Content Biases in the Cultural Transmission and Evolution of Urban Legends

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Abstract

This thesis examines the role of cognitive content biases in cultural transmission. The concept of cognitive content biases suggests that humans preferentially attend to, recall and transmit certain types of information over others, and that this bias influences the transmission and evolution of cultural artefacts. A number of studies are presented which primarily use genuine urban legends as material. In using 'real world' material such as urban legends these studies expand our knowledge of how content biases operate and shed light on the cultural success of these legends. Methodology included qualitative analyses, experiments using participants in linear transmission chains and computational phylogenetic techniques. The studies demonstrate that content biases are an effective force in cultural transmission but that different biases may not necessarily operate in exactly the same manner. It is argued that the cultural success of urban legends can be explained by their exploitation of cognitive content biases. The studies also demonstrate the efficacy of using 'real-world' material such as urban legends in the examination of the mechanisms of cultural transmission and evolution.

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Declaration

This thesis is of my own original work and has not been submitted for any other award than stated above. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature.

This work was completed under the guidance of Dr. Jamie Tehrani and Dr. Emma Flynn, Durham University.

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Chapter 1

Introduction

1.1 Cultural Evolution and Transmission

Culture is ubiquitous in humans and our capacity for extensive and cumulative culture can be considered unique to our species and has allowed humans to survive in every environment on Earth (Henrich & McElreath, 2003). Culture is considered to be any information (referring here to ideas, knowledge, beliefs, values, practices, skills and attitudes) which is acquired by individuals through social learning mechanisms such as imitation, teaching or language (Henrich & McElreath, 2003; Mesoudi & Whiten, 2008). The process by which culture accumulates can be considered an evolutionary process as it features the basic characteristics of Darwinian evolution: *variation*, *differential fitness* and *inheritance* (Boyd & Richerson, 1985; Cavelli-Sforza & Feldman, 1981; Mesoudi & Whiten, 2008; Mesoudi, Whiten, & Laland 2004, 2006). *Variation* can be observed in the manner in which cultural traits vary between groups and individuals; *differential fitness* is demonstrated by the fact that cultural traits are not equally likely to be transmitted and held by individuals or groups; *inheritance* can be observed through the transmission of cultural traits from one individual (model) to another (learner) through various social learning mechanisms.

Starting with Darwin (1871/2004), there is now a long history of researchers drawing parallels between biological evolution and cultural evolution and over recent years researchers have shown a great deal of interest in the processes of cultural evolution (Boyd, Richerson & Henrich, 2011; Mesoudi, 2011; Mesoudi & Whiten, 2008; Whiten, Hinde, Laland & Stringer, 2011). Of course, the processes of cultural evolution are not exact parallels of biological evolution as there are a number of key differences. First, in biological evolution, inheritance of genetic information primarily occurs through vertical

descent via reproduction or replication processes (Zhaxybayeva & Doolittle, 2011). Horizontal (or lateral) gene transfer has been found to commonly occur in bacteria and archaea, as well as less commonly in certain unicellular eukaryotes, plants and insects, but its contribution to biological evolution in general remains controversial (Boto, 2010; Dunning Hotopp, 2011; Richardson & Palmer, 2007). In cultural evolution, inheritance processes beyond vertical transmission play a greater role, as an individual can inherit cultural information from their parents (vertical transmission), from non-kin individuals of their parents' generation (oblique transmission) and from individuals of their own generation (horizontal transmission)(Cavalli-Sforza & Feldman, 1981). This range of inheritance patterns allows cultural evolution to occur at a pace that surpasses genetic evolution and has allowed humans to adapt to a diverse range of circumstances. Second, in biological evolution high fidelity replication of genetic information is common; cultural evolution, however, is more frequently a transformative process in which traits are reconstructed through transmission rather than replicated (Henrich & McElreath, 2003; Richerson & Boyd, 2005; Sperber, 1996). Despite this reconstructive process, human culture is relatively stable, suggesting processes which maintain this stability, to be discussed later (Sperber, 1996). Although there are key differences between cultural and biological evolution cumulative culture can still be considered an evolutionary process, but one which features a unique system of inheritance and is subject to much greater mutational forces than biological evolution.

It is argued that human cognition uses a number of heuristics and mechanisms which facilitate the acquisition of useful information (Henrich & McElreath, 2003). These mechanisms are generally referred to as 'cognitive biases' and examination and identification of these biases has been the focus of several studies. Cognitive biases are generally separated into 'context biases' (*Who to copy?*) and 'content biases' (*What to copy?*). Figure 1 illustrates how these biases have been organised. Context biases exploit

features of potential models or the frequency of alternative cultural traits and can be further divided into model-based and frequency-dependent biases. Model-based biases respond to the cues or characteristics of a potential model and a number of them have been suggested by research (for a review, see Wood, Kendal & Flynn, 2013). One example of a model-based bias is success or prestige bias, this suggests that humans preferentially acquire cultural information from more successful or more prestigious models within their social group (Boyd & Richerson, 1985). Frequency-based biases respond to the relative frequency of alternative cultural traits; one such bias is conformity bias which suggests that humans preferentially copy cultural traits which are held by the majority of individuals within their social group (Boyd & Richerson, 1985). Content biases result from an interaction between the cognitive psychology of the individual and the characteristics of the cultural information being transmitted and these biases cause humans to preferentially attend to, recall and transmit certain types of information over others (Barrett & Nyhof, 2001; Henrich & McElreath, 2003). It is also suggested that these biases will act upon information in transmission and alter it to better exploit the bias (Barrett & Nyhof, 2001).

Content biases can be seen as somewhat analogous to the 'cognitive attractors' suggested by Claidière and Sperber (2007), which are argued to explain the relative stability of cultural traits despite the lack of high fidelity replication in cultural transmission, however, the approaches from which these terms are drawn are often thought to be somewhat in opposition. The two approaches are the 'cultural attraction' approach, shared by Atran (1990, 2002), Boyer (1994, 2001), Hirschfeld (1996), Sperber (1996), Claidière (Claidière & Sperber, 2007) and their collaborators and the 'biased transmission' approach of Boyd, Richerson (1985; Richerson & Boyd, 2005), Henrich (Henrich & Boyd, 2002; Henrich & McElreath, 2003) and their collaborators. These two approaches have been described as "different but mutually compatible and possibly complementary" (p. 40, Sperber & Hirschfeld, 2004) and many of the perceived divergences and opposition arises

from the approaches being originally "pursued in mutual ignorance" (p. 89, Claidière & Sperber, 2007). Both approaches agree on several key points in the field of cultural evolution. They agree that culture evolves through a Darwinian evolutionary process determined by both psychological, cognitive processes and by social and ecological processes (Claidière, Kirby & Sperber, 2012; Claidière, Scott-Phillips & Sperber, 2014; Henrich & Boyd, 2002; Sperber & Hirschfeld, 2004) and that social learning involves domain-specific cognitive mechanisms or heuristics that facilitate the acquisition of culture (Atran, 2002; Boyer, 1998; Henrich & McElreath, 2003; Sperber, 1996; Sperber & Hirschfeld, 2004). Although the extent to which the process is considered Darwinian is a matter of debate (Claidière et al. 2014). Both also reject the concept of memetics, arguing that culture does not feature the discrete units necessary for replication (Atran, 2001, 2002; Boyer, 1998; Henrich & Boyd, 2002; Henrich, Boyd & Richerson, 2008; Sperber, 1996), although Henrich, Boyd and Richerson (2008) do accept that models which assume discrete cultural units can be useful in explaining cultural evolution.

Their divergences currently lie primarily in what elements best explain the stability of culture. While both accept that cultural evolution involves both psychological and social processes, the biased transmission approach argues that the stability of culture, despite the inaccuracy of cultural transmission, is best explained by selective pressures and that context biases, such as prestige or conformist bias, at a micro level can lead to more accurate replication at the macro level, resulting in cultural stability (Henrich & Boyd, 2002). The cultural attraction approach argues that the stability of culture is better explained by the concept that culture converges on attractors which are determined by shared domain specific cognitive dispositions (Claidière et al, 2014; Sperber & Hirschfeld, 2004). Although they have gone on to state that attractors are not exclusively cognitive and can also include environmental constraints (Claidière & Sperber, 2007). Essentially, the biased transmission approach can be said to place emphasis on the source or context of

culture to explain its success or stability, while the cultural attraction approach places emphasis on how properties of the culture itself exploit dispositions in those transmitting it to explain cultural success or stability. The two approaches have provided valuable insight into cultural evolution and this thesis draws influence from them both.

When compared to context biases in social learning, content biases have received relatively little examination (although there are several notable examples which will be discussed in the next section). As such they provide a fascinating avenue for research and will be the focus of this thesis. The fact that they are the focus of this thesis should not be taken as an argument that they should be considered more relevant to cultural evolution than context biases, just that they are as yet somewhat under-researched. Both context and content biases contribute to culture evolution and their relative level of influence is not examined in this thesis and remains an interesting avenue for future research. The term content bias here refers to shared biases or dispositions in human cognition that respond to the properties of a cultural item itself rather than the model. The term cultural attractor is not used to refer to this for two reasons. First, attractors are not considered to be exclusively cognitive and can also include environmental constraints (Claidière & Sperber, 2007), in this thesis I choose to focus on content biases that, while they may be socially influenced to some extent, can be argued to have evolved in order to facilitate the acquisition of fitness-enhancing information or as a by-product of this process (Henrich & McElreath, 2003). Second, attractors are not considered to be causal explanations of cultural phenomena but rather statistical observations which can be explained by other factors such as cognitive content biases or ecological factors (Claidière et al., 2014; Sperber, 1996), as such the focus here is on the content biases themselves.

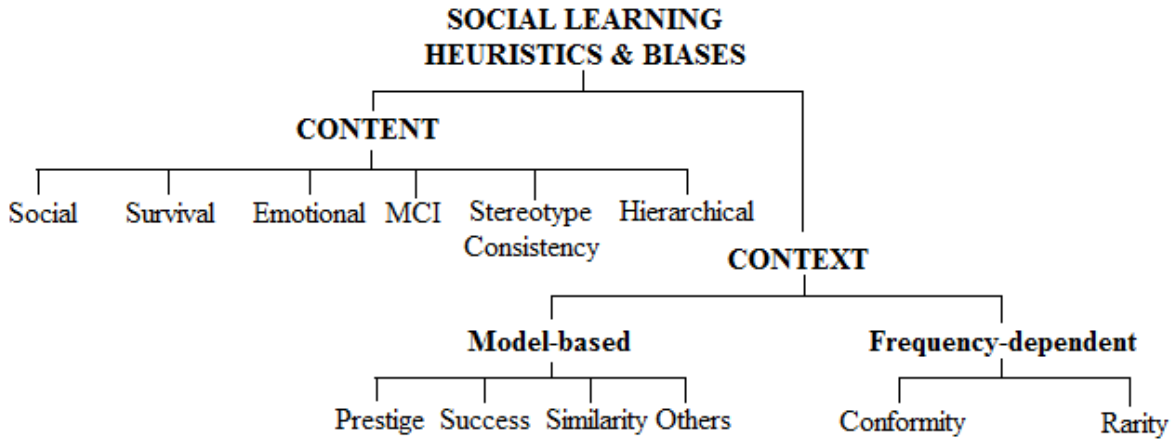

*Figure 1.*Psychological biases in social learning (adapted from Henrich & McElreath, 2003)

1.2 Content Biases

The key aim of this thesis is to utilise research focusing on the roles of content biases in cultural transmission to provide insight into how cognitive psychology can influence the transmission of information. The content biases of interest in this thesis are as follows:

- Ecological survival information bias (Nairne, 2010).
- Social information bias (Mesoudi, Whiten, & Dunbar 2006).
- Emotional bias (Heath et al., 2001).
- Minimally counter-intuitive (MCI) bias (Boyer & Ramble, 2001).
- Stereotype consistency bias (Kashima, 2000). Each of these is now described in turn.

Ecological survival information bias comes from an ecological hypothesis of primate intelligence evolution (Clutton-Brock & Harvey, 1980), suggesting that human memory has evolved to be 'tuned' towards encoding and recalling ecological information related to survival and fitness better than other forms of information (Nairne & Pandeirada,

2008). Therefore, ecological survival bias suggests that humans will be biased towards ecological information relevant to survival. Social information bias has its origins in the *Machiavellian Intelligence* (Byrne & Whiten, 1988, Whiten 1999) or *Social Brain* (Dunbar, 1998, 2003) hypotheses suggest that primates evolved greater intelligence in order to deal with complex social interactions and suggests, therefore that humans will be biased towards information related to social interaction (Mesoudi, Whiten & Dunbar, 2006). Content which evokes a greater emotional response has been shown to grant a mnemonic advantage (LaBar & Cabeza, 2006) and content eliciting a greater level of disgust has been shown to have an advantage in transmission (Eriksson & Coultas, 2014; Heath, Bell & Sternberg, 2001), as such emotional content bias suggests that humans are biased in transmission towards content that evokes a greater emotional response. MCI bias has its origins in the suggestion that humans hold a number of intuitive assumptions about the properties of different entities generally described as 'folk biology', 'folk physics' and 'folk psychology' (Boyer, 1994). Concepts and narratives which strike a balance between satisfying these intuitive assumptions while violating some of them are thought to have an advantage in transmission (Boyer, 1994). MCI bias, therefore, suggests that humans are biased towards content which meets this cognitive optimum balance between a small number of counter-intuitive concepts and a majority of intuitive concepts, hence *minimally* counter-intuitive. Cultural stereotypes are social representations about social groups which are likely to arise from the cognitive processes of sense-making and conventionalisation (Bangerter, 2000; Kashima, 2000). Stereotype consistency bias suggests that humans are biased towards content which is consistent with these cultural stereotypes.

While it is not examined in the studies presented in this thesis, a sixth content bias, hierarchical bias, has also been suggested by research. Evidence for this bias comes from research demonstrating that humans, from pre-verbal infants to adults, represent and recall events in the form of hierarchical scripts (Bauer & Mandler, 1989; Bower, Black & Turner,

1979; Nelson & Gruendel, 1986; Schank & Abelson, 1977; Thorndyke, 1977). Mesoudi and Whiten (2004) demonstrated that a hierarchical structure can be imposed on a narrative through transmission and that information higher in a hierarchical structure will be more successful in transmission than information lower in a hierarchical structure, suggesting a hierarchical bias in cultural transmission.

As indicated above the content biases discussed in this thesis can be argued to have their origins in the evolution of human cognition. Both social information bias and survival information bias are argued to be functionally adaptive in that they increase the degree to which fitness enhancing information is salient. Whether that information is about our social or ecological environment, natural selection would favour the attention and recollection of these forms of information (Mesoudi, Whiten & Dunbar, 2006; Nairne & Pandeirada, 2008). Emotions are thought to have functionally adaptive origins (Eckman, 1992; Keltner & Gross, 1999) and it has been found that the adrenal hormones related to emotional arousal can enhance memory consolidation (Cahill & McCaugh, 1998). These hormones have two adaptive functions; first, they aid an immediate response to the arousing event and, second, they aid future responses by enhancing the recall of the previously arousing event (Cahill & McCaugh, 1998). As such, emotional content bias is a product of the adaptive function of emotional arousal on memory. MCI bias is considered to be the by-product of adaptive cognitive architecture which evolved to solve adaptive problems unrelated to counterintuitive narratives or concepts (Norenzayan, Atran, Faulkner & Schakker, 2006). MCI concepts are expectation incongruent or expectation violating and Upal (2005, 2010) argues that when expectations are violated it presents the agent with a learning opportunity. Natural selection would have favoured cognitive architecture which devoted more memory and cognitive resources to concepts which offered potentially more information about the environment, therefore expectation violating concepts would be particularly salient (Upal, 2005). This may also explain why MCI concepts become less

memorable as they become more familiar (Willard, Henrich & Norenzayan, under review). The process of stereotyping is argued to be a product of cognitive biases towards internal consistency (Schacter, 1999), sense-making (Bartlett, 1932) and categorical structure (Medin & Smith, 1981). Stereotypes themselves are functional in that they are mental shortcuts which ease the cognitive burden by providing easily learnable structural relationships where group membership indicates possession of certain characteristics (Macrae & Bodenhausen, 2000; Martin, Hutchinson, Slessor, Urquhart, Cunningham & Smith, 2014). As such the processes of cultural transmission and evolution are likely to produce material consistent with cultural stereotypes (Martin et al., 2014).

That content biases are either functionally adaptive themselves or the by-products of functionally adaptive cognitive systems does not necessarily explain why they would be exploited by fictional narratives such as urban legends. In fact, attending to such material could be considered maladaptive. Sperber and Hirschfield (2004) argue that cognitive systems can be activated by material from outside of their 'proper' domain. For example a cognitive module for face-recognition can be activated by any face-like stimuli such as portraits or masks (Sperber & Hirschfield, 2004). Evolved cognitive content biases will dispose humans to certain types of information but this in turn leads them to be susceptible to material which exploits those dispositions, leading humans to preferentially attend to, recall and transmit material even if it may be functionally useless.

