to investigate a possible bias for highly-competent individuals, as both real-life event reporting analysis and narrative universals in fictions would suggest there is, and whether or not this impacts the social bias proposed by Mesoudi *et al*. (2006). This study found no significant difference in recall accuracy between successful and unsuccessful individual stories; however it did show a significant difference in recall between the gossip story and all the other stories (except for successful individual). Most importantly, the results of the study demonstrate that there are yet-unexplored confounds present in Mesoudi *et al*.'s study, which lead to the difference between their results and the results outlined here. The current data suggest that narrative form and content affect recall, for a number of reasons:

1) The gossip story was recalled with superior accuracy to the other stories, compared to Mesoudi *et al*.'s results. This may be because humans have a particular bias to pay attention to individuals that violate norms, or it may be because the gossip story represents the most high-stakes instance of rupture and resolution in terms of human social survival. Moreover, the romantic element of the gossip story is a literary universal that exists precisely because it is memorable, which is most likely a proximate mechanism for an evolved

need to pay attention to novel methods of maintaining equilibrium in crucial social situations.

2) The differences between social and individual stories in this study were not as clear-cut as in Mesoudi *et al*.'s results. This may be due to the fact that research has shown people make judgements about and are affected by fictional characters in ways that mirror real-life social interaction.

It would be beneficial for replication studies to use completely new versions of each of the story types, in order to rule out any confounds specific to the situations presented in the current study. Additionally, given the fragility of the single-parent transmission chain method, it would be useful to conduct a replication using the multiple cultural parent design and/or oral re-telling as outlined by Eriksson and Coultas. These methods more accurately replicate real-life story transmission, and thus may reveal biases more accurately. Furthermore, telling the participants that the test is a memory test and allowing them to read over the material more than once may minimise the error due to the limits of the human memory load. As Eriksson and Coultas note, the avoidance of floor effects (where the stories are severely degraded by the end of the chain) is a significant issue in transmission chain studies. Multiple-parent and oral conditions better preserve material, and thus should be incorporated into future methodology. While this study has presented evidence that the narrative elements being explored are cross-cultural universals, it would still be valuable to test participants from non American/British cultures.

What I have shown in this paper is that the experimental study of evolved human biases benefits from a closer examination of literary theory. As Hogan (2003, p 4.) so aptly writes, 'Cognitive science can hardly claim to explain the human mind if it fails to deal with such a ubiquitous and significant aspect of human mental activity as literature'. As such, any study that investigates human biases through the transmission of stories must take into account the structure of literary narratives, because literature has been culturally crafted through generations *precisely* to be maximally attention-grabbing, and thus should include elements that directly appeal to human biases.

Appendix I

Gossip

Nancy is having an affair with her married college professor,/ and wants him/ to leave his wife. Nancy recently became pregnant with his child./ The professor promised Nancy/ he would leave his wife/, but when Nancy told him/ she was pregnant,/ he refused/ to see her./ Nancy was angry./ She told the professor's wife about the affair./ The wife was so upset/ that she left the professor /

(68 words, 7 sentences, 14 propositions)

Social

Nancy enjoys swimming./ One morning, Nancy decided/ to go swimming./ Nancy walked to the pool/ but got lost,/ so she asked an old man/ waiting at a bus stop for directions./ The old man didn't know/ where the pool was,/ so he couldn't help her./ When a bus arrived at the bus stop,/ the old man asked the driver for directions./ The driver gave Nancy directions,/ so Nancy found the pool./

(71 words, 7 sentences, 14 propositions)

Unsuccessful Individual 1

One morning, Nancy's alarm clock broke/ and she overslept./ When she finally woke up,/ she realized that/ she was late for an important lecture./ Nancy panicked,/ jumped out of bed/ and got dressed quickly./ She skipped her morning shower/ and ran out of the house./ Nancy ran all the way to the lecture theatre,/ but when she got there,/ the lecture theatre was empty./ Nancy had missed the lecture./

(69 words, 7 sentences, 14 propositions)