1.3 Urban Legends

Previous research examining content biases has used a wide range of materials and methods, from word lists in individual memory tests (e.g. Nairne & Pandeirada, 2008) to coding naturally occurring folktales with a longstanding oral history (e.g. Barrett, Burdett & Porter, 2009) and includes using original narratives in linear transmission chain experiments (e.g. Mesoudi et al., 2006). For the purposes of the studies presented in this

thesis, it was decided that urban legends would provide excellent material for examination. Urban legends are defined as short, apocryphal tales which are told as true, involve a contemporary setting and feature a single event, usually an individual experience, as the core of the narrative (Brunvand, 2000; Heath et al., 2001; Tangherlini, 1990). Culturally successful urban legends often share a number of features, such as a suspenseful or humorous narrative that contains surprising information or a twist ending and/or a warning or moral message that is either explicit or implied (Brunvand, 2000; Fox Tree & Weldon, 2007). Often they are attributed to a 'friend of a friend' (Brunvand, 2000). The majority of popular urban legends have their origins in post-World War II America and for much of their history have been orally transmitted. Over the last two decades, however, their transmission has increasingly been through electronic means such as email, internet forums and other electronic media (Brunvand, 2000; Fox Tree & Weldon, 2007). These legends were thought to be a useful means of examining content biases for five key reasons:

1. They exploit known content biases.

As a genre urban legends can be seen to exploit a number of biases that have been previously demonstrated by studies and this exploitation is likely to be key to their success. Most obviously they would seem to exploit social information bias, survival information bias and emotional content bias.

2. They are culturally successful.

The cultural success of urban legends and their effect should not be underestimated. To illustrate this I will use the example that in 1985 ABC News found that 60% of American parents believed that anonymous sadists were contaminating trick or treating children's food. This belief led American schools to train children to check their sweets, hospitals to X-ray sweets and several communities attempted to ban children from Halloween trick or treating. This was done despite the fact that no greater injury than small

cuts (and not from ingestion) have been reported since 1958 and that the vast majority of incidents similar to the belief were hoaxes (Best, 1990; Best & Horiuchi, 1985). More recently a Chinese restaurant in Bawtry, UK faced bankruptcy after a local urban legend spread describing a woman choking on a dog's identification microchip while she was eating at the restaurant; the microchip supposedly coming from a dog which had been served in her meal ("Chinese restaurant bankruptcy fear", 2011). Their cultural success suggests examination of why they might be successful and cultural evolution provides excellent means to explain it. An added benefit of their cultural success and the public's interest in urban legends means they are readily available, with websites such as the *Urban Legends Reference Pages* (www.snopes.com) dedicated to collecting them.

3. They are real world material that is actively transmitted.

Studies examining content biases often use some form of narrative ranging from original material created by the experimenters that is unlikely to be transmitted in a natural setting, such as a description of a woman asking for directions to a swimming pool (see Mesoudi et al., 2006) to folklore which has a long oral history, such as Native American folktales (see Barret & Nyhof, 2001). As contemporary folklore, urban legends are actively transmitted between individuals today and as such represent material with a high degree of ecological validity when used in experiments examining cultural transmission. Also, unlike traditional western folklore there are no 'canonised' versions which people are likely to be particularly familiar with.

4. There is a precedent for their use in content bias studies.

Heath et al. (2001) and Eriksson and Coultas (2014) have both successfully used urban legends as material in their studies examining emotional content bias, demonstrating the efficacy of using these legends as experimental material.

5. Cultural evolution can add to the existing body of research examining them.

As highly successful cultural artefacts, urban legends have already been the subject of research by a number of anthropologists and sociologists. Until recently, however, academic explanations for the cultural success of urban legends have relied on a psychoanalytic approach (e.g. Dundes, 1998, Tucker, 2005) or have discussed the ecological dimensions of their transmission. A typical approach has been 'symbolic interactionism', which sees legends as collective attempts to make meaning out of confusing or disturbing events, particularly during periods of rapid social and economic change. For example, the success of the 'Halloween food contamination' legend discussed above has been attributed to increased fears about child safety, crime and other social issues (Best & Horuichi, 1985). While symbolic interactionism and related approaches have proved to be valuable in providing insights into the ecological and socio-cultural factors that can increase the transmission of an individual legend, they do not address the psychological factors at play in this transmission. Drawing on the theories of cultural evolution and transmission to explain the cultural success of urban legends will provide useful contributions to an existing body of research.

1.4 Overview of Methods

Three of the experiments presented in this thesis (in **Chapters 4**, **5** and **6**) use a linear transmission chain design. The transmission chain design was originally developed by Bartlett (1932) in his experiment demonstrating the constructive nature of memory using Native American folktales. The design resembles the children's game known as 'Chinese Whispers' or 'Broken Telephone' with the first participant receiving the original material, then transmitting it to the next participant, who transmits it, in turn, to the following participant. The original material is passed along a chain of participants allowing the researcher to examine the cumulative effect of transmission. Generally the

material is read and then recalled (sometimes after a distraction task) and it is the product of this recall which is passed on to the next participant. The transmission chain method has been used successfully to examine the effect of content biases in cultural transmission (Mesoudi & Whiten, 2008) and has been used to empirically demonstrate a number of the content biases discussed in this thesis. Stereotype consistency bias has been demonstrated using a transmission chain design by Bangerter (2000) and Kashima (2000), social information bias has been demonstrated by Mesoudi et al. (2006) and emotional bias has been demonstrated by Eriksson and Coultas (2014). In the experiments presented here each transmission chain is comprised of three participants (or 'generations'). Three generations was judged to be a length capable of capturing the cumulative effects of transmission while still being practical in terms of recruiting participants. Transmission chains of three generations have been used successfully in previous research (Barrett & Nyhof, 2001; Nielsen, Cucchiaro & Mohamedally, 2012).

The original material given to the first generation of a transmission chain in two of the experiments (**Chapters 4** and **5**) were urban legends, re-written to match for number of words and central propositions. One of the key intentions of the studies in this thesis is to use 'real world' material. By using material that actually reflects stories that are actively transmitted between people the experiments provide a greater insight into the cultural transmission of urban legends and retain a high degree of ecological validity while examining content biases. In order to control as much as possible for the potential confounds present in the content of the different legends their selection was based on ratings provided by participants. The means of selecting this material is discussed in **Chapter 3**.

The other method used in this thesis is a qualitative analyses of naturally occurring urban legends and a computational phylogenetic analysis. Phylogenetic analysis uses an

explicit evolutionary model whereby new entities arise by descent with modification from existing ones. In this context, phylogenetic analysis provides a useful means for estimating relationships of common ancestry among existing variants and examining which traits tend to be preserved and which ones modified. This method has been used successfully to examine the cultural evolution of the folktale 'Red Riding Hood' (Tehrani, 2013) and here it is used in **Chapter 7** to explore the influence of MCI elements in the cultural evolution of the urban legend 'Bloody Mary'.

1.5 Aims and Structure of Thesis

In using content biases as a means to examine the cultural success of urban legends it is intended that the studies presented here will also shed light on how these biases operate and, as a result, will extend our current knowledge of content biases in general. Previous research has focused on single content biases and has largely used recall-based experimental paradigms. In contrast some of the work in this thesis examines how biases interact and can be combined in a single 'successfully-transmitted' narrative. It also uses paradigms beyond those based on recall, including both a computational approach and a unique non-recall based transmission chain paradigm.

The chapters of this thesis are presented in a publication manuscript format. Before each chapter there will be a cover sheet, displaying the publication status of each paper. Chapter references are presented at the end of each corresponding chapter. Appendices are presented at the end of the thesis.

In **Chapter 2** previous research examining urban legends is reviewed. This review includes a discussion of literature that has explained the cultural success of urban legends by focusing on the ecological dimensions of their transmission, epitomised by the 'symbolic interactionist' approach which served as the key focus of research examining urban legends throughout the 80s and 90s. In this chapter I present an alternative

explanation for the cultural success of urban legends by drawing on Sperber's (1996) 'epidemiology of representations', in which the distributions of cultural traits in a population are seen as the outcome of both social-ecological and psychological processes. To do this I review literature examining content biases in cultural transmission. I argue that a key reason for the success of urban legends lies in their ability to exploit cognitive biases arising from our disposition to learn and transmit certain kinds of content. This proposal is complemented by an analysis of 254 naturally occurring urban legends collected from the internet. This analysis found that almost all legends featured at least one known content bias, with emotional information (occurring in 78% of the sampled legends) and social information (occurring in 77% of the sampled legends) being the most frequently coded as present.

Content biases in cultural transmission have been demonstrated experimentally using a range of different materials as stimulus. In **Chapter 3** the material used in previous experiments is reviewed and a study used to aid in selecting stimuli for the subsequent experiments in this thesis is presented. Using a questionnaire-based study, participants' ratings based on content biases were collected for seventeen different urban legends. These ratings were then used to inform the selection of stimulus material for the transmission chain experiments presented in **Chapter 4** and **Chapter 5**.

Previous experiments that have used urban legends to examine content biases in cultural transmission have both used them to investigate emotional content bias, focusing on the single emotion of disgust. **Chapter 4** uses a linear transmission chain design to examine this bias but without focusing on a single emotion. A significant effect of emotion level on transmission fidelity was found with high emotion legends being recalled with significantly greater accuracy than low emotion legends. The emotional valence of a legend, positive or negative, was found not to have any effect on transmission. Based on

this result it is argued that emotional biases in transmission go beyond disgust and can incorporate other emotions such as amusement, interest and surprise.

Two of the biases demonstrated in previous research, a social information bias and a survival information bias have their theoretical origins in two seemingly oppositional theories regarding the evolution of human intelligence and memory: (i) the ecological hypothesis of primate intelligence evolution (Clutton-Brock & Harvey, 1980) and (ii) the *Machiavellian Intelligence* (Byrne & Whiten, 1988, Whiten 1999) or *Social Brain* (Dunbar, 1998, 2003) hypotheses. **Chapter 5** seeks to examine these two content biases by pitting them against each other in a linear transmission chain experiment. The effects of combining both biases in a single narrative are also examined. As well as investigating the effects of social information bias and survival information bias in a transmission chain which focuses on the encode-and-retrieve phase of transmission, their effect on transmission at the choose-to-receive and choose-to-transmit phases are also examined. Legends that contained social information were shown to have a transmission advantage over survival information legends at the 'encode-and-retrieve' phase of transmission, although survival information legends were transmitted with greater accuracy than the control material.

Two forms of mutation in cultural evolution have been suggested: 'copying error', where the learner makes non-intentional modifications and 'guided variation' where the learner's modifications are intentional. The decision-making processes underlying guided variation may produce similar results to cultural transmission as both are likely to be influenced by cognitive biases. Previous research has compared the products of guided variation with those produced by context biases in transmission (Mesoudi & Whiten, 2008); **Chapter 6** presents the first study to examine guided variation and content biases. Participants in a linear transmission chain received news stories and then were given the

opportunity to alter them however they wished without having to recall the material. The next participant in the chain then received the material produced by the previous participant and they altered it in turn. The results showed that guided variation was somewhat effective in increasing the degree to which material exploits content biases but only when the original material did not already exploit biases to a greater extent. The suggested content biases of social information was increased in one story and MCI content was added in a number of examples. No other content biases were increased. Material which already exploits biases to a greater degree was found not to be enhanced through guided variation.

Transmission chain experiments represent an excellent means to examine content biases in cultural transmission by creating micro-cultures; however, other means of examining these biases are worthy of pursuit. The study presented in **Chapter 7** used computational methods for analysing cultural transmission and presents the first study to use computational phylogenetic analysis in the study of urban legends. This method uses an explicitly evolution-based model of descent with modification. Phylogenies function as naturally occurring transmission chains and allow the researcher to examine the fidelity in transmission of content within a narrative across a number of generations. The study used the 'Bloody Mary' urban legend in a computational analysis to examine Boyer's (1994) MCI bias. MCI bias provides an interesting point of investigation for urban legends because, while MCI content occurs less frequently in urban legends, some of the most culturally successful urban legends feature MCI content. Previous research using traditional folklore and religious texts to examine MCI bias has suggested a cognitively optimum number of 1-2 or 2-3 counterintuitive concepts. The research presented here found that counterintuitive and intuitive concepts were equally stable in transmission, suggesting that MCI bias may function on the narrative as a whole, rather than the individual concepts within it.

Chapter 8 presents an overview of the thesis with discussion of the findings of the studies in the broader context of cultural transmission and evolution. The theoretical and practical implications of the studies are discussed in the context of content biases in cultural transmission and the study of urban legends. Avenues for future research implied by these findings are also discussed.

References

Atran, S. (1990). *Cognitive foundations of natural history: Towards an anthropology of science*. Cambridge: Cambridge University Press.

Atran, S. (2001). The trouble with memes. *Human Nature*, 12, 351-381.

Atran, S. (2002). *In gods we trust: The evolutionary landscape of religion*. Oxford: Oxford University Press.

Bangerter, A. (2000). Transformation between scientific and social representations of conception: The method of serial reproduction. *British Journal of Psychology*, 97, 405-423.

Barrett, J. L., Burdett, E. R., & Porter, T. J. (2009). Counterintuitiveness in folktales: Finding the cognitive optimum. *Journal of Cognition and Culture*, 9, 271-287.

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

Bartlett, F.C. (1932). *Remembering*. Oxford, UK: Macmillan.

Bauer, P.J. & Mandler, J.M. (1989). One thing follows another: Effects of temporal structure on 1- to 2-year-olds' recall of events. *Developmental Psychology*, 25, 197-206.

Best, J. (1990).*Threatened Children: Rhetoric and Concern About Child Victims*. Chicago: University of Chicago Press.

Best, J., & Horiuchi, G.T. (1985). The razor blade in the apple: The social construction of urban legends. *Social Problems*, 32, 488-499.

Boto, L. (2010). Horizontal gene transfer in evolution: facts and challenges. *Proceedings of the Royal Society B: Biological Sciences*, 277, 819-827.

Bower, G.H., Black, J.B., & Turner, T.J. (1979). Scripts in memory for text. *Cognitive Psychology*, 11, 177-220.

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

Boyd, R., Richerson, P. J., & Henrich, J. (2011). The cultural niche: Why social learning is essential for human adaptation. *Proceedings of the National Academy of Sciences*, 108 (Supplement 2), 10918-10925.

Boyer, P. (1994). *The Naturalness of Religious Ideas: A Cognitive Theory of Religion*. Berkeley, CA: University of California Press.

Boyer, P. (1998). Cognitive tracks of cultural inheritance: How evolved intuitive ontology governs cultural transmission. *American Anthropologist*, 100, 876-889.

Boyer, P. (2001). *Religion explained: the evolutionary origins of religious thought*. New York: Basic Books.

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

Brunvand, J.H. (2000). *The Truth Never Stands in the Way of a Good Story*. Chicago: University of Illinois Press.

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

Cahill, L., & McGaugh, J. L. (1998). Mechanisms of emotional arousal and lasting declarative memory. *Trends in neurosciences*, 21, 294-299.

Cavelli-Sforza, L. L. & Feldman, M. W. (1981). *Cultural Transmission and Evolution*. Princeton University Press.

Chinese restaurant bankruptcy fear after false dog meat rumour. (2011). *Telegraph Online*. Retrieved from http://www.telegraph.co.uk/foodanddrink/8824481/Chinese-restaurant-bankruptcy-fear-after-false-dog-meat-rumour.html.

Claidière, N., Kirby, S., & Sperber, D. (2012). Effect of psychological bias separates cultural from biological evolution. *Proceedings of the National Academy of Sciences of the United States of America*, 109, E3526.

Claidière, N., Scott-Phillips, T. C., & Sperber, D. (2014). How Darwinian is cultural evolution?. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 369, 20130368.

Claidière, N., & Sperber, D. (2007).The role of attraction in cultural evolution.*Journal of Cognition and Culture*, 7, 89-111.

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

Darwin, C. (1871/2004). *The Descent of Man*. London: Penguin

Dunbar, R.I.M. (1998). The social brain hypothesis.*Evolutionary Anthropology*, 6, 178-190.

Dunbar, R. I. M. (2003). The social brain: Mind, language, and society in evolutionary perspective. *Annual Review of Anthropology*, 32, 163–181.

Dundes, A. (1998). Bloody Mary in the mirror: A ritual reflection of pre-pubescent anxiety. *Western Folklore*, 57, 119-135.

Dunning Hotopp, J.C. (2011). Horizontal gene transfer between bacteria and animals. *Trends in Genetics*, 27, 157-163.

Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion*, 6, 169-200.

Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14, 1-26.

Fox Tree, J.E., & Weldon, M.S. (2007). Retelling urban legends. *The American Journal of Psychology*, 120, 459-476.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

Henrich, J., & Boyd, R. (2002). On modeling cultural evolution: why replicators are not necessary for cultural evolution. *Journal of Cognition and Culture*, 2, 87–112.

Henrich, J., Boyd, R., & Richerson, P. J. (2008). Five misunderstandings about cultural evolution. *Human Nature*, 19, 119-137.

Henrich, J., & McElreath, R. (2003). The evolution of cultural evolution. *Evolutionary Anthropology: Issues, News, and Reviews*, 12, 123-135.

Hirschfeld, L. A. (1996). *Race in the making: cognition, culture, and the child's construction of humankinds*. Cambridge, MA: MIT Press.

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

Keltner, D., & Gross, J. J. (1999). Functional accounts of emotions. *Cognition & Emotion*, 13, 467-480.

LaBar, K.S., & Cabeza, R. (2006). Cognitive neuroscience of emotional memory. *Nature Reviews Neuroscience*, 7, 54-64.

Macrae, C. N., & Bodenhausen, G. V. (2000). Social cognition: Thinking categorically about others. *Annual review of psychology*, 51, 93-120.

Martin, D., Hutchison, J., Slessor, G., Urquhart, J., & Martin, D. (2014). The spontaneous formation of stereotypes via cumulative cultural evolution. *Psychological Science*, 25, 1-10.

Medin, D. L., & Smith, E. E. (1981). Strategies and classification learning. *Journal of Experimental Psychology: Human Learning and Memory*, 7, 241.

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.

Mesoudi, A. (2011). *Cultural Evolution: How Darwinian Theory Can Explain Human Culture and Synthesize the Social Sciences*. Chicago, IL: University of Chicago Press.

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.I.M. (2006). A bias for social information in human cultural transmission.*British Journal of Psychology*, 97, 405-423.

Mesoudi, A., Whiten, A., & Laland, K. N. (2004). Perspective: is human cultural evolution Darwinian? Evidence reviewed from the perspective of The Origin of Species. *Evolution*, 58, 1-11.

Mesoudi, A., Whiten, A., & Laland, K. N. (2006). Towards a unified science of cultural evolution. *Behavioral and Brain Sciences*, 29, 329-347.

Nairne, J.S. (2010). Adaptive memory: Evolutionary constraints on remembering. *Psychology of Learning and Motivation*, 53, 1-32.

Nairne, J.S., & Pandeirada, J.N.S. (2008). Adaptive memory: Is survival processing special? *Journal of Memory and Language*, 59, 377-385.

Nelson, K. & Gruendel,, J. (1986). Children's scripts. In K. Nelson (Ed.), *Event knowledge: Structure and function in development* (pp. 21-46). Hillsdale, NJ: Erlbaum.

Nielsen, M., Cucchiaro, J., & Mohamedally, J. (2012). When the transmission of culture is child's play. *PLoS One*, 7, e34066.

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

Richerson, P. & Boyd, R. (2005). *Not by Genes Alone: How culture transformed human evolution*. Chicago: Chicago University Press.

Richardson, A.O., & Palmer, J.D. (2007). Horizontal gene transfer in plants. *Journal of Experimental Botany*, 58, 1-9.

Schacter, D. L. (1999). The seven sins of memory: Insights from psychology and cognitive neuroscience. *American Psychologist*, 54, 182–203.

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

Sperber, D., & Hirschfeld, L. A. (2004). The cognitive foundations of cultural stability and diversity. *Trends in cognitive sciences*, 8, 40-46.

Tangherlini, T.R. (1990). "It happened not too far from here...": A survey of legend theory and characterization. *Western Folklore*, 49, 371-390.

Tehrani, J. J. (2013). The Phylogeny of Little Red Riding Hood. *PloS one*, 8, e78871.

Thorndyke, P.W. (1977). Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology*, 9, 77-110.

Tucker, E. (2005). Ghosts in mirrors: Reflections of the self. *The Journal of American Folklore*, 118, 186-203.

Upal, M. A. (2005). Role of context in memorability of intuitive and counterintuitive concepts. In B. Bara, L. Barsalou, & M. Bucciarelli (Eds.), *Proceedings of the 27th annual conference of the cognitive science society* (pp. 2224–2229). Mahwah, NJ: Lawrence Earlbaum.

Upal, M. A. (2010). An alternative account of the minimal counterintuitiveness effect. *Cognitive Systems Research*, 11, 194-203.7

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.

Whiten, A., Hinde, R. A., Laland, K. N., & Stringer, C. B. (2011). Culture evolves. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1567), 938-948.

Willard, A. K., Henrich, J., & Norenzayan, A. (under review). The role of memory, belief, and familiarity in the transmission of counterintuitive content.

Wood, L. A., Kendal, R. L., & Flynn, E. G. (2013). Whom do children copy? Model-based biases in social learning. *Developmental Review*, 33, 341-356.

Zhaxybayeva, O., & Doolittle, W.F. (2011). Lateral gene transfer. *Current Biology*, 21, R242-R246.

Chapter 2

Santa Crucified and Death by Lollypop: Culture, Cognition and the Epidemiology of Urban Legends

This chapter presents a review of previous research examining the cultural success of urban legends as well as research examining content biases in cultural transmission. An analysis of content biases in urban legends is also presented. A version of this chapter has undergone one round of peer review in *Current Anthropology*. The authorship will be as follows: Joseph M. Stubbersfield[1 2], Jamshid J. Tehrani[1] and Emma G. Flynn[2]

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Abstract

The popularity of urban legends is explained by drawing on Sperber's (1996) 'epidemiology of representations', in which the distributions of cultural traits in a population are seen as the outcome of both social-ecological and psychological processes. To date, most explanations for the success of urban legends have focused on social-ecological contexts and ignored the psychological mechanisms involved in learning, remembering and transmitting narratives. Light is shed on the latter by invoking Sperber's distinction between dispositions (preferences that were positively selected over evolutionary time) and susceptibilities (non-adaptive by-products of those preferences). It is argued that a key reason for the success of urban legends lies in their ability to exploit cognitive susceptibilities arising from our disposition to learn and transmit certain kinds of information. Analyses of 254 urban legends found that almost all legends featured at least one known content bias, with emotional information (occurring in 78% of the sampled legends) and social information (77%) being the most common. Most legends contained two to three biases, suggesting that there is an optimum number of biases to be combined for a transmission advantage. The findings highlight the value of an epidemiological approach to urban legends and cultural transmission more generally.

2.1 Introduction

Urban legends, also referred to as 'contemporary legends' (Simpson, 1981), 'urban belief tales' (Fine, 1979) and 'modern legends' (Mullen, 1972) are generally defined as apocryphal stories that are told as true (Brunvand, 2000; Heath, Bell, & Sternberg 2001; Tangherlini, 1990), involve a contemporary setting (Brunvand, 2000) and feature a single event, usually an individual experience, as the core of the narrative (Tangherlini, 1990). Successful legends often share a number of features, such as a suspenseful or humorous narrative (Brunvand, 2000) containing surprising information or a twist ending (Fox Tree & Weldon, 2007), a warning or moral message that is either explicit or implied and they are often attributed to a 'friend of a friend' (Brunvand, 2000). Historically, these legends have been transmitted through word-of-mouth in the same manner as other oral narratives, but more recently their transmission has been accelerated by modern technology such as email, internet forums and other electronic media (Brunvand, 2000; Fox Tree & Weldon 2007).

The cultural success of urban legends can be illustrated with a number of examples. One such example is the widely believed legend that anonymous sadists contaminate "trick-or-treating" children's food at Halloween. A 1985 poll by ABC News found that 60% of parents in the USA were concerned that their children might become the victims of sharp items such as razor blades, sewing needles and shards of glass being purposefully placed in food by adults (cited in Best, 1990). This urban legend led American schools to train children to check their sweets, hospitals to X-ray sweets and several communities attempted to ban children from Halloween trick or treating despite the fact that no greater injury than small cuts (and not from ingestion) have been reported since 1958 and that the vast majority of incidents similar to the belief were hoaxes (Best, 1990; Best & Horiuchi, 1985).

Urban legends can also have a significant negative impact on companies and businesses. In 1995 Proctor and Gamble removed their longstanding man-in-the-moon logo from their products after a widespread urban legend claimed that the company president had appeared on American television and declared the company's association with the Church of Satan, the logo was thought to be a satanic symbol (Kapferer, 1990). As recently as 2007 the company successfully sued individuals who revived and propagated the original legend. In 2011 a Chinese restaurant in Bawtry, UK, faced bankruptcy after a local urban legend spread involving a woman choking on a dog's identification microchip while eating at the restaurant, the microchip supposedly coming from a retired racing greyhound that had been served in her meal ("Chinese restaurant bankruptcy fear", 2011). Widespread urban legends have also gone on to inspire horror movies such as *Candyman* (Barker & Golin, 1992) and *Urban Legend* (Mattews, McDonnell, & Monitz, 1998).

Given that most urban legends are not based on true events (and are often easy to disprove), their popularity cannot be explained in simple utilitarian terms. On the surface, they do not appear to contain useful information worth remembering and sharing – in fact, insofar as they can promote unwarranted fear and mistrust, they may even have maladaptive influences on behaviour. To understand how such narratives spread, it is useful to invoke Sperber's (e.g. 1996) important distinction between dispositions and susceptibilities in cultural transmission. Dispositions are preferences that have been positively selected for in the evolution of an organism because they contribute to survival and reproduction; susceptibilities are the by-products of those dispositions, and are either neutral with regards to fitness, or sometimes even harmful. For example, humans have an evolved disposition for sweet tasting foods such as fruits because they had important nutritional value to the diets of our ancestors. However, in the age of mass-produced foods, this disposition has created a susceptibility to over-consume sugary foods, contributing to widespread problems with obesity in the developed world (Sperber, 1985: 81). Similarly,

dispositions to attend to, remember and transmit certain kinds of information may make us susceptible to non-adaptive or even maladaptive ideas, beliefs, narratives and other cultural representations that exploit those evolved preferences (Sperber & Hirschfeld, 2004). Sperber (1996) argues that psychological susceptibilities are as important to the transmission of culture as immunological susceptibilities are to the transmission of disease. Thus, just as the epidemiology of diseases incorporates both ecological and immunological determinants of contagion, the 'epidemiology of representations' demands an understanding of both the socio-environmental context of cultural transmission, as well as the psychological biases involved in learning, storing and communicating information (e.g. perception, inference, memory, etc.) (Claidière & Sperber, 2007; Sperber, 1996).

To date, most efforts to explain the popularity of urban legends have focused almost exclusively on the ecological dimensions of their transmission. This is epitomised by the 'symbolic interactionist' approach, which sees legends as collective attempts to make meaning out of confusing or disturbing events, particularly during periods of rapid social and economic change. A classic example is Fine's analysis of the highly persistent and popular legend of the 'Kentucky fried rat' (Fine, 1980). In this legend, a person (almost consistently female) buys some fried chicken from a popular fast food outlet and later discovers a deep-fried rat amongst the chicken pieces. In some variations this causes her death by shock but in more modern version she sues the fast food company for a substantial amount of money. Fine (1980) found that 76% of respondents believed the legend to be true or at least probably true and some had even changed their eating habits because of it, despite the fact that such an event has never taken place. Drawing on Dundes (1971) and Shibutani (1966), Fine argues that urban legends such as the 'Kentucky fried rat' arise from what folklorist Warren (1972) called 'the Great Change' in American society following WWII. Fine argues that changes to society, such as impersonalisation, the transfer of functions to profit enterprises, urbanisation, suburbanisation and shifting

moral values created a conflict between the traditional social order and the complexities of modern society that urban legends are a response to. In the case of the 'Kentucky fried rat' legend the expansion of the fast food industry represents a threat to the traditional home-cooked meal and the legend expresses society's anxiety over this conflict (Fine, 1980).

Ellis (1983) takes a similar approach in his analysis of the 'ritual murder of a child' legend, which has existed in many different forms for over two-thousand years. Early variations attribute the ritual murder of children to Christians (Ellis, 1983), later the murderers became Jews in Medieval Europe (Hsia, 1988, cited in Victor, 1990), aristocrats in Revolutionary France (Victor, 1990) and hippies, Satanists or black and Latino gang members over the past fifty years (Ellis, 1983; Victor, 1990). Ellis (1983) suggests that this legend becomes most popular during periods of social change where a minority group is appearing to be gathering greater prominence, for example, during the growth of Christianity in ancient Rome (Ellis 1983). Similarly, Best and Horuichi (1985) have argued that the 'Halloween food contamination' legend mentioned above came to prominence in the 1970s as a reflection of increased fear about child safety, crime and other social strains. Victor (1990) came to similar conclusions in his examination of various satanic cult urban legends that found prevalence during the 1980s in the USA, suggesting that these legends are metaphors for social stresses related to societal changes in the family and economics. Thus, in each of these case studies urban legends are viewed as responses to social strain and shaped by the perception of threat to the traditional social order.

While symbolic interactionist and related approaches (e.g. Dundes, 1971) support rich interpretive insights into the ecological factors that promote the spread of specific individual legends, they do not directly address the underlying psychological factors that make people susceptible to them and which explain the general success of urban legends as a genre (see also Heath et al., 2001). To bridge this gap in the literature recent research

focusing on the roles of 'content biases' (Barrett & Nyhof, 2001) or 'cognitive attractors' (Claidière & Sperber, 2007) in cultural transmission is drawn upon. This work suggests that humans are disposed to learn, remember and transmit certain types of information more easily than others, and that any information that is passed between people will be subjected to cognitive selective pressures which alter the content and structure so as to make it maximally transmittable (Barrett & Nyhof, 2001). Potential cognitive content biases which could make us susceptible to urban legends include an ecological survival information bias (Nairne, 2010), a social information bias (Mesoudi, Whiten, & Dunbar, 2006); an emotional bias (Heath, Bell, & Sternberg, 2001), a minimally counter-intuitive (MCI) bias (Boyer & Ramble, 2001), and a stereotype consistency bias (Kashima, 2000).

Ecological Survival Information Bias

Nairne and colleagues (Nairne 2010; Nairne, Thompson, & Pandeirada, 2007; Nairne & Pandeirada, 2008) argue that, as human memory is an evolved trait that must have been shaped by selection pressures to achieve specific fitness-related goals, memory should display functional specialisation. They argue that human memory is unlikely to have evolved to be domain general, as some information, such as the locations of food sources or predators, would be more beneficial to remember than random events. Human memory, therefore, has evolved to be 'tuned' towards encoding and recalling fitness related information better than other forms of information. Nairne, Thompson and Pandeirada (2007) had participants imagine themselves stranded in a foreign grassland scenario and then rate the relevance of words to finding food, water and protection from predators; they refer to this as 'survival processing'. Later, surprise free-recall tests revealed an advantage for survival processing. Nairne, Pandeirada and Thompson (2008) found a similar result as words processed within a survival context (e.g. relating to food

and predators) were more likely to be recalled than when presented in a non-survival context.

In Nairne and Pandeirada (2008) participants were asked to make either survival relevance decisions or pleasantness ratings about words in the same categorised list. They found that survival processing produced the best recall in both within- and between-subject designs, despite the fact that the pleasantness rating of words in a categorised list is considered one of the best methods for enhancing free-recall. Kang, McDermott and Cohen (2008) found that survival processing produced better recall than a control scenario chosen to match the novelty and potential excitement of the survival scenario.

A number of studies, using a variety of experimental designs and materials (Nairne & Pandeirada, 2008; Nairne et al., 2007; Kang et al., 2008; Otgaar, Smeets, & van Bergen, 2010; Weinstein, Bugg, & Roediger, 2008) have demonstrated the strong mnemonic advantage that survival processing grants participants over other forms of processing and that this effect is robust within and between participants. The recall advantage for ecological survival information found in these studies suggests a potential bias for ecological information relevant to survival in human cultural transmission.

Traditional folklore from different cultures provides examples of narratives which contain ecological information relevant to survival (Sugiyama, 2001). Information relevant to hunting game, gathering edible plants and avoiding dangerous carnivores can be found in the oral narratives of the Ju/'hoansi (Biesele, 1993), !Kung (Biesele, 1978), White Mountain Apache (Goodwin, 1939) and Yanomamö (Simoneau, 1990). Sugiyama (2001) argues that oral narratives among foraging peoples are used as a means to transmit this survival relevant information. Since these folktales are likely to have been passed down over many generations, the presence of this content supports the results of experimental

studies suggesting that ecological survival information is transmitted with a high degree of fidelity.

Social Information Bias

The *Machiavellian Intelligence* (Byrne & Whiten, 1988; Whiten, 1999) or *Social Brain* (Dunbar, 1998; 2003) hypothesis suggests that primates evolved greater intelligence in order to deal with complex social interactions, rather than to deal with non-social challenges in their ecological environment. These hypotheses oppose an ecological hypothesis of the evolution of primate intelligence (Clutton-Brock & Harvey, 1980) by emphasising the importance of social interaction. These hypotheses are complemented by Dunbar's *Social Gossip Theory* (1993) of human language evolution, which argues that language evolved as a means to maintain social cohesion in the complex social groups that are characteristic of modern humans. Together they suggest that greater intelligence and language were necessary for tracking social relationships and interactions in complex social groups, and therefore evolved in response to social selection.

Mesoudi, Whiten and Dunbar (2006) argue that if human cognition evolved to deal with social relationships and interactions, then humans should preferentially attend to, recall and transmit social information over equivalent non-social information. They tested this proposal by comparing the transmission of social and non-social information along linear transmission chains. For Mesoudi, Whiten and Dunbar (2006) social information was defined as information which concerned the interactions and relationships between a number of third parties, while non-social information was defined as concerning a single individual's interactions with the physical environment, or solely concerning the physical environment. For the purposes of their study social information was divided into two categories: gossip, which involved intense and salient social interactions or relationships, such as an illicit sexual affair, and social non-gossip, which involved 'everyday'

interactions and relationships, such as someone receiving directions. They found that social information was transmitted with greater accuracy and in greater quantity than equivalent non-social information. Social non-gossip was transmitted to a similar degree as gossip, suggesting that the intensity of social relationships described in the information has no effect on the fidelity of transmission but what is important is some form of third party interactions. These results are consistent with the *Machiavellian Intelligence* or *Social Brain* hypotheses and suggest that humans are biased towards social information, explaining the bias for social information seen in popular media, such as gossip magazines, reality television and tabloid newspapers (Mesoudi et al., 2006).

While a bias for social information is evidenced by the prevalence of gossip and rumour in human communities, it is also thought to play an important role in the success of fictional narratives. According to Mar and Oatley (2008), good stories are engaging and entertaining because they simulate the tensions and dilemmas inherent in real social relationships, providing an imaginative context in which one can explore their possibilities. This claim is supported by evidence from traditional folktales, which, as Sugiyama (2001) points out, frequently concern topics such as kinship, marriage, sex, friendship, betrayal, social status, interpersonal conflict and deception. In a similar vein, it might be expected that urban legends which exploit the social bias suggested by Mesoudi et al. (2006) will have an advantage in transmission and recall.