Unsuccessful Individual 2

One evening, Nancy was hungry./ She wanted/ to cook mushroom soup,/ but realized/ that she had no mushrooms./ She only had pot noodles in her flat, /so she went to the shop across the road/ to buy some mushrooms, /but couldn't find any./ There were no available employees./ Nancy was very annoyed, /and she left the shop./ She could not cook soup,/ so she ate pot noodles for dinner./

(69 words, 7 sentences, 14 propositions)

Successful Individual 1

One morning, Nancy's alarm clock broke/ and she overslept./ When she woke up,/ she realised that/ she was late for an important lecture./ She panicked,/ got dressed extremely quickly,/ and ran out of the house./ Outside, she found her flatmate's bike/ and rode it to the lecture theatre./ When she got to the theatre,/ her watch said it was time/ for the lecture to start./ Nancy was not late./

(69 words, 7 sentences, 14 propositions)

Successful Individual 2

One evening, Nancy was hungry./ She wanted/ to cook mushroom soup,/ but realised that/ she had no mushrooms./ She only had pot noodles in her flat,/ so she went to the shop across the road/ to buy some mushrooms,/ but couldn't find any./ There were no available employees,/ and Nancy was very annoyed./ She looked under an enormous pile of lettuce/ and found mushrooms there./ Nancy cooked soup for dinner./

(70 words, 7 sentences, 14 propositions)

Physical

The weather in Colorado gets very hot in the summer./ This removes moisture from the soil/ and dries out the plants/ that grow there./The dry vegetation catches fire easily,/ so when lightning strikes/ or rocks fall/ and cause sparks,/ this leads to frequent forest fires./ These fires release smoke/ containing carbon monoxide into the atmosphere./ This smoke contributes to global warming,/ increasing temperatures further./ This causes more fires./

(68 words, 7 sentences, 14 propositions)

References

Abbott, H. P. (2008). *The Cambridge Introduction to Narrative: Second Edition*. Cambridge: Cambridge University Press.

Astington, J. W. (1990). Narrative and the child's theory of mind. In: B. K. Britton, A.D. Pellegrini (Eds.), *Narrative Thought and Narrative Language*, pp. 151-172. Hillsdale: Lawrence Erlbaum Associates, Inc.

Bangerter, A. (2000). Transformation between scientific and social representations of conception: the method of serial reproduction. *British Journal of Social Psychology, 39,* 521 –535.

Bartlett, F. C. (1932). *Remembering: A Study in Experimental and Social Psychology.* Cambridge: Cambridge University Press.

Barrett, J.L. & Nyhof, M.A. (2001). Spreading non-natural concepts: the role of intuitive conceptual structures in memory and transmission of cultural materials. *Journal of Cognition and Culture, 1(1)*, 69-100.

Baumeister, R. F., & Newman, L. S. (1994). How stories make sense of personal experiences: motives that shape autobiographical narratives. *Personality and Social Psychology Bulletin, 20,* 676-690.

Brewer, W. F. (1985). The story schema: universal and culture-specific properties. In D. R. Olson, N. Torrance, & A. Hildyard (Eds.), *Literacy, language, and learning*, pp. 167-194. Cambridge: Cambridge University Press.

Brighton, H. (2002). Compositional syntax from cultural transmission. *Artificial Life, 8,* 25–54.

Boyd, B. (2009). *On the Origin of Stories: Evolution, Cognition, and Fiction*. Cambridge, MA: Harvard University Press.

Boyd, R., and Richerson, P. (1985). *Culture and the Evolutionary Process*. Chicago: The University of Chicago Press.

Boyer, P, & Ramble, C, (2001). Cognitive templates for religious concepts: cross-cultural evidence for recall of counter-intuitive representations. *Cognitive Science, 25*, 535-564.

Bruner, J. (1986). *Actual Minds, Possible Worlds*. Cambridge, MA: Harvard University Press.

Bruner, J. S. (1990). *Acts of Meaning*. Cambridge, MA: Harvard University Press.

Byrne, R.W., & Whiten, A. (1988). *Machiavellian Intelligence - Social Expertise and the Evolution of Intellect in Monkeys, Apes and Humans*. Oxford: Clarendon.

Chafe, W. (1990). Some things that narratives tell us about the mind. In: B. K. Britton, A.D. Pellegrini (Eds.), *Narrative Thought and Narrative Language*, pp. 79-98. Hillsdale: Lawrence Erlbaum Associates, Inc.

Clutton-Brock, T. H., & Harvey, P. H. (1980). Primates, brains and ecology. *Journal* of the Zoological Society of London, 190, 309–323.

Cook, G. (1997). Language play, language learning. *ELT Journal, 51(3),* 224-231.

Dessalles, J-L. (2000). Language and hominid politics. In: C. Knight, J.R. Hurford & M. Studdert-Kennedy (Eds.), *The evolutionary emergence of language; social function and the origins of linguistic form*, pp. 62-79. Cambridge: Cambridge University Press.

Dessalles, J-L. (2007). *Why We Talk - The Evolutionary Origins of Language*. Oxford: Oxford University Press.

Dessalles, J-L. (2008). Spontaneous narrative behaviour in homo sapiens: how does it benefit to speakers? In: A.D.M. Smith, K. Smith & R.F. Cancho (Eds.), *The Evolution of Language: Proceedings of the 7th International Conference (EVOLANG7)*, pp. 91-98. World Scientific Publishing.

de Waal, F.B.M. (1982). *Chimpanzee Politics: Power and Sex among Apes.* Baltimore: The Johns Hopkins University Press.

Dunbar, R. I. M. (1996). *Grooming, Gossip and the Evolution of Language*. London, Boston: Faber and Faber Limited.

Dundes, A (1964). *The Morphology of North American Indian Folktales*, FFC 195. Helsinki.

Eggins, S. & Slade, D. (1997). *Analysing casual conversation*. London: Equinox.

Enquist, M., & Leimar, O. (1993). The evolution of cooperation in mobile organisms. *Animal Behavior, 45*, 747–757.

Enquist, M., Strimling, P., Eriksson, K., Laland, K. & Sjöstrand, J. (2010). One cultural parent makes no culture. *Animal Behavior, 79,* 1353–1362.

Eriksson, K. & Coultas, J.C. (in press). The advantage of multiple cultural parents in cultural transmission chains. *Evolution and Human Behavior*.

Fenk-Oczlon, G. & Fenk, A. (2002). The clausal structure in linguistic and prelinguistic behavior. In: T Givon & B.E. Malle (Eds.), *The Evolution of Language out of Prelanguage*, pp. 215–229. Amsterdam: John Benjamins.

Frith, U., & Frith, C.D. (2003). Development and neurophysiology of mentalizing. Philosophical Transactions of the Royal Society of London: Series B. *Biological Sciences, 358,* 459–473.

Gerrig, R. J. (1989). Reexperiencing fiction and non-fiction. *The Journal of Aesthetics and Art Criticism*, *47(3),* 277-280.

Green, M.C. (2004). Transportation into narrative worlds: The role of prior knowledge and perceived realism. *Discourse Processes, 38*, 247–266.

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology, 79(5)*, 701-721.

Greimas, A.J. & Cortes, J. (1976). The cognitive dimension of narrative discourse. *New Literary History, 7*, 433-447.

Hogan, P. C. (2003). *The Mind and its Stories - Narrative Universals and Human Emotion*. Cambridge, UK: Cambridge University Press.

Halász, L. (1991). Effect and reminding in literary text processing. In: E. Ibsch, D. Schram, G. Steen (Eds.), *Empirical Studies of Literature*, pp. 79-85. Amsterdam: Rodopi.

Harvey, J.H., Webber, A.L., & Orbuch, T.L. (1990). *Interpersonal Accounts: A Social Psychological Perspective.* Oxford, UK: Blackwell.

Hurford, J. (in press) *The Origins of Grammar: Language in the Light of Evolution.*

Jackendoff, R. (2003). Foundations of Language: Brain, Meaning, Grammar, Evolution. Oxford: Oxford University Press.