Emotional Bias

Emotional arousal is known to be an important factor in the storage and recall of memories (LaBar & Cabeza, 2006), and is thought to play a major role in the transmission of cultural knowledge and beliefs. For example, Whitehouse (2004) has described how 'imagistic' religions (i.e. religions that are based on esoteric experiences of the divine, rather than formal doctrines and institutions) are reproduced through highly arousing,

climatic rituals, such as traumatic initiation rites and ecstatic trances. Heath, Bell and Sternberg (2001) investigated whether fictional narratives were similarly affected by emotional content, focusing specifically on the importance of disgust in urban legends. They designed experiments in which participants were asked to rate urban legends for emotional, informational and story characteristics and how likely they would be to pass the story on. It was found that, while informational characteristics, such as plausibility, were important in the likelihood of passing on a legend, legends were also more likely to be passed on if they elicited a greater level of disgust. When the number and level of disgust evoking motifs in a legend was manipulated, participants preferred, and were more likely to pass on, legends which produced the highest level of disgust. As the high level disgust legends were less plausible, this finding suggests that evoking emotion is more important to the transmission of a legend than informational content. Heath et al. (2001) also found that urban legends which featured a greater number of disgust evoking motifs were more widely distributed on urban legend websites. This suggests that urban legends are transmitted and retained in the social environment due to a bias for narratives which evoke emotions that are common across individuals, rather than any particular metaphorical representation of social stress.

Eriksson and Coultas (2014) expanded on the work of Heath et al. (2001) and demonstrated a bias for urban legends which evoked higher levels of disgust across three phases of cultural transmission: 'choose-to-receive', 'encode-and-retrieve' and 'choose-to-transmit'. Further evidence for this bias in cultural transmission is provided by a study carried out by Berger and Milkman (2010), who analysed 6,956 articles published on the *New York Times* website for their emotional valence and how often they were forwarded by email. They found that articles which aroused emotions characterised by high arousal, such as anger, were more likely to be transmitted than articles which aroused emotions characterised by low arousal, such as sadness.

Minimally Counter-Intuitive (MCI) Bias

Boyer (1994) has argued that humans have evolved a rich cognitive architecture for making intuitive assumptions about the properties of different categories of entities. These intuitive assumptions are generally described as 'folk biology', 'folk physics' and 'folk psychology'. Concepts which violate these category-level expectations are considered to be counterintuitive and feature inherent transmission advantages that can increase the salience of a narrative (Boyer, 1994). Boyer, however, also argues that this effect is not linear and that a balance must be met between satisfying intuitive expectations and violating enough of them to be cognitively optimal. If a narrative features too many counterintuitive concepts it can render it incomprehensible and unmemorable (Boyer & Ramble 2001). Upal, Gonce, Tweney and Slone (2007) argue that humans evolved to preferentially remember and recall events or objects which violate expectations about the future but can be justified once they have been observed and that MCI concepts meet these requirements.

Stories which are considered MCI will balance a minority of counterintuitive concepts with a majority of everyday, intuitive events. Several studies have supported the idea that MCI narratives are cognitively optimal, granting them an advantage in recall and transmission (Barrett, Burdett, & Porter, 2009; Barrett & Nyhof, 2001; Boyer & Ramble, 2001; Norenzayan, Atran, Faulkner & Schaller, 2006; Upal et al. 2007; Upal 2011). While Barrett (2000) suggests that MCI concepts hold a transmission advantage because they can be understood and represented without the allocation of too many cognitive resources but are challenging enough to require increased attention in order to be assimilated into conceptual schemes

Barrett and Nyhof (2001) examined whether MCI narratives have a cognitive advantage using linear transmission chains. Using both traditional Native American

folktales (as used in Bartlett 1932) and a science-fiction style story as material, they found that, after three generations of transmission, counterintuitive and intuitive but bizarre items were recalled in greater proportions than intuitive items. This recall of counterintuitive items was found both immediately and after a three month delay. They also replicated these findings using oral transmission in a group serving as a mock community. The fact that recall of counterintuitive items was upheld after a three month gap is important, as an idea that is immediately memorable but becomes significantly less memorable with time could not be as culturally successful as those ideas that retain memorability.

Norenzayan et al. (2006) examined MCI bias using lists featuring intuitive and counterintuitive ideas and, while the intuitive ideas were better recalled in the short-term (similarly to the results of Bartlett 1932), MCI lists had a recall advantage over time. In a second study folktales collected by the Brothers Grimm were rated for MCI concepts, memorability and other psychological variables. They found that MCI tales were more likely to be culturally successful (determined by number of hits using a Google web search) and were perceived to be more memorable and more psychologically appealing in terms of comprehension and ease of transmission. They suggest that the cognitively optimum level is around two to three counterintuitive features in a narrative. Norenzayan et al. (2006) concluded that MCI narratives are culturally successful due to a stronger cognitive advantage in recall compared to other narrative templates. Upal et al. (2007; 2011) refers to the hypothesis that the presence of a specific number of MCI concepts increases the memorability of a narrative as the Fixed MCI-narrative template (FMNT) hypothesis. Upal (2011) found that the inclusion of counterintuitive concepts only increases the memorability of a narrative if the concepts make the story more coherent. He suggests that the global cohesion of the narrative is a key mediating factor in its memorability and calls into question the idea that there is a specific cognitive optimum for all narratives. He argues that memorability is not a property of a concept but it is a property

of the concept, its context, and the background knowledge of the comprehender, therefore the memorability of a concept will vary depending upon its context and this context should not be ignored when examining transmission. The importance of the context in which counterintuitive concepts are presented is also supported by Atran and Norenzayan (2004) who found that recall for counterintuitive concepts only increased when they were surrounded by intuitive concepts, suggesting that the counterintuitive concepts were not inherently more memorable, they only became more memorable when placed in an intuitive context. The interaction between counterintuitive and intuitive concepts within a narrative and their joint influence on its cultural transmission is an area that is yet to be fully explored.

To date, only one study has addressed the role played by MCI bias in the transmission of urban legends. Stubbersfield and Tehrani (2013, presented in Chapter 7) used computational phylogenetic methods to analyse the evolution of the urban legend 'Bloody Mary', in which a violent ghost is summoned through a ritual involving a mirror. Counterintuitive and intuitive concepts were found to be equally stable in transmission, suggesting that MCI bias functions on the narrative as a whole, rather than on individual concepts within it, supporting Upal's conceptualisation of how MCI bias operates and the importance of the narrative context.

Stereotype Consistency Bias

Cultural stereotypes are social representations about social groups which are likely to arise from the cognitive processes of sense-making and conventionalisation (Bangerter, 2000; Kashima, 2000). It has been suggested that information that conforms to stereotypical assumptions is more likely to be transmitted than information that conflicts with them. Fyock and Stangor's (1994) meta-analysis found that people recalled stereotype-consistent (SC) information better than stereotype-inconsistent (SI) information,

when presented with both. In contrast, Rojahn and Pettigrew's (1992) meta-analysis found that expectation-inconsistent information is actually more likely to be remembered than expectation-consistent information in most social contexts; suggesting that, when recalling another person's behaviour, SI information should be better recalled than SC information. Other studies into individual recall have found that when ability and motivation are high enough, SI information is better remembered than SC information (Dijksterhuisand & van Knippenberg, 1995; Macrae, Hewstone, & Griffiths, 1993). The success of SI information in transmission relates to a bias for MCI information (discussed earlier), as it violates intuitive assumptions about groups of people and can be considered MCI. In terms of collective recall, however, Allport and Postman (1947) found that serial reproduction led to SI information regarding race being subject to conventionalisation and becoming SC.

Kashima (2000) investigated the effect of stereotype-based information on both individual and collective recall using a transmission chain method. A story about a man and a woman exhibiting gender-stereotype relevant behaviour was transmitted along a five-person chain. When remembering details relevant to the plot, participants in earlier positions in the chain recalled SI information better than SC information, however, SC information was retained better than SI information towards the end of the chain. Regarding background details, however, SC information was consistently recalled better than SI information across the chain. Bangerter (2000) found that scientific text describing the conception process was subject to transformation along diffusion chains, with the abstract scientific description becoming progressively more anthropomorphic, with stereotypical sex-role attributions being projected onto the sperm and ovum.

Thus, while on an individual level SI information is better recalled under certain circumstances, over a number of generations SC information is consistently retained and recalled better than SI information. Importantly however, the extent to which people hold

these stereotypes as true affects the degree of bias in transmission, as does an in-group out-group effect; participants are more likely to view an out-group's behaviour as homogenous compared to the behaviour of their in-group (Kashima, 2000). Transmission of SC information is also affected by an individual's perception of how shared the stereotype is in the community, with individuals being more likely to transmit SC information if they believe others also hold that stereotype to be true (Clark & Kashima, 2007).

The Present Research

The research summarised above suggests there are a number of cognitive dispositions toward learning and passing on certain kinds of information that may make us susceptible to apocryphal and potentially even harmful narratives. With that in mind, the present study addresses three main questions concerning the epidemiology of urban legends:

1. Do urban legends consistently feature content that exploits known cognitive biases?
2. If so, which of the aforementioned biases are the most important in the transmission of urban legends? For example, based on the experimental studies reviewed above, one may expect social information to appear more frequently in urban legends than ecological information, and stereotype consistent content to be more frequent than stereotype inconsistent content.
3. When content biases are present in legends do they tend to occur individually or in combination with other biases? If in combination, which combinations are common and which ones rare?

2.2 Method

Material

Two-hundred and sixty urban legends were collected from the *Urban Legends Reference Pages* (www.snopes.com) using the websites own 'randomizer' function which provides a random selection of one legend from their database of thousands. The *Urban Legends Reference Pages* is the most complete collection of urban legends available and has been praised by folklorists knowledgeable in the field such as Brunvand (Seipp, 2004). It has also been used as a source for material in studies examining biases in cultural evolution (see Fessler, Pisor, & Navarrete, 2014). For the purposes of this study urban legends were defined as apocryphal narratives, told as true, involving a contemporary setting and featuring or referencing a single event as the core of their narrative. As the *Urban Legends Reference Pages* applies a more expansive use of the term 'urban legend' than is used here, also including rumours, trivia, hoaxes, common misconceptions and misinformation, only legends which met the above criteria were used in analysis. A key intention of the *Urban Legends Reference Pages* is to ascertain the veracity of urban legends and each is rated as 'true', 'false', 'a mixture of true and false information', 'true but outdated information' or 'legend'; these ratings are generally considered accurate (McNamara, 2009). To meet the criteria of being an 'apocryphal narrative' only those legends which have been rated by the *Urban Legends Reference Pages* as 'False' or 'Legend' were used (complete details on the *Urban Legends Reference Pages* rating system can be found at http://www.snopes.com/info/ratings.asp).

Two-hundred and sixty legends were originally collected as it was felt that this number was large enough to provide a representative sample with potentially all biases being represented. During analysis six of these were rejected for not matching the criteria

for an urban legend described above, leaving 254 legends in the final sample. Only one version of a legend was collected.

Coding

The collected legends were coded for the presence of biases using NVivo 10 (QSR International, 2012). These biases included emotional content (subdivided into anger, amusement, disgust and fear), MCI content, social content (subdivided into social, social context and social gossip), stereotype consistency (subdivided into male behaviour, female behaviour, race/nationality and regional), and survival information (subdivided into high and low). See Table 1 for the coded biases and the definitions used.

The emotions coded were anger, disgust, fear and amusement. The first three of these emotions are taken directly from Ekman's (1992) list of Basic Emotions which are defined as discrete, separate emotional states which differ in terms of expression, antecedents, behavioural responses and physiology. The six Basic Emotions are argued to be universal and to have evolved to deal with fundamental life tasks common to all humans (Ekman, 1992). Of the original six Basic Emotions sadness was not coded due to research suggesting it does not enhance transmission (Berger & Milkman, 2009) and surprise was not coded due to its neutral valence. Amusement (also referred to as mirth, exhilaration [McGhee, 1979; Ruch, 1993] or joy [Panksepp & Burgdorf, 2003]), was chosen for coding in place of happiness for a number of reasons. First, it was thought that material deliberately intending to elicit amusement would be easier for coders to recognise than happiness. Second, as in the other emotions coded, amusement is thought to have an adaptive function (Gervais & Wilson, 2005). Amusement is thought to be an adaptive part of the human communicative system which enhances social cohesion (Burling, 1993; Provine, 2000). Third, Ekman (1999) suggests that amusement shares characteristics with the six Basic Emotions and included it in an expanded list. All four of the emotions coded

are characterised by high-arousal, are cross-culturally recognised and have been included in studies examining emotion in transmission (Eriksson & Coultas, 2014; Meagher, Arnau & Rhudy, 2001; Ruch, 1993; Russell & Mehrabian, 1974).

To assess inter-rater reliability an independent coder, blind to the hypothesis, coded a sample of 50 randomly selected legends. They were provided with the coding definitions (see Table 1) and instructed to code as present any biases that they believed were featured in the legends. The coding of the second coder and the researcher was highly consistent, being in 88% agreement for all biases coded.

Table 1. *Definitions of each of the content biases coded in this study.*

Bias	Coding Definition
Emotional Anger	Content which is intended by the teller to evoke anger in the receiver.
Emotional Amusement	Content which is intended by the teller to evoke amusement in the receiver, e.g. 'a funny story.'
Emotional Disgust	Content which is intended by the teller to evoke disgust in the receiver.
Emotional Fear	Content which is intended by the teller to evoke fear in the receiver, e.g. 'a scary story.'
Minimally Counter-Intuitive (MCI)	Content which breaches category level expectations, such as acting against folk physics, folk biology, etc.*
Social	Content concerning third-party social relationships and interactions at the core of the narrative. †
Social Context	Third-party social relationships and interactions are present but are not at core of the narrative.
Social Gossip	Content concerning intense third-party social relationships and interactions at the core of the narrative, e.g. sexual infidelity. †
Stereotype Consistent Male Behaviour	Behaviour at the core of the narrative which is consistent with male cultural stereotypes.
Stereotype Consistent Female Behaviour	Behaviour at the core of the narrative which is consistent with female cultural stereotypes.
Stereotype Consistent Race/Nationality Behaviour	Behaviour at the core of the narrative which is consistent with cultural stereotypes based on race or nationality.
Stereotype Consistent Regional Behaviour	Behaviour at the core of the narrative which is consistent with regional cultural stereotypes.
Stereotype Inconsistent Behaviour	Behaviour at the core of the narrative which is inconsistent with cultural stereotypes.
High Survival Information	Information relevant to serious injury or death.
Low Survival Information	Information relevant to injury or potential injury.

Note. - ***** Definition based on Boyer (1994); † Definition based on Mesoudi, Whiten and Dunbar (2006).

2.3 Results

The majority of urban legends coded were shown to feature content which exploits cognitive biases. Biases for emotional content, MCI, social information, ecological survival information and stereotype consistency were all represented, with 92% of legends featuring at least one bias (see Table 2 for frequency of biases coded).

Table 2. *Frequency of each bias coded in the urban legends and the percentage of total legends in which the bias was coded.*

Bias	Frequency	Percentage of total (%)
Emotional	198	78
Social	195	77
Survival	69	27
Stereotype Consistent	58	23
MCI	14	6
Stereotype Inconsistent	0	0

Emotional Bias

One of the two biases most frequently coded as present was emotional content bias, which was present in 78% of the legends. The bias was subdivided into four emotions, three which are characterised by negative valence and high arousal: anger, disgust and fear (Russell & Mehrabian, 1974; Meagher et al., 2001), and one which is characterised by positive valence and high arousal: amusement (Ruch, 1993). Of these, amusement was the most frequent, being present in 47% of legends. Fear and disgust occurred at a frequency of 14% and 13% respectively. Anger was the least frequent, present in only 4% of legends. An abridged example of a legend which was coded as featuring amusing content is given below (it was also coded as featuring social information):

Example 1 (Amusing Legend)

One of the funniest "most-embarrassing-moment" stories I've come upon in a long time was about a lady who picked up several items at a discount store. Imagine her embarrassment when the checker got on the intercom and boomed out for all the store to hear, "PRICE CHECK ON LANE THIRTEEN TAMPAX, SUPERSIZE."That was bad enough, but somebody at the rear of the store apparently misinterpreted the word "tampax" for "thumbtax." In a business-like tone, a voice boomed back over the intercom. "DO YOU WANT THE KIND YOU PUSH IN WITH YOUR THUMB, OR THE KIND YOU POUND IN WITH A HAMMER?"

Social Information Bias

Social information was one of the two most frequently coded biases, being coded as present in 77% of legends. Social information was subdivided into three levels: social context, social and social gossip (see Table 1 for definitions). Of these levels, social was the most frequently coded, present in 49% of legends. 18% of legends contained social context and 9% contained social gossip. Below is an example of a legend which was coded as featuring social information:

Example 2 (Social Information Legend)

Have you heard the story about the Rockingham County farmer who bought an old Harley-Davidson motorcycle at a yard sale and discovered "To Elvis, Love Priscilla" written under the seat? Then he sold it to Jay Leno, late-night talk show host, who handed over $1 million for the bike?

Ecological Survival Information Bias

Ecological survival information was present in 27% of legends. This bias was subdivided into two levels: high, concerning serious injury or death, and low, concerning injury or potential injury. Of these levels high survival information was the most frequently coded, being present in 20% of the legends, while low survival information was present in 7% of legends. The abridged example below featured high survival information:

Example 3 (Survival Legend)

This was a friend of my cousin's husband…This is real, please be careful…

Stuart Bidasoe was found slumped over dead in the drivers[sic]*seat of his Silver 1997 Saturn. Beside him was a bag of Halloween candy. It appears that in the dense fog, Thursday night, he had run off the road and hit a fence post causing the airbag to deploy…Stu Bidasoe had attended a Halloween Party and was on his way home. He had a lollypop in his mouth and in the dense fog ran off the road, hit the fence post inflating the airbag, pushing the lollypop into his throat. He suffocated before help could arrive…*

Stereotype Consistency Bias

Stereotype consistent behaviour was present in 23% of the legends. Stereotypical behaviour based on race or nationality was the most frequent (9%). Other stereotypes included gender stereotypes, 7% contained stereotypical male behaviour and 5% contained stereotypical female behaviour. Only 2% contained stereotypical behaviour based on region. No legends were coded as featuring stereotype inconsistent behaviour. The example below was coded as featuring content consistent with racial and/or national stereotypes as well as amusement and social information:

Example 4 (Stereotype Consistent Legend)

A few Decembers ago Japanese department store, desperate to appear westernised and with-it, mounted an extravagant Christmas display, featuring a life-sized Santa Claus, crucified upon a cross.

Minimally Counterintuitive (MCI) Bias

MCI was the least frequently coded bias, present in only 6% of the legends. Below is a legend which has MCI content:

Example 5 (MCI Legend)

… Apparently in the movie "Three Men and a Baby" there is one scene that revealed what appeared to be a young boy standing between curtains in a room. The scene had Ted Danson speaking to a woman I believe…The facts are, a young boy died in the house in which the movie was filmed. Some people think it was his spirit…

Each MCI legend was coded for the number of counterintuitive objects or concepts. The number of counterintuitive features present ranged from 1-2. 93% of the MCI legends featured just one MCI object or concept.

Multiple Biases

76% of the legends featured two or more biases, with the majority of legends featuring two (see Figure 1).

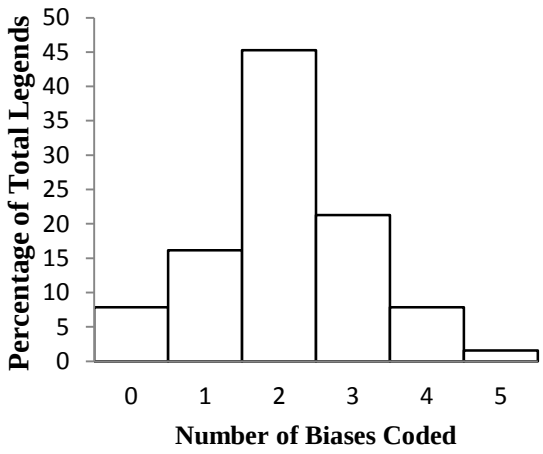

Figure 1. Chart showing the percentage of total legends coded with multiple biases.

There were a number of common combinations (see Tables 3 and 4 for the frequency of combined biases).

Table 3. *Frequency of general biases coded as appearing together in the same legend (% of total legends).*

Bias	Emotional	MCI	Social	Stereotype	Survival
Emotional		7 (3)	164 (65)	58 (23)	58 (23)
MCI			9 (4)	0	3 (1)
Social				52 (20)	44 (17)
Stereotype					13 (5)
Survival					

Table 4. *Frequency of specific biases coded as appearing together in the same legend.*

Bias	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1.Amuse.		1	8	2	2	78	10	20	9	13	16	4	7	5
2. Anger			0	0	0	7	2	0	0	0	1	0	0	0
3.Disgust				8	0	8	11	4	3	4	4	0	13	4
4.Fear					5	11	12	1	3	0	1	0	27	2
5.MCI						4	5	0	0	0	0	0	3	0
6.Social							0	0	6	5	17	3	14	3
7.Soc. Context								0	2	1	4	0	19	6
8.Gossip									3	10	1	0	2	0
9.Stereotype Female										4	1	1	4	0
10.Stereotype Male											2	1	3	1
11.Stereotype Race												1	5	0
12.Stereotype Regional													0	0
13.Survival High														0
14.Survival Low														

Amusement and Social Information were found together in 31% of the legends, Survival (High) and Fear were found together in 11% of the legends and Survival (High) and Disgust were found in 5% of the legends. The abridged example below is a legend which featured social information and amusing content:

Example 6 (Social-Amusement Legend)

… Now, let me tell you something which really, truly happened to a friend of a friend, last Christmas… she decided to enclose some rather generous cheques with her Christmas cards, scribbling the message: "Have a lovely Christmas but, if you don't mind, buy your own present this year!"…a week or so into January, having not received the customary thank-yous from her relatives and friends, she found all the cheques in a drawer. In the rush, she had neglected to enclose them.

An abridged example of a legend featuring ecological survival information and fear content is below:

Example 7 (Survival-Fear Legend)

Don't forget to look !!! This is really scary ...the mystery behind a recent spate of deaths has been solved…3 women in Chicago, turned up at hospitals over a 5 day period, all with the same symptoms. Fever, chills, and vomiting, followed by muscular collapse, paralysis, and finally, death… It was discovered, however, that they had all visited the same restaurant……one toxicologist… drove out to the restaurant, went into the restroom, and lifted the toilet seat. Under the seat, out of normal view, was small spider……So please, before you use a public toilet, lift the seat to check for spiders.

It can save your life!...

The example below featured survival information and disgusting content:

Example 8 (Survival-Disgust Legend)

An old lady ordered out for Kentucky Fried Chicken. She was eating along when she noticed teeth; she pulled back the crust and discovered she was eating a rat. She had a heart attack and died, and her relatives sued Kentucky Fried Chicken for a lot of money.

No Biases

No biases were coded in 8% of the legends (n = 20). Below is a legend which was coded as not featuring any biased content.

Example 9 (No Bias Legend)

When I was a little girl, I would watch [Julia Child's] *show every Sunday afternoon on PBS. I still remember that episode. In fact I never forgot it. It was a topic of conversation with my Mom around Thanksgiving time. It was a raw turkey she was preparing. It slid right off the table. She bent down, picked it up, put it back on the table and kept on going with the show*

2.4 Discussion

This study set out to investigate the role of cognitive susceptibilities in the epidemiology of urban legends. To discuss these findings, let us return to the three key questions raised in the introduction.

1. **Do urban legends consistently feature content that exploits known cognitive biases?**

The results of this study provide compelling evidence that the content and popularity of urban legends has been influenced by cognitive biases in cultural transmission. Over 90% of the legends included in this analysis contained at least one bias. This is consistent with experimental studies demonstrating superior recall and fidelity of transmission of information that exploit biases for social and ecological information, emotionally arousing content and MCI concepts. They are also in line with studies of traditional folklore suggesting that successful tales and myths frequently reflect these biases (Barrett, Burdett, & Porter, 2009; Norenzayan et al., 2006; Sugiyama, 2001).

Only a small minority of legends were coded as featuring no biases. One possible explanation of this relates to the individual version of a legend which was coded. Any legend, urban or traditional, is likely to exist in multiple versions due to the infidelity of cultural transmission. These versions will vary in content to some degree and some will be more culturally successful than others. The legend given in Example 9, for instance, more commonly ends with the television chef telling the audience at home “Remember you’re alone in the kitchen” or “What they don’t know won’t hurt them”, giving the legend a much more humorous slant. It is likely that when looking at multiple versions of the one legend more versions would exploit at least one bias than none.

2. Which biases are the most important in the transmission of urban legends?

Content which would exploit emotional bias was one of the most frequently coded biases (78%), being found in the majority of legends, with all of the emotions coded characterised by high arousal. This provides good evidence for an emotional content bias in the transmission of narrative. This bias was rarely found on its own (3% of the legends were coded as only featuring emotional bias) suggesting that high emotional content grants a transmission advantage to a narrative but this is mostly in addition to another content bias. The most frequently coded emotion bias was amusement, being coded as present more frequently than both disgust and fear put together. The results suggest that 'funny stories' (Example 1) are found more frequently than 'disgusting stories' (Example 8) or 'scary stories' (Example 7). Eriksson and Coultas (2014) found that participants were more willing to transmit stories which evoked positively valenced emotions, such as amusement, compared to stories which evoked negatively valenced emotions, such as anger, sadness and fear. Based on these results it is feasible that positively valenced narratives may feature a transmission advantage over negatively valenced narratives. Further research examining emotional bias is required to establish if and how it varies between emotions evoked and what effect this has on transmission.

MCI was the least frequent bias, as only 6% of the legends were coded as containing this bias. This was unexpected as traditional folklore and myth commonly features MCI content (Barrett, Burdett, & Porter, 2009; Norenzayan et al., 2006).The number of counterintuitive characters found in each legend is consistent with the cognitive optimum of 1-2 suggested by Barrett, Burdett and Porter (2009), however, with the majority (93%) only featuring one counterintuitive character they generally fall below the cognitive optimum of 2-3 suggested by Norenzayan et al. (2006). Where MCI content is featured it is generally in reference to a ghost (see Example 5). Other, more widely known

urban legends which feature MCI content, such the 'Bloody Mary' or 'Vanishing Hitchhiker' legends, also refer to ghosts or ghost-like figures. References to other MCI characters which are found in traditional folklore, such as talking animals, are apparently non-existent in urban legends. The low frequency of legends containing MCI information could be explained by genre categorisation. Contemporary folklore which features MCI content is usually categorised as 'ghost stories' or cryptozoology and UFO tales rather than urban legends. Another possible explanation could be the relative ages of traditional folklore and urban legends, it is feasible that the MCI urban legends will survive transmission for many years longer than the non-MCI urban legends.

23% of legends were coded as featuring behaviour consistent with cultural stereotypes of race, nationality, gender and region but none were coded as featuring stereotype inconsistent behaviour. This is generally consistent with the literature; Fyock and Stangor (1994) and Clark and Kashima (2007) suggest that SC content has a transmission advantage. Thus the results stand in contrast to Dijksterhuis and van Knippenberg (1995), Macrae, Hewstone, and Griffiths (1993) and Rojahn and Pettigrew (1992) as there was no evidence that SI content would be more frequent than SC content. The nature of stereotype consistent information means that it was never seen in isolation as a bias and has a strong association with social information and the emotion amusement. Example 4 is fairly typical of the legends which featured stereotype consistent content; they were almost consistently 'funny stories' with the amusement being found in cultural stereotypes. Future research needs to examine whether the transmission advantage provided by stereotype consistent content is actually due to the advantage provided by social information and if these two biases can be separated.

Over a quarter of legends were coded as featuring ecological survival information. This provides support for a survival information bias (Nairne & Pandeirada, 2008; Nairne

et al., 2007; Kang et al., 2008; Otgaar et al., 2010; Weinstein et al., 2008) and data on the oral narratives of foraging peoples (Sugiyama, 2001).The consistency with the latter is noteworthy, given the radical differences in the contexts of transmission. One might expect ecological information to be less salient to post-industrial populations than to foragers, who depend on detailed knowledge of their environments to survive. However, the popularity of urban legends concerned with health risks and environmental hazards, such as food contamination (e.g. the 'Razor blade in the apple' and 'Kentucky fried rat' legends discussed above) suggests that ecological survival bias still plays an important role in the spread and persistence of narratives in the modern world. In most cases, it seems unlikely that the legends actually contain useful survival-relevant information. Example 3, for instance, could be seen as a serious warning against having a lollypop in your mouth while driving, but such a cause of death would seem to be too random and improbable to be taken seriously by sweet-toothed road users. On the other hand, legends such as the 'razor blade in the apple' did affect behaviour on a wide scale (despite its false premises). In both cases, the successful transmission of the legend would appear to be based more on our susceptibility to information about survival, rather than the usefulness of the information itself.

Over three quarters of urban legends contain social information, a finding consistent with experimental studies (Mesoudi, Whiten & Dunbar, 2006). This is a far greater than the number of legends containing ecological survival information. Social information bias was the bias most frequently coded as the sole bias in a narrative (9% of the legends were coded as only featuring social bias), suggesting that a social information bias provides enough of an advantage alone for transmission success. Celebrities (such as Elvis and Priscilla Presley in Example 2) were sometimes featured in legends containing social information, perhaps because they represent people that a large number of people are familiar with and therefore provide relevant social information to a wide audience.

One of the more unexpected results of Mesoudi, Whiten and Dunbar (2006) was that social non-gossip was transmitted just as well as gossip, suggesting that the intensity of social relationships described in the information has no effect on the fidelity of transmission but what is important is some form of third party interaction. A similar result was found in the current study as the social sub-category (which featured the same definition as Mesoudi et al.'s social non-gossip) was coded as present more frequently than the social gossip sub-category. This result is consistent with the expectation that gossip would not be more frequent than social non-gossip. In general, these results are consistent with the predictions based on the *Machiavellian Intelligence* or *Social Brain* hypotheses and suggest that humans are highly susceptible to narratives featuring social information content.

3. **When content biases are present in legends do they tend to occur individually or in combination with other biases? If so, which combinations are common and which rare?**

The majority of legends were coded as featuring more than one bias (see Figure 1), suggesting that exploiting multiple biases provides a greater transmission advantage to a narrative. In the majority of legends, however, a combination of two biases was the highest number featured, suggesting an optimum number of biases to be combined for a transmission advantage. One possible explanation for this is that biases are exploited by content and that with more biases there would be more content which could make the narrative overly complex and unmemorable. Another possible explanation is that different biases may conflict with each other, making the narrative nonsensical or unappealing. As Upal (2011) has suggested, with counterintuitive characters in a narrative, the legend must remain coherent to be memorable so there is likely to be a limit to the amount of biased content which can be included before the narrative loses coherence. Multiple biases

appearing together is also seen in model-based biases (Wood, Kendal, & Flynn, 2013).In this case children have been shown to calibrate across multiple model-based biases and certain biases will dominate over others. Content biases could function in a similar way, with certain biases granting a greater transmission advantage than others. Seeing which biases are combined and the frequency of their combination with other biases could suggest the relative strength of a bias in transmission.

Social information was by far the most frequent single bias, suggesting it provides enough of a transmission advantage in itself. Other biases were also frequently combined with social information. As yet research into content biases has focused on a single bias, future research should examine how bias combination can affect the transmission of a narrative and to what extent this increases the transmission advantage. The most frequent combinations suggest certain common 'story types' which are culturally successful. The most common 'story type' among the legends collected for this study was the 'funny story'; these legends combined social information and amusement. Generally the amusement would be generated by the social interaction (see Example 6). Another 'story type' would be the 'scary story' or 'warning' (see Example 7), combining survival information and fear and structured as a warning against certain behaviour. 'Scary' legends frequently emphasise the truth of the information and often urge the receiver to transmit the content (as in Example 7). Another common 'story type' that could be viewed as the stereotypical urban legend is the 'disgusting story' (see Example 8) which combines disgust and survival information. Example 8 is a version of the 'Kentucky fried rat' legend, which has proved to highly successful in cultural transmission (Fine, 1980). Its success could be explained by the fact that it exploits two cognitive biases, both survival information bias and emotional content bias. These different story types suggest that some biases may complement each other and generate a greater transmission advantage and therefore be frequently found together

Another question that arises from legends featuring multiple biases is: are the biases all contributing to a transmission advantage or is some biased content 'riding' on the transmission advantage of another? For example, the majority of survival information was coded as high survival (information relevant to serious injury or death) so feasibly the cultural success of urban legends which feature survival content owe their success to also exploiting emotional biases such as fear or disgust (77% of legends which were coded as featuring high survival information were also coded as evoking fear or disgust) rather than combining survival information and emotional content. Stubbersfield, Tehrani and Flynn (under review c, presented in Chapter 5) found that survival information granted less of an advantage along a transmission chain compared to social information and that urban legends which combined social information and survival information did not significantly differ in transmission fidelity from legends which just featured social information. These results suggest that the prevalence of threats and hazards found in urban legends may be due to their combination with social information bias or emotional bias, rather than a strong susceptibility to survival-related content per se.

The assumption of content biases is that they exploit shared cognitive dispositions towards certain properties of cultural items. A criticism of this is that the majority of the research examining content biases has used participants from nations described by Henrich, Heine and Norenzayan (2010a) as western, educated, industrialised, rich and democratic (WEIRD). People from WEIRD nations represent only 12% of the world's population and are thought to be psychologically unusual (Arnett, 2008; Henrich, Heine & Norenzaya, 2010b). As such the results of such studies may not be generalisable to humans as a whole. The urban legends presented here are collected from western, English-speaking countries and as such may only reflect the content biases of people from WEIRD nations. There is evidence, however, to suggest that the same content biases are present in the folklore of non-WEIRD nations. Studies have found evidence for content biases using

traditional, pre-industrial folklore such as fairy tales (Barrett, Burdett, & Porter, 2009; Norenzayan et al., 2006) and, as discussed above, the oral narratives of foraging people can be seen to contain information relevant to survival and social interaction (Sugiyama, 2001). Some of the *Setsuwa bungaku* (tale literature) of Japan's Kamakura period (1185-1333) frequently feature motifs related to survival information (i.e. food contamination stories or tales of unpleasant death) and social information (i.e. tales involving social interaction and social embarrassment) which bear striking similarities to contemporary, Western urban legends (Schaefer, 1990). Given the presence of biased content in this diverse, international range of folklore it is plausible to suggest that content biases (or some of them at least) are shared universally, however, the relative frequencies examined here may vary significantly. For instance, social information is likely to be particularly salient cross-culturally, as humans live in social groups, but the frequency of survival information found in folklore may vary on how dangerous the ecological environment is, or how reliant on the local ecological environment one is for food. The relative frequency of other biases may also vary depending on the environment. As such the relative frequencies found here may not necessarily be found in non-WEIRD folklore. Examining how the relative frequency of content biases is reflected in folklore cross-culturally presents an interesting avenue for future research and would go towards examining how truly universal these biases are.