Kashima, Y. (2000). Maintaining cultural stereotypes in the serial reproduction of narratives. *Personality and Social Psychology Bulletin, 26*, 594–604.

Keen, S. (2006). A theory of narrative empathy. *Narrative, 14,* 207– 236.

Kirby, S. (2001). Spontaneous evolution of linguistic structure: an iterated learning model of the emergence of regularity and irregularity. *IEEE Journal of Evolutionary Computation, 5,* 102–110.

Larsen, S.F. & Seilman, U. (1988). Personal remindings while reading literature. *Text, 8*, 411-429.

Lieberman, M. (2007). Social cognitive neuroscience: A review of core processes. *Annual Review of Psychology, 58,* 259–289.

Long, S.A., Winograd, P.N., & Bridge, C.A. (1989). The effects of reader and text characteristics on imagery reported during and after reading. *Reading Research Quarterly, 24*, 353–372.

Lucariello, J. (1990). Canonicality and consciousness in child narrative. In: B. K. Britton, A.D. Pellegrini (Eds.), *Narrative Thought and Narrative Language*, pp. 131-150. Hillsdale: Lawrence Erlbaum Associates, Inc.

Lyons, A. & Kashima, Y. (2003). How are stereotypes maintained through communication? *Journal of Personality and Social Psychology, 85,* 989–1005.

Mandler, J. M., & Goodman, M. S. (1982). On the psychological validity of story structure. *Journal of Verbal Learning and Verbal Behavior, 21*, 507-523.

Mar, R. A. & Oatley, K. (2008). The function of fiction is the abstraction and simulation of social experience. *Perspectives on Psychological Science*, *3(3),* 173-192.

Mar, R.A., Oatley, K., Hirsh, J., dela Paz, J., & Peterson, J.B. (2006). Bookworms versus nerds: Exposure to fiction versus non-fiction, divergent associations with social ability, and the simulation of fictional social worlds. *Journal of Research in Personality, 40,* 694–712.

McComb, K. & Semple, S. (2005) Co-evolution of vocal communication and sociality in primates. *Biology Letters (The Royal Society) 1,* 381-385.

McKeough, A., & Genereux, R. (2003). Transformation in narrative thought during adolescence: The structure and content of story compositions. *Journal of Educational Psychology, 95,* 537–552.

Mesoudi, A. & Whiten, A. (2004). The hierarchical transformation of event knowledge in human cultural transmission. *Journal of Cognition and Culture, 4,* 1–24.

Mesoudi, A., Whiten, A., & Dunbar, R. (2006). A bias for social information in human cultural transmission. *British Journal of Psychology, 97*, 405–423.

Mesoudi, A. & Whiten, A. (2008) The multiple roles of cultural transmission experiments in understanding human cultural evolution. *Philosophical Transactions of the Royal Society B, 363*, 3489-3501.

Norenzayan, A., Atran, S., Faulkner, J., Schaller, M. (2006). Memory and mystery: the cultural selection of minimally counterintuitive narratives. *Cognitive Science, 30*, 531–553.

Oatley, K., & Mar, R.A. (2005). Evolutionary pre-adaptation and the idea of character in fiction. *Culture and Evolutionary Psychology, 3*, 181–196.

Owens, J., Bower, G. H., & Black, J. B. (1979). The soap opera effect in story recall. *Memory and Cognition, 7*, 185–191.

Park, B., DeKay, M. L., & Kraus, S. (1994). Aggregating social behavior into person models: Perceiver-induced consistency. *Journal of Personality and Social Psychology, 66*, 437–459.

Paulme, D (1963). Le garçon travesti ou Joseph en *Afrique. L'Homme, 3(2),* 5-21.

Pinker, S. (1994). *How the Mind Works*. NY: Norton.

Propp, V. I. A. (1968). *Morphology of the folktale*. Austin: University of Texas Press.

Rapp, D. N., & Gerrig, R. J. (2002). Readers' reality-driven and plot-driven analyses in narrative comprehension. *Memory & Cognition, 30*, 779-788.

Rime, B., Philippot, P., Boca, S., & Mesquita, B. (1992). Long lasting cognitive and social consequences of emotion: social sharing and rumination. In: W. Stroebe & M. Hewstone (Eds.), *European Review of Social Psychology, Volume 3*, pp. 225–258. John Wiley & Sons Ltd.

Saxe, R., & Wexler, A. (2005). Making sense of another mind: The role of the right temporo-parietal junction. *Neuropsychologia, 43*, 1391–1399.

Schank, R. C. & Abelson, R. P. (1995). Knowledge and memory: the real story. In: Wyer, R. S. (Ed.), *Knowledge and Memory: The Real Story: Advances in Social Cognition, Volume V111,* pp. 1-85. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Schleidt, M. and Kien, J., 1997. Segmentation in behavior and what it can tell us about brain function. *Human Nature, 8,* 77–111.

Searle, J. R. (1975). The logical status of fictional discourse. *New Literary History, 6(2)*, 319-332.

Skulsky, H. (1980). On being moved by fiction. *The Journal of Aesthetics and Art Criticism, 39(1),* 5-14.

Smith, K., Kirby, S., and Brighton, H. (2003). Iterated learning: a framework for the emergence of language. *Artificial Life*, *9(4)*, 371-386.

Smith, K. and Hurford, J.R. (2003). Language evolution in populations: Extending the iterated learning model. In: W. Banzhaf, T. Christaller, J. Ziegler, P. Dittrich and J.T. Kim (Eds.), *Advances in Artificial Life: Proceedings of the 7th European Conference on Artificial Life, Lecture Notes in Computer Science/Lecture Notes in Artificial Intelligence*, pp. 507–516. Berlin: Springer-Verlag.

Sperber, Dan. (1996). *Explaining Culture: A Naturalistic Approach.* Oxford: Blackwell.

Sutton-Smith, B. (1981). *The Folk Stories of Children*. Philadelphia: University of Pennsylvania Press.

Sutton-Smith, B. (2001). *The Ambiguity of Play*. Cambridge, MA: Harvard University Press.

Tannen, D. (1979). What's in a frame? Surface evidence for underlying expectations. In: R. Freedle (Ed.), *New Directions in Discourse Processing*, pp. 137-181. Norwood, NJ: Ablex Publishing Corporation

Tannen, D. (1984). *Conversational Style - Analyzing Talk Among Friends*. Norwood, NJ: Ablex Publishing Corporation

Tomasello, M., Kruger, A. & Ratner, H. (1993) Cultural learning. *Behavioral and Brain Sciences, 16,* 495–552.

Tooby, J. & Cosmides, L. (2001). Does beauty build adapted minds? Toward an evolutionary theory of aesthetics, fiction and the arts. *SubStance, 94/95*, 6-27.

Tsai, J.L., Louie, J.Y., Chen, E.E., & Uchida, Y. (2007). Learning what feelings to desire: Socialization of ideal affect through children's storybooks. *Personality and Social Psychology Bulletin, 33,* 17–30.

Walton, K.L. (1978) Fearing fictions. *The Journal of Philosophy, 75(1),* 5-27.

Whiten, A. & Byrne, R. W. (1997). *Machiavellian intelligence II: Extensions and evaluations*. New York: Cambridge University Press.

Whiten, A. (1999). Machiavellian intelligence hypothesis. In: R. A. Wilson & F. C. Keil (Eds.), *The MIT Encyclopedia of the Cognitive Sciences*, pp. 495–497. Cambridge, MA: MIT Press.

Wilson, D. S., Wilczynski, C., Wells, A., & Weiser, L. (2000). Gossip and other aspects of language as group-level adaptations. In: C. Heyes & L. Huber (Eds.), *The Evolution of Cognition. Vienna Series in Theoretical Biology*, pp. 347–365. Cambridge, MA: MIT Press.

Zipes, J. (2006). *Why Fairy Tales Stick: The Evolution and Relevance of a Genre*. New York: Routledge.

Zunshine, L. (2006). *Why We Read Fiction: Theory of Mind and the Novel*. Columbus, OH: Ohio State University Press.