Conclusions

In sum, this study has found compelling evidence that the popularity and longevity of urban legends can be explained, at least in part, by cognitive dispositions to learn and transmit certain kinds of information. Following Sperber (1996), I have argued that although it is likely that most of these dispositions were selected for in our evolutionary past, they make us susceptible to narratives that may have no adaptive value in themselves,

such as urban legends. Evidence was found for all of the content biases which have been suggested by experimental research, with the exception of stereotype inconsistent content. The distributions of content biases suggest humans are especially susceptible to narratives containing social information, which was found in the majority of legends. This finding supports the hypothesis that human cognition was shaped to a greater degree by selective pressures from the social environment than the natural environment. The results further suggest that combining biases together in a single narrative could confer a greater transmission advantage than a single bias alone, although further research needs to be conducted to examine how biases can combine and the effects of this on transmission. Last of all, I emphasise that in discussing 'susceptibilities' I eschew any pejorative implications associated with the term. Occasionally urban legends may be harmful, but on the whole they are entertaining and fun (as evidenced by the frequency of amusing themes). Sometimes they may even be therapeutic, providing ways of making sense of a frightening or unpredictable world, as proponents of the symbolic interactionist school have emphasised. But above all, urban legends are catchy, and by investigating the underlying psychological factors that make them so, I have sought to demonstrate the value of an epidemiological approach to cultural phenomena.

References

Allport, G.W., & Postman, L. (1947).*The Psychology of Rumor*. New York: Holt, Rinehard and Winston.

Arnett, J. J. (2008). The neglected 95%: why American psychology needs to become less American. *American Psychologist*, 63, 602.

Atran, S., & Norenzayan, A. (2004). Religion's evolutionary landscape: Counterintuition, commitment, compassion, communion. *Behavioral and Brain Sciences*, 27, 713–770.

Bangerter, A. (2000). Transformation between scientific and social representations of conception: The method of serial reproduction. *British Journal of Psychology*, 97, 405-423.

Barrett, J.L. (2000). Exploring the natural foundations of religion.*Trends in Cognitive Sciences*, 4, 29-34.

Barrett, J.L. (2008). Coding and quantifying counterintuitiveness in religious concepts: Theoretical and methodological reflections. *Method and Theory in the Study of Religion*, 20, 308-338.

Barrett, J.L., Burdett, E.R., & Porter, T.J. (2009).Counterintuitiveness in folktales: Finding the cognitive optimum. *Journal of Cognition and Culture*, 9, 271-287.

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

Bartlett, F.C. (1932). *Remembering*. Oxford, UK: Macmillan.

Berger, J., & Milkman, K. (2010).Social transmission, emotion, and the virality of online content.*Wharton Research Paper*.

Best, J. (1990).*Threatened Children: Rhetoric and Concern About Child Victims*. Chicago: University of Chicago Press.

Best, J., & Horiuchi, G.T. (1985). The razor blade in the apple: The social construction of urban legends. *Social Problems*, 32, 488-499.

Biesele, M. (1978). Sapience and scarce resources: Communication systems of the !Kung and other foragers. *Social Science Information*, 17, 921-947.

Biesele, M. (1993).*Women Like Meat: The Folklore and Foraging Ideology of the Kalahari Ju/'hoan.* Bloomington: Indiana University Press.

Blanks, J. (Director), Matthews, G., McDonnell, M. & Monitz, N.H. (Producers). (1998). *Urban Legend* [Motion Picture]. United States: TriStar Pictures.

Boyer, P. (1994). *The Naturalness of Religious Ideas: A Cognitive Theory of Religion*. Berkeley, CA: University of California 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.

Brunvard, J.H. (1981). *The Vanishing Hitchhiker*. New York: Norton.

Brunvand, J.H. (2000). *The Truth Never Stands in the Way of a Good Story*. Chicago: University of Illinois Press.

Burling, R. (1993). Primate calls, human language, and nonverbal communication. *Current Anthropology*, 34, 25-53.

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

Chinese restaurant bankruptcy fear after false dog meat rumour. (2011). *Telegraph Online*. Retrieved from http://www.telegraph.co.uk/foodanddrink/8824481/Chinese-restaurant-bankruptcy-fear-after-false-dog-meat-rumour.html.

Claidière, N., & Sperber, D. (2007).The role of attraction in cultural evolution.*Journal of Cognition and Culture*, 7, 89-111.

Clark, A.E., & Kashima, Y. (2007). Stereotypes help people connect with others in the community: A situated functional analysis of the stereotype consistency bias in communication. *Journal of Personality and Social Psychology*, 93, 1028-1039.

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

Dijksterhuis, A., & van Knippenberg, A. (1995). Memory for stereotype-consistent and stereotype-inconsistent information as a function of processing pace.*European Journal of Social Psychology*, 25, 689-693.

Dunbar, R.I.M. (1993). Coevolution of neocortical size, group size and language.*Behavioural and Brain Sciences*, 16, 681-735.

Dunbar, R.I.M. (1998). The social brain hypothesis.*Evolutionary Anthropology*, 6, 178-190.

Dunbar, R. I. M. (2003). The social brain: Mind, language, and society in evolutionary perspective. *Annual Review of Anthropology*, 32, 163–181.

Dundes, A. (1971). On the psychology of legend. In W.D. Hand (Ed.), *American Folk Legend* (pp. 21-22.). Los Angeles: University of California Press.

Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion*, 6, 169-200.

Ekman, P. (1999). Basic emotions. In T. Dalgleish & M. Power (Eds.), *Handbook of Cognition and Emotion* (pp. 45-60). Sussex: John Wiley & Sons, Ltd.

Ellis, B. (1983). De Legendis Urbis: Modern legends in ancient Rome. *Journal of American Folklore*, 96, 200-208.

Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14, 1-26.

Fessler, D. M., Pisor, A. C., & Navarrete, C. D. (2014). Negatively-biased credulity and the cultural evolution of beliefs. *PloS one*, 9, e95167.

Fine, G.A. (1979). Cokelore and Coke law: Urban belief tales and the problem of multiple origins. *Journal of American Folklore*, 92, 477-482.

Fine, G.A. (1980). The Kentucky Fried Rat: Legends and modern society. *Journal of the Folklore Institute*, 17, 222-243.

Fox Tree, J.E., & Weldon, M.S. (2007).Retelling urban legends.*The American Journal of Psychology*, 120, 459-476.

Fyock, J., & Stangor, C. (1994). The role of memory biases in stereotype maintenance. *British Journal of Social Psychology*, 33, 331-343.

Gervais, M., & Wilson, D. S. (2005). The evolution and functions of laughter and humor: A synthetic approach. *The Quarterly Review of Biology*, 80, 395-430.

Goodwin, G. (1939). Myths and tales of the White Mountain Apache. In: *Memoirs of the American Folk-Lore Society, vol. XXXIII* (pp. 1-223). New York: J. J. Augustin.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010a). Most people are not WEIRD. *Nature*, 466, 29-29.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010b). The weirdest people in the world?. *Behavioral and brain sciences*, 33, 61-83.

Kang, S., McDermott, K. B., & Cohen, S. (2008). The mnemonic advantage of processing fitness-relevant information.*Memory and Cognition*, 36, 1151-1156.

Kapferer, J-N. (1990). *Rumors: Uses, Interpretations, and Images*. New Brunswick, N.J.: Transaction Publishers.

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

LaBar, K.S., & Cabeza, R. (2006). Cognitive neuroscience of emotional memory. *Nature Reviews Neuroscience*, 7, 54-64.

Macrae, C.N., Hewstone, M., & Griffiths, R.J. (1993). Processing load and memory for stereotype-based information. *European Journal of Social Psychology*, 23, 77-87.

MacGhee, P. E. (1979). *Humor: Its origin and development*. San Francisco, CA: WH Freeman and Company.

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

McNamara, P. (2009, April 13). Fact-checking the fact-checkers: Snopes.com gets an 'A' [Web log post]. Retrieved 30 July, 2014, from http://www.networkworld.com.

Meagher, M.W., Arnau, R.C., & Rhudy, J.L. (2001). Pain and emotion: Effects of affective picture modulation. *Psychosomatic Medicine*, 63, 79-90.

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

Mullen , P.B. (1972). Modern legend and rumor theory.*Journal of the Folklore Institute*, 9, 95.

Nairne, J.S. (2010). Adaptive memory: Evolutionary constraints on remembering. *Psychology of Learning and Motivation*, 53, 1-32.

Nairne, J.S., and Pandeirada, J.N.S. (2008). Adaptive memory: Is survival processing special? *Journal of Memory and Language*, 59, 377-385.

Nairne, J.S., Pandeirada, J.N.S., & Thompson, S.R. (2008). Adaptive memory: The comparative value of survival processing. *Psychological Science*, 19, 176-180.

Nairne, J.S., Thompson, S.R., & Pandeirada, J.N.S. (2007). Adaptive memory: Survival processing enhances retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33, 263-273.

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

Otgaar, H., Smeets, T., & van Bergen, S. (2010). Picturing survival memories: Enhanced memory after fitness-relevant processing occurs for verbal and visual stimuli. *Memory and Cognition*, 38, 23–28.

Panksepp, J., & Burgdorf, J. (2003). "Laughing" rats and the evolutionary antecedents of human joy? *Physiology & Behavior*, 79, 533-547.

Provine, R. R. (2001). *Laughter: A scientific investigation*. London: Penguin.

QSR International.(2012). Nvivo 10 [Computer software].Available from http://www.qsrinternational.com.

Rojahn, K., & Pettigrew, T.F. (1992). Memory of schema-relevent information: A meta-analytic resolution. *British Journal of Social Psychology*, 31, 81-109.

Rose, B. (Director), Barker, C., & Golin, S. (Producers). (1992). *Candyman* [Motion picture]. United States: Propaganda Films.

Ruch , W. (1993). Exhilaration and humor. In M. Lewis and J.M. Haviland (Eds.), *Handbook of Emotions* (pp. 605-616). New York: Guilford Press.

Russell, J.A., & Mehrabian, A. (1974).Distinguishing anger and anxiety in terms of emotional response factions.*Journal of Consulting Clinical Psychology*, 42, 79-83.

Schaefer, D. (1990). *Urban legends and the Japanese tale*. Tumbridge Wells: Institute for Cultural Research.

Seipp, C. (2004). Where urban legends fall.*National Review Online*, 21 July, viewed 19 April 2011, http://www.nationalreview.com/articles/211560/where-urban-legends-fall/catherine-seipp/.

Shibutani, T. (1966).*Improvised News: A Sociological Study of Rumor*. New York: Bobbs-Merrill.

Simpson, J. (1981). Rationalized motifs in urban legends.*Folklore*, 92, 203-207.

Sperber, D. (1985). *On Anthropological Knowledge*. Cambridge: Cambridge University Press.

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

Sperber, D. & Hirschfeld, L. (2004). The cognitive foundations of cultural stability and diversity. *TRENDS in Cognitive Science* 8(1): 40-46

Stubbersfield, J. & Tehrani, J. (2013). Expect the unexpected? Testing for minimally counterintuitive (MCI) bias in the transmission of contemporary legends: A computational phylogenetic approach. *Social Science Computer Review*, 31, 90-102.

Stubbersfield, J.M., Tehrani, J.J, & Flynn E.G. (under review c). Serial killers, spiders and cybersex: social and survival information bias in the transmission of urban legends. *British Journal of Psychology*.

Sugiyama, M.S. (2001). Food, foragers, and folklore: The role of narrative in human subsistence. *Evolution and Human Behaviour*, 22, 221-240.

Tangherlini, T.R. (1990). "It happened not too far from here...": A survey of legend theory and characterization. *Western Folklore*, 49, 371-390.

Upal, M.A. (2011). Memory, mystery and coherence: Does the presence of 2-3 counterintuitive concepts predict cultural success of a narrative? *Journal of Cognition and Culture*, 11, 23-48.

Upal, M.A., Gonce, L.O., Tweney, R.D., & Slone, D.J. (2007). Contextualising counterintuitiveness: How context affects comprehension and memorability of counterintuitive concepts. *Cognitive Science*, 31, 415-439.

Victor, J. (1990). Satanic cult rumors as contemporary legend. *Western Folklore,* 49, 51-81.

Warren, R. (1972). *The Community in America*. Chicago: Rand McNally.

Weinstein, Y., Bugg, J. M., & Roediger, H. L. (2008). Can the survival recall advantage be explained by basic memory processes? *Memory and Cognition*, 36, 913–919.

Whitehouse, H. (2004) *Modes of Religiosity: A Cognitive Theory of Religious Transmission*. Walnut Creek: Alta Mira.

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.

Wood, L. A., Kendal, R. L., & Flynn, E. G. (2013). Whom do children copy? Model-based biases in social learning. *Developmental Review*, 33, 341-356.

Chapter 3

Experimental Material and Rating Content Biases

This chapter presents a study which involved rating urban legends on scales related to their content in order to generate material for future experiments. A version of this chapter has been published as Stubbersfield, J. M[1, 2]., Tehrani, J. J[1]., & Flynn, E. G[2]. (2014). Serial killers, spiders and cybersex: Social and survival information bias in the transmission of urban legends. *British Journal of Psychology*, DOI: 10.1111/bjop.12073.

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Abstract

The experimental material used in studies examining content biases has varied considerably, ranging from word lists specifically created for the experiment to naturally occurring stories with a longstanding oral history. The narratives used range from stories that people would be unlikely to transmit in a natural setting to stories which are likely to be still actively transmitted today. The aim of this study is to collect ratings based on content biases for a number of urban legends so that some of these legends can be used in future experiments examining these biases. A questionnaire is used to collect the ratings and the results demonstrate that the urban legends vary significantly in bias-related content. The ratings provided by this study and the analysis of how the legends differ will be used to select legends to be used as material in future experiments.

3.1 Introduction

Research has demonstrated that when material is transmitted from one person to another it is subject to cognitive selection pressures which alter its content and structure (Bartlett, 1932; Barrett & Nyhof, 2001; Mesoudi & Whiten, 2008; Mesoudi, Whiten & Dunbar, 2006; Sperber, 1996). Experimental studies have demonstrated that humans are biased to attend to, recall and transmit certain types of content. A number of 'content biases' have been demonstrated experimentally; these include an ecological survival information bias (Nairne 2010), a social information bias (Mesoudi et al., 2006), an emotional bias (Heath, Bell, & Sternberg, 2001), a minimally counter-intuitive (MCI) bias (Boyer & Ramble, 2001), and a stereotype consistency bias (Kashima, 2000).

The experimental studies which have examined these content biases have used a range of experimental material. In demonstrating survival information bias Nairne and colleagues have used individual recall tests using word lists. For example, Nairne and Pandeirada (2008) used a list of thirty-two words, comprising of eight exemplars from four unique categories: four footed animals, fruits, vegetables and types of human dwelling. Social information bias, however, has mostly been demonstrated using short narratives. Mesoudi et al. (2006) used original paragraphs reflecting four types of information: social gossip, social non-gossip, individual and physical. The social gossip paragraph related a story about a female university student having an affair with her married professor and becoming pregnant. The social non-gossip paragraph described a female student asking a man for directions to a swimming pool. The individual paragraph gave details of a student's everyday life with no social interaction. The physical paragraph related the physical description of a place. These paragraphs were matched for number of words, sentences and propositions and were rated for coherence, familiarity and realism by ten participants. Mesoudi et al.'s material was influenced by material used by Owens, Boyer

and Black (1979). Owens et al. used five written descriptions of a female student involved in five everyday events including making a cup of coffee, going to the doctors or attending a lecture. Participants were given either a social or non-social motivation for the student, with the social motivation being that she had had an affair with her professor. Similar material has also been used by Reysen, Talbert, Dominko, Jones and Kelley (2011), which used narrative paragraphs reflecting a range of social and non-social information including gossip implicit, gossip explicit and non-gossip implicit. Again, stories of a female student having an affair with her male professor were used, as well as stories describing a male student cheating on his girlfriend, people playing tennis, a student meeting Oprah Winfrey and a shoe salesman walking home from work.

A bias for stereotype consistent content has been largely demonstrated using written narratives as experimental material. Bangerter (2000) used a short scientific text describing the conception process. Kashima (2000) used an original short narrative describing a couple's plans to entertain the man's employer by hosting a dinner party. The narrative had the couple displaying both stereotype consistent (SC) and stereotype inconsistent (SI) behaviour. Propositions were classified as plot relevant (central propositions) or background and stereotype relevant or stereotype neutral. Stereotype relevant propositions were then classified as either male SI, male SC, female SC or female SI. Unlike the studies investigating stereotypes in cultural transmission which followed, Allport and Postman (1947) used a picture as the original material, with the serial reproduction being based on participants' recalled description of the picture.

In demonstrating MCI bias, Barrett and Nyhof (2001) followed Bartlett (1932) in using Native American folktales. These stories were deliberately chosen as narratives which would be unfamiliar to the experiment's participants. They also used two original stories, one describing an inter-galactic diplomat's visit to an alien museum and the other

describing a brother and sister's journey from school to home. Both of these stories could be manipulated to alter the number of counterintuitive and intuitive concepts, with the alien exhibits being altered in the alien museum story and items encountered during the journey altered in the brother and sister story. Essentially, these stories function as lists of counterintuitive and intuitive concepts within a narrative framework. Experimental material from Barrett and Nyhof (2001) has also been used as the material for experiments by Boyer and Ramble (2001) and Upal (2005; Upal, Gonce, Tweney, & Slone, 2007). Upal (2011) used three short narratives, matched for word length, with three versions of each story, each version having either one, three or six counterintuitive concepts. Rather than using a narrative form of experimental material, Norenzayan (2006) used lists which varied in the proportion of counterintuitive to intuitive ideas presented.

In demonstrating a bias for content which evokes a higher level of emotion, Heath et al. (2001) used urban legends. As their experiment focused on the emotion of disgust, only urban legends featuring one or more disgust evoking motifs were used. These legends were rated by eight participants on their emotional content and a variety of characteristics such as informational value, plausibility and whether they contained a moral lesson. These urban legends were naturally occurring narratives and, due to the potential for confounding variables between the legends, in a second experiment a sample of twelve legends was manipulated in terms of the level of disgust evoked. Eriksson and Coultas (2014) also used urban legends to examine emotional content bias. In their study four separate, naturally occurring, urban legends were altered into paragraphs of a story about a person travelling and their experiences. Each paragraph was matched for number of sentences and rated for how humorous, surprising, interesting and plausible they were. Different versions of the story were created: high-disgust, low-disgust and social and asocial.

As discussed above, the experimental material used in studies demonstrating content biases are for the most part short narrative passages. These vary from original narratives created for the experiment with a high degree of manipulation, such as the alien museum story (Barrett & Nyhof, 2001), to naturally occurring stories with a longstanding oral history, such as Native American folktales (Barret & Nyhof, 2001). The narratives also range from stories that people would be unlikely to transmit in a natural setting, such as the description of a woman asking for directions to a swimming pool (Mesoudi et al., 2006), to stories which are likely to be actively transmitted today, such as the urban legends used by Heath et al. (2001). For the purposes of the experimental studies examining content biases presented here, it was decided that urban legends would provide excellent experimental material.

The use of urban legends presents several opportunities. The stories themselves are naturally occurring and are actively transmitted between people, as such they provide excellent ecological validity as experimental material. As multiple versions of each story exist they can also be manipulated to a degree while still reflecting the content of a naturally occurring story. Urban legends offer a wide range of readily available stories that exploit all of the biases that have been demonstrated thus far, and as such they can provide excellent material for examining these content biases. In order to provide a greater degree of experimental control, the urban legends used are re-written to match for number of words and number of central propositions (for the purposes of analysis). Here, central propositions are defined as plot-relevant propositions without which the overall legend would either change fundamentally or be rendered incoherent. Other propositions are considered to be those which can be removed without altering the plot. Only central propositions were used so as to avoid legends with more background details appearing to have poorer recall.

The aim of the study presented in this chapter is to rate the legends in various criteria relevant to transmission including ratings on each content bias that has been experimentally demonstrated (with the exception of MCI, the complex nature of defining MCI makes it unsuitable for ratings by naïve participants, although it may be reflected somewhat in the plausibility ratings). These ratings can then be used to select appropriate legends for studies examining content biases and provide information regarding potentially confounding variables between the legends so accurate conclusions can be drawn.

3.2 Methods

Participants

One-hundred-and-six participants (71 females) completed questionnaires. Their ages ranged from 19 to 58 years with a mean age of 23 years (SD = 5.75). The majority (73%) were undergraduate students studying psychology, others were not students and were recruited through opportunity sampling.

Materials

Seventeen urban legends were collected from the *Urban Legend Reference Pages* (www.snopes.com); these were selected based on how they reflected content biases. The legends were re-written to approximately match for word length (88-93 words) and number of central propositions (5-6). Control material was also created; this was adapted from a description of the formation of Cheddar Gorge from *Wikipedia* (http://en.wikipedia.org/wiki/Cheddar_gorge), re-written to match the legends in terms of word length and central propositions (see Appendix A for the full text of these legends and the control material). Questionnaires were created which contained eight questions asking about familiarity with each legend, emotional content, plausibility, survival information, social information and gender stereotypes. The questions were:

- Are you familiar with the story? (This was a multiple choice question. In the case that participants were familiar they were asked further questions related to who they heard it from and how they heard it).
- What emotion or emotions did you feel while reading this story?
- Please rate to what extent you felt each emotion (this questions was answered using a seven-point Likert scale from '1 = very little' to '7 = very much').
- Please rate to what extent you you believe this story to be plausible (from '1= likely to be true' to '7= very unlikely to have taken place')
- Please rate to what extent the story contains 'information relevant to health and survival' / 'information concerning social interaction or relationships' / 'behaviour stereotypical for either gender' (each of these was answered '1 = very little' to '7 = a lot'.
- Please rate how likely you would be to pass this story on as a true/interesting/funny story (each of these was answered '1 = not likely' to '7 = very likely').

See Appendix B for the full questionnaire. These questions were intended to collect data on potential content biases that the legends may exploit (see Mesoudi & Whiten, 2008). The order of legends presented was counterbalanced so no two participants received the same legends in the same order.

Procedure

Participants were asked to take part in a study regarding the cultural transmission of urban legends. Each participant was presented with a questionnaire and answered questions on three or four legends, or the control material. This number was chosen so as it be practical in terms of participant recruitment while not producing questionnaires that were over-long and would lose the participant's interest. Each of the eight questions was asked for each of the material presented.

3.3 Results

Each legend and the control material received 20 ratings on each scale (see Appendix C for the mean ratings for each legend).

Familiarity

Participants were asked to identify their level of familiarity with the legend, from three options "Yes, I have heard it before," "I have heard a similar story" and "No, I am not at all familiar." 72 of the participants had either heard a legend before or heard a similar story (20% of the legends were rated as heard before or heard similar). Chi-square tests on each legend revealed that significantly more legends were rated as unfamiliar (χ^2_1 = 5 to 16.20, *ps* < .05). The exceptions being four legends where there was no significant difference between the frequency of familiar and unfamiliar ratings. These three legends were "Caller" (9/20 unfamiliar, χ^2_1 = .20, *p* >.05), "Fish" (12/20 unfamiliar, χ^2_1 = .80, *p* >.05), "Spiders" (14/20 unfamiliar, χ^2_1 = .20, *p* >.05) and "Clown" (11/20 unfamiliar, χ^2_1 = .20, *p* >.05). 52 (49%) of the participants were either familiar or had heard similar for at least one of the legends they received.

Content Bias Ratings

Kruskal-Wallis one-way ANOVA tests were conducted to examine the variation in scores between legends. Significant variation between legends was found in emotional content (χ^2_{17} = 43.37, *p* < .001), plausibility (χ^2_{17} = 32.31, *p* < .05), survival information (χ^2_{17} = 101.76, *p* < .0001), social information (χ^2_{17} = 186.77, *p* < .0001) and gender stereotyped behaviour (χ^2_{17} = 126.47, *p* < .0001). Campbell and Skillings (1985) stepwise step-down multiple comparisons (overall error rate controlled at *p* = .05) were used to group the legends into homogenous subsets (see Appendix D for tables showing homogenous subsets for each scale).

There were three subsets with similar emotion scores, with fifteen legends in the highest scoring subset. The legend with the highest mean emotion score was Tumour with a mean of 6.50 and the lowest was the control material with a mean score of 4.70. There were two subsets with similar plausibility scores, with fourteen legends in the highest scoring subset. As the scale used in the plausibility rating ran from 1 being 'likely to be true' to 7 being 'very unlikely to have taken place', a high score here reflects being rated as less plausible. The legend with highest mean plausibility score (the least plausible) was Skin with a mean score of 5.60 and the lowest (most plausible) was Dinner with a mean score of 3.50. There were five subsets with similar survival information scores, with ten legends in the highest scoring subset. The legend with the highest mean survival score was Killer, with a mean score of 5.05 and the lowest was Dinner, with a mean score of 1.80. There were six subsets with similar social information scores, with six legends in the highest scoring subset. The legend with the highest mean social information score was Cybersex, with a mean score of 5.85 and the lowest was the control material, with a mean score of 1.40. There were ten subsets with similar gender stereotype scores, with six legends in the highest scoring subset. The legend with highest mean gender stereotype score was Choke with a mean score of 5.30 and the lowest was the control material, with a mean score of 1.45.

Significant correlations were found between social information score and emotion score ($r_{358} = .17$, $p < .01$) and between social information score and gender stereotype score ($r_{358} = .48$, $p < .01$). No other ratings were significantly correlated ($ps > .05$).

'Pass on' Ratings

'Pass on as true' ratings were found to be significantly correlated with scores for emotion ($r_{358} = .12$, $p < .05$), plausibility ($r_{358} = -.21$, $p < .01$) and survival information ($r_{358} = .21$, $p < .01$). 'Pass on as interesting' ratings were found to be significantly correlated

with scores for emotion (r_{358} = .18, p < .01), survival information (r_{358} = .27, p < .01) and social information (r_{358} = .19, p < .01). 'Pass on as funny' ratings were found to be significantly correlated with scores for plausibility (r_{358} = -.14, p < .01), survival information (r_{358} = -.25, p < .01), social information (r_{358} = .33, p < .01) and stereotype consistent behaviour (r_{358} = .37, p < .01).

Participant Effects

Gender differences in each of the scales for each legend were tested for using Mann-Whitney *U* tests but no significant differences were found (*Us* = 17.5 – 72, *ps* > .05). For most of the legends there were no significant age effects on each scale (*rs* = -.42 to .42, p > .05). Significant age effects were found in the stereotype score of the Tumour legend (r = .44, p < .05), and the social information scores of the Skin legend (r = -.46, p < .05) and the control material (r = .56, p < .05).

3.4 Discussion

The aim of this study was to provide information and ratings for urban legends which could then be used to inform the selection of these legends for future experiments. Each urban legend received twenty ratings on a number of scales related to content which has been demonstrated to influence transmission. These ratings can then be used to select which of the urban legends are suitable to be used as material to examine content biases and can also inform interpretation of the results of these experiments.

Previous research has found that bias exploiting content can increase a participants willingness to pass information on (the 'choose-to-transmit' phase of transmission). As part of this study participants were asked to give each legend a score based on their willingness to pass the story on as interesting, true and funny. These 'pass on' ratings were found to correlate with some of the content bias-related scores. Legends which scored high

for emotion were more likely to be passed on as true or interesting. The range of emotions evoked by the legends is likely to have prevented this score from correlating with 'pass on as funny'. This finding supports Heath et al. (2001) and Eriksson and Coultas (2014) who found that urban legends which evoked high emotion levels had an advantage at the 'choose-to-transmit' phase of transmission. Legends which were rated as more plausible were more likely to be passed on as true or funny; this supports Heath et al. (2001) who found plausibility to be a significant predictor of participants' willingness to pass a story on. The finding that social information and stereotype consistency were correlated with the pass on as funny scores is consistent with the association between both of these biases and the emotion of amusement found by Stubbersfield, Tehrani and Flynn (under review a, presented in Chapter 2).

Familiarity with the legends was thought to be potentially influential in how participants recall the legends in a linear transmission chain. As such, one of the questions asked if participants were familiar with the legends. The majority (80%) of urban legends had not been seen before by participants, with only a small number (6.9%) having been heard before. For most of the legends significantly more participants were unfamiliar with the legends than familiar. For the legends which were most familiar to participants, the difference was not significant. No legend was found to be significantly more familiar than unfamiliar, suggesting that the legends were suitable to be used as experimental material.

In order for the legends to be used as material for experiments examining content biases it is necessary that they significantly vary in content related to these biases. This was found to be the case. Of the potential content biases suggested by previous research (see Mesoudi & Whiten, 2008), there was evidence for all such biases across the legends with significantly high ratings in emotional content, survival information, social information and stereotyped behaviour. Significant correlations were found between social information

and emotional content and between social information and gender stereotyped behaviour content, suggesting that these biases may often be found together in urban legends. This is supported by an analysis of the biases present in urban legends (Stubbersfield et al., under review a, presented in Chapter 2). Equally, gender stereotyped behaviour is unlikely to appear without social information as it will often require some form of human interaction. Of particular relevance to one of the studies presented here in Chapter 5, urban legends can be seen to feature content which would exploit a bias for social information and content which would exploit a bias for survival information. The results also provide information which can then be controlled for in future studies, such as the degree to which they contain gender stereotyped behaviour. These results further support the argument that urban legends provide a fruitful avenue for research into the effects of content biases on the cultural transmission and evolution of narratives as they are shown to exploit these biases.

References

Allport, G.W., & Postman, L. (1947).*The Psychology of Rumor*. New York: Holt, Rinehard and Winston.

Bangerter, A. (2000). Transformation between scientific and social representations of conception: The method of serial reproduction. *British Journal of Psychology*, 97, 405-423.

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

Bartlett, F.C. (1932). *Remembering*. Oxford, UK: Macmillan.

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

Campbell, G., & Skillings, J. H. (1985). Nonparametric stepwise multiple comparison procedures. *Journal of the American Statistical Association*, 80, 998-1003.

Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14, 1-26.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

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

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.

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

Nairne, J.S. (2010). Adaptive memory: Evolutionary constraints on remembering. *Psychology of Learning and Motivation*, 53, 1-32.

Nairne, J.S., & Pandeirada, J.N.S. (2008). Adaptive memory: Is survival processing special? *Journal of Memory and Language*, 59, 377-385.

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

Reysen, M. B., Talbert, N. G., Dominko, M., Jones, A. N., & Kelley, M. R. (2011). The effects of collaboration on recall of social information. *British Journal of Psychology*, *102*, 646-661.

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

Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (under review a). Santa Crucified and Death by Lollypop: Culture, Cognition and the Epidemiology of Urban Legends. *Current Anthropology*.

Upal, M. A. (2005). Simulating the emergence of new religious movements. *Journal of Artificial Societies and Social Simulation*, 8.

Upal, M.A. (2011). Memory, mystery and coherence: Does the presence of 2-3 counterintuitive concepts predict cultural success of a narrative? *Journal of Cognition and Culture*, 11, 23-48.

Upal, M.A., Gonce, L.O., Tweney, R.D., & Slone, D.J. (2007). Contextualising counterintuitiveness: How context affects comprehension and memorability of counterintuitive concepts. *Cognitive Science*, 31, 415-439.

Chapter 4

Chicken Tumours and a Fishy Revenge: Evidence for Emotional Content Bias in the Cumulative Recall of Urban Legends

This chapter presents a study examining emotional content bias in the cumulative recall of urban legends. A version of this chapter has undergone one round of peer-review in *Evolution and Human Behaviour*. The authorship will be as follows: Joseph M. Stubbersfield[1 2], Jamshid J. Tehrani[1] and Emma G. Flynn[2]

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Abstract

This study used urban legends to examine the effects of a cognitive bias for content which evokes higher levels of emotion on cumulative recall. As with previous research into content biases, a linear transmission chain design was used. One-hundred and twenty participants, aged 16-52, were asked to read and then recall urban legends that provoked both high levels and low levels of emotion and were both positively and negatively valenced. The product of this recall was presented to the next participant in a chain of three generations. A significant effect of emotion level on transmission fidelity was found with high emotion legends being recalled with significantly greater accuracy than low emotion legends. The emotional valence of a legend was found not to have any effect on cumulative recall; thus emotional biases in recall go beyond disgust and can incorporate other emotions such as amusement, interest and surprise. This study is the first to examine an emotion bias in cultural transmission as a general phenomenon without focusing on the emotion of disgust.

4.1 Introduction

Recently researchers have convincingly argued that the ability to acquire and transmit knowledge through social learning has been a powerful selective force in the evolution of human cognition (Hermann, Call, Hernández-Lloreda, Hare, & Tomasello, 2007; van Schaik & Burkart, 2011; Richerson & Boyd, 2005). Reciprocally, it has been suggested that the ways in which information is processed and stored in the brain have a strong influence over the selection and modification of cultural traits that get passed on from person to person (Claidière & Sperber, 2007; Mesoudi & Whiten, 2008; Sperber, 1996). The positive influence of emotional arousal on the encoding and retrieval of memories in individual memory tests is well established (LaBar & Cabeza, 2006) but how this mnemonic advantage may translate to a content bias for emotional content in cultural transmission has received relatively little attention.

With regards to the effects of emotion on cultural transmission, previous research has focused on its influence on people's willingness to pass a story on (in Eriksson and Coultas' [2014] three phases of transmission, the stage defined by an individual's willingness to pass cultural information on is the 'choose-to-transmit' phase. The other two phases are 'choose-to-receive', based on an individual's willingness to receive cultural information and 'encode-and-retrieve', based on an individual's ability to encode the information to memory and later retrieve it). Heath, Bell and Sternberg (2001) propose that cultural items such as narratives undergo 'emotional selection', whereby concepts that trigger a stronger emotional response are positively selected for. To test this hypothesis they conducted two studies using urban legends, focusing on the emotion of disgust. In their first study Heath et al. (2001) asked participants to read urban legends and to rate them for emotional, informational and story characteristics such as plot, characters, morals, practical information and plausibility, as well as their willingness to pass the story along to others. It was found that, while informational characteristics such as plausibility, were

important in the likelihood of passing on a legend, legends were also more likely to be passed on if they elicited a greater level of disgust. In a second study, when the number and level of disgust evoking motifs in a legend were manipulated, participants preferred, and were more likely to pass on, legends which produced the highest level of disgust despite the fact that these stories were also less plausible and featured higher mean levels of other negative emotions such as anger and sadness. Heath et al. (2001) also found that urban legends which featured a greater number of disgust evoking motifs were more widely distributed on urban legend websites. They argue that urban legends are transmitted and retained in the social environment due to a positive selection for narratives that evoke stronger levels of emotion in general.

Another study by Peters, Kashima and Clark (2009) examined the effect of emotionality on the dissemination of social information. Participants were asked to read anecdotes then complete a questionnaire on how likely they would be to tell this anecdote to an unspecified audience, an audience of friends or an audience of strangers. They found that anecdotes which evoked medium to high levels of emotion were more likely to be passed on than anecdotes which evoked lower levels of emotion. Participants were also significantly more willing to pass on anecdotes which evoked interest, disgust and happiness than sadness, fear and contempt to all three types of audience.

Other research suggests that it is the features of emotions rather than individual emotions themselves which enhances transmission. Berger and Milkman (2010) conducted an empirical analysis of 6,956 articles published over three months on the *New York Times* website. When controlling for external drivers of attention (position on the website etc.) and the emotions of surprise and interest, they found that articles which aroused emotions characterised by high arousal, such as anger, anxiety and awe were more likely to be forwarded via email than articles which evoked emotions characterised by low arousal,

such as sadness. A survey of *New York Times* readers about their most recently shared article supported this finding (Berger & Milkman, 2010). No relation was found between disgust and how likely an article was to be shared but they suggest that this result is likely to be due to few of the news articles eliciting this emotion. Berger (2011) argues that this increased transmission is driven by the mobilising effect of an excitatory state and found a similar effect even when the arousal was incidental to the material being shared. Other studies have similarly found that increased emotional arousal increases the amount of sharing of information by participants (Christophe & Rimé, 1997; Luminet, Bouts, Delie & Manstead, 2000) but have not looked at the specific emotions involved.

Cultural transmission, however, does not just rely on people's willingness to pass a story on; in oral transmission at least, they must also encode and recall it. The cumulative effects of recall will have a particular influence over cultural transmission as only those elements which are preserved will be passed on to the next generation. Eriksson and Coultas (2014) examined the role of cumulative recall in transmission by expanding on Heath at al. (2001). They introduced the concept of three distinct phases of cultural transmission: 'choose-to-receive', 'encode-and-retrieve' and 'choose-to-transmit'. In a number of experiments using urban legends, they demonstrated that content evoking a high degree of disgust had a transmission advantage over content evoking a lower degree of disgust in all three phases. However, when looking at individual differences in willingness to pass along stories they found that positively valenced emotions (amusement, surprise) received higher ratings than negatively valenced emotions (anger, sadness, fear, disgust), suggesting that other emotions, particularly positively valenced ones, may be selected for to an even greater degree than disgust, at least in the 'choose-to-transmit' phase. While this study did demonstrate an advantage in cumulative recall for content which evoked higher levels of emotion (in their 'encode-and-retrieve' phase), like Heath et al (2001) it focused on the emotion of disgust.

The Present Research

As in Heath et al. (2001) and Eriksson and Coultas (2014), real urban legends were used as a means to investigate emotional content biases. The study focused on urban legends because they represent culturally successful narratives from the real world, which are also practical for use in experiments because they are relatively short and self-contained. Successful legends often share a number of features, such as a suspenseful or humorous narrative, which contains surprising information or a twist, a warning or moral message that is either explicit or implied, and they are often attributed to a "friend of a friend" (Brunvand, 2000; Fox Tree & Weldon, 2007).

In contrast to the studies by Heath et al. (2001) and Eriksson and Coultas (2014), emotional content bias is investigated as a general phenomenon, rather than focusing on the single emotion of disgust, and the effects of emotion level on cumulative recall (the 'encode-and-retrieve' phase of transmission) are examined rather than either just the 'choose-to-transmit' phase or all three phases of transmission. Cumulative recall was chosen for examination as this can produce different results from individual recall, for example studies examining stereotype consistency bias have found that stereotype inconsistent (SI) information is recalled better than stereotype consistency (SC) bias at the individual level (Dijksterhuisand & van Knippenberg, 1995; Macrae, Hewstone, & Griffiths, 1993) but in cumulative recall stereotype consistent information is recalled better (Allport & Postman, 1947; Bangerter, 2000). Kashima (2000) found that, when remembering plot-relevant details, participants in earlier positions in a transmission chain recalled SI information better than SC information, however, SC information was retained better than SI information towards the end of the chain.

A transmission chain design is used, in which some form of information is passed from one participant to another in a linear 'chain' (as per the children's game 'Chinese

Whispers'/'Broken Telephone'). Transmission chain experiments are uniquely effective in uncovering content biases in transmission (Mesoudi et al, 2006) and have been used successfully to investigate cognitive content biases, such as minimally counter-intuitive (MCI) bias (Barrett & Nyhof, 2001), a hierarchical bias (Mesoudi & Whiten, 2004), a stereotype consistency bias (Kashima, 2000) and a social information bias (Mesoudi, Whiten & Dunbar, 2006). In order to select appropriate material, seventeen urban legends were selected from the *Urban Legends Reference Pages* (www.snopes.com). The extent to which the legends evoked emotion was then rated by participants on a 7-point scale (see Chapter 3). Four legends were selected, two which scored high for evoking emotion and two which scored low. These legends evoked a range of emotions including disgust and amusement. This experiment aimed to test the hypothesis that emotional content bias is a general phenomenon and that legends that evoke higher levels of emotion will be recalled with higher fidelity along a transmission chain than legends that evoke lower levels of emotion, regardless of the emotion evoked. Individual recall-based experiments have shown a recall advantage for content which evokes high emotion across both positive and negative valences (LaBar & Cabeza, 2006) while transmission-based experiments have found differences between positive and negative valence in certain circumstances (Eriksson & Coultas, 2014; Peters et al., 2009) so here the effect of valence of cumulative recall is also examined.

4.2 Methods

Participants

One-hundred and twenty participants (94 females) took part in. Their ages ranged from 16 to 52 years with a mean age of 20.36 years (SD = 6.34). The majority (92%) were undergraduate students studying psychology, education or recruited through opportunity sampling. Others were prospective students and parents attending a Psychology

Department Open Day; all participants under the age of 18 took part with their parents' consent.

Design

A linear transmission chain design was used. Each individual legend was transmitted along ten chains of three participants or 'generations', totalling forty chains for all four legends. Three generations was judged to be an optimum chain length, capable of capturing long-term cumulative effects of cultural transmission but short enough to be practical in terms of participant recruitment and has been used successfully in previous research (Barrett & Nyhof, 2001; Nielsen, Cucchiaro & Mohamedally, 2012). The first participant in each chain received a selection of legends which were counterbalanced so no legend appeared in the same position more than another legend. The next participant was presented with the material that had been recalled by the previous participant and so on, along the chain.

Material

Before conducting the transmission chain study it was necessary to select appropriate legends. From a selection of seventeen original urban legends edited to match for word count and number of central propositions (presented in Chapter 3), two high emotion legends and two low emotion legends were selected. These legends are presented below:

1. Steroids in chicken cause ovarian cysts (low emotion)

A woman underwent an operation to remove an ovarian cyst but just a few months later she relapsed and was rushed to her gynaecologist. The gynaecologist asked her if she often ate chicken wings, when she said yes he explained that, today, chickens are injected with steroids to accelerate growth. These steroids can have a

terrifying effect on the body and are most dangerous in the presence of female hormones. Exposure to these steroids can lead to women being more prone to the growth of cysts in her womb.

2. Woman has revenge on boyfriend with rotten fish in car (low emotion)

A woman caught her boyfriend with another woman and decided to get revenge. She cut open the passenger seat of his car and hid fish inside before neatly re-stitching along the seam. As the fish rotted his car was filled with a terrible smell that he couldn't get rid of no matter what he did. He had no luck finding a new girlfriend because no woman would set foot in his car. He finally gave up and sold the car at a huge loss because of the horrible smell.

3. Woman eats a tumour in a chicken burger (high emotion)

A woman went into a takeaway and ordered a chicken burger but asked for it without mayonnaise. After leaving the restaurant she bit into the burger and discovered that there was mayonnaise in it after all, but she finished the burger anyway. Later that evening, she checked herself into the local hospital after falling violently ill with food poisoning. Her stomach was pumped and the doctors discovered that the chicken in her burger had contained a tumour and that the sauce wasn't mayonnaise, it was pus from the tumour.

4. Man suffers from flatulence at dinner party hosted by his girlfriend's parents (high emotion)

A man was having dinner with his girlfriend's parents when he was suddenly gripped by terrible flatulence. He excused himself from the table and went in search of a toilet, however, he couldn't find one in time so instead he farted through an open window out of the parent's earshot. Much relieved, he returned to

the table and continued the meal. Later, he asked his girlfriend how the night had gone, expecting a good response, however, she replied "it was going fine until you farted through the serving hatch!"

Table 1 gives further detail about the legends used, such as their valence and the emotions they were said to evoke by participants. The legend selection was informed by questionnaire ratings from 106 participants on scales relevant to potential content biases such emotion, plausibility, survival information, social information and gender stereotyped behaviour. The ratings from this questionnaire allow for comparisons to be made between the legends in terms of content which may influence their recall and transmission. The high emotion legends were rated as evoking higher levels of emotion than the low emotion legends. Of the seventeen legends originally rated, Tumour-HN received the highest rating for emotion and Dinner-HP was ranked 4th, Cyst-LN was ranked 12th and Fish-LP was ranked 16th. For full details about the questionnaire and its results, see Chapter 3.

In order to ensure that level of emotion was driving any differences in transmission of the legends, efforts were made to select legends that did not significantly vary on measures of potentially confounding content biases such as survival information, social information and gender stereotyped behaviour. The selected legends were successfully matched across the measures in most cases but there were some potentially confounding differences in content. Fish-LP and Dinner-HP both differed from Cyst-LN and Tumour-HN in survival information, social information and gender stereotypes but the effect of these differences were taken into account (see Appendix E for the mean differences between legends on these scores).

Table 1. *The legends used in this study with their respective emotion levels, valence, two most frequently evoked emotions and code names.*

Legend	Emotion Level (Mean Score)	Valence	Emotions	Code Name
1. Steroids in chicken cause ovarian cysts	Low (5.5)	Negative*	Interest and Surprise	Cyst-LN
2. Woman has revenge on boyfriend with rotten fish in car.	Low (5)	Positive	Amusement and Interest	Fish-LP
3. Woman eats a tumour in a chicken burger.	High (6.5)	Negative	Disgust and Interest	Tumour-HN
4. Man farts in front of girlfriend's parents at a dinner party.	High (5.8)	Positive	Amusement and Surprise	Dinner-HP

* Although interest and surprise were the most frequently evoked emotions by this legend these can be positive or negative, it also evoked fear, concern and sadness and as such was designated negatively valenced.

Procedure

Participants were asked to take part in a study regarding the cultural transmission of urban legends. Participants were individually presented with the experimental materials on a computer. They were asked to read the material and then, on a new page, type what they remembered of this material. No distracter task was performed and no time limit for recall was set. At no point during the procedure were participants told that the material had come from a previous participant or that their recall would be presented to another participant.

Coding

Following previous studies which used a linear transmission chain design (Bangerter, 2000; Kashima, 2000; Mesoudi, et al., 2006; Mesoudi & Whiten, 2004), a propositional analysis (Kintsch, 1974) was performed on each participant's recall. This involves dividing the text into separate propositions. Only propositions central to the narrative were coded so as to avoid legends with more background details appearing to have poorer recall, as previous research has demonstrated that information relevant to the plot of a narrative is better recalled than background details (Kashima, 1997). This propositional analysis was used to calculate the percentage of original central propositions correctly recalled. Percentages were used instead of total number as the original texts varied between five and six central propositions. No significant difference in the percentage of central propositions recalled was found between legends with five central propositions and legends with six.

To assess coder reliability, an independent coder blind to the study hypothesis coded two chains of each legend (20% of all material). There was a significant correlation between the coding of the independent coder and the original coder ($r_{24} = .88$, $p < .001$).

4.3 Results

A mixed 3x4 analysis of variance (ANOVA) was conducted with generation as a within subjects variable and legend as a between groups variable. There was a significant main effect of generation on the percentage of central propositions recalled ($F_{2, 72} = 38.23$, $p < .001$). Planned contrasts revealed that recall quantity was significantly higher in generation 1 than generation 2 ($F_{1, 36} = 28.62$, $p < .001$) and higher in generation 2 than generation 3 ($F_{1, 36} = 11.38$, $p < .005$).

There was also a significant main effect of legend on the percentage of propositions recalled ($F_{3, 36} = 22.87$, $p < .001$). A Games-Howell *post hoc* test revealed that Tumour-HN and Dinner-HP both had significantly higher recall than Fish-LP and Cyst-LN ($ps \leq .001$). No other significant results were found. Figure 1 shows the pattern of recall for each legend along the chains for each generation

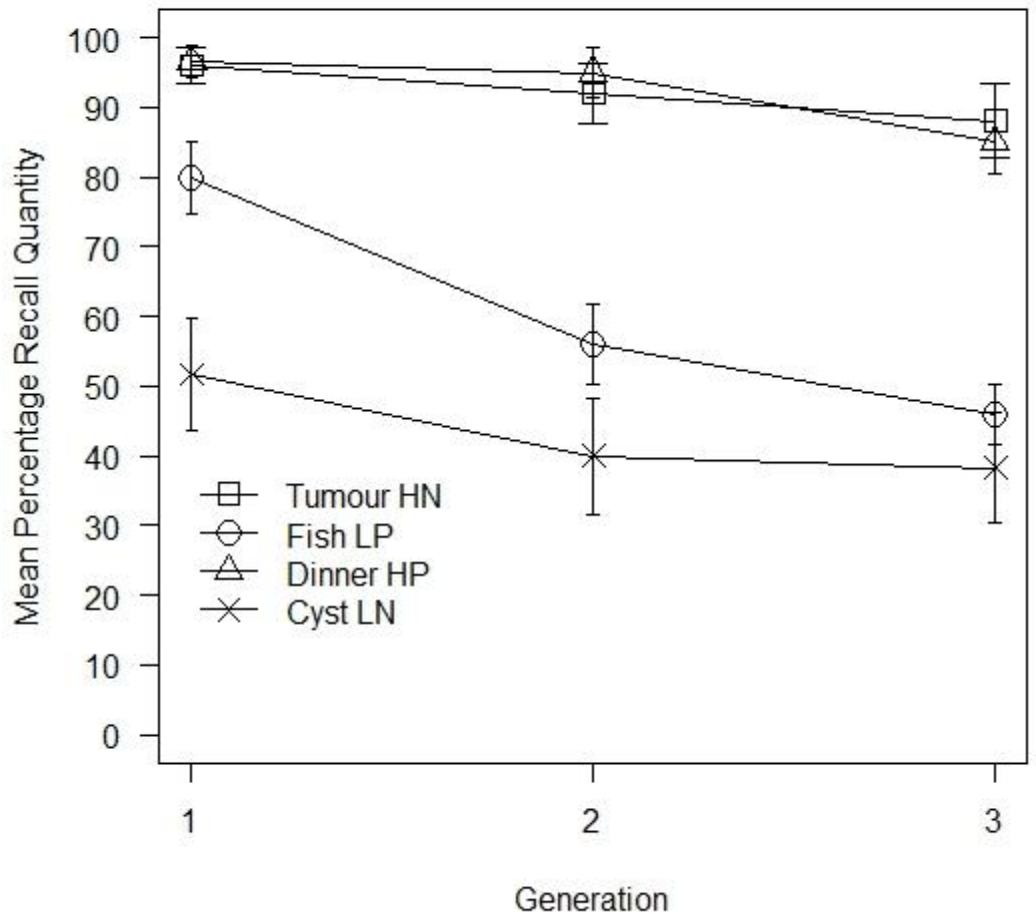

Figure 1. Mean percentage of original central propositions recalled by each generation for each legend used in this study. Letter codes are used to indicate emotion level and valence (corresponding with codes used in the chapter), with H indicating 'high emotion', L indicating 'low emotion', P indicating positive valence and N indicating negative valence. Error bars show standard error.

A second mixed 3x2 ANOVA was conducted with generation as a within subjects variable and degree of emotion evoked (high vs. low) as a between groups variable. This revealed a significant main effect of generation as before ($F_{2, 76} = 33.17$, $p < .001$). Legends which evoked a higher degree of emotion showed a higher level of recall than legends which evoked a lower degree of emotion ($F_{1, 38} = 56.97$, $p < .001$). A third mixed 3x2 ANOVA was conducted with generation as a within subjects variable and emotional valence (positive vs. negative) as a between groups variable but no significant main effect of emotional valence was found ($F_{1, 38} = 1.12$, $p > .05$).

As some of the legends were not matched across potentially confounding content biases it is important to test for any effects this content may have had on recall. No significant correlations were found between the percentage of central propositions recalled and the social information score (M = 3.84, SD = 1.67) or the stereotype score (M = 3.73, SD = 1.15), both tests $p > .05$. However, a significant negative correlation was found between the percentage of central propositions recalled and the survival information score ($r = -.35$, n = 120, $p < .01$). In order to test how much effect the survival information score had on the percentage of central propositions recalled, a multiple regression was run to predict percentage of central propositions recalled from emotion level and survival information score. The regression model significantly predicted recall ($F_{2, 117} = 68.87$, $p < .01$, $R^2 = .54$, adjusted $R^2 = .53$). Emotion level received the strongest weight in the model, explaining 41.6% of the unique variance compared to the survival information score which only predicted 2.79% of the unique variance. No significant age or gender effects were found.

4.4 Discussion

The results of this study show that the urban legends which evoked higher levels of emotion in general were recalled with greater accuracy across a linear transmission chain

than urban legends which evoked lower levels of emotion. This is consistent with previous research, which has demonstrated a cognitive bias for content which evokes higher levels of emotion (Berger & Milkman, 2010; Christophe & Rimé, 1997; Luminet, Bouts, Delie & Manstead, 2000). Importantly, however the emotional valence of an urban legend, positive or negative, was found to have no significant effect on cumulative recall. This is consistent with individual recall experiments where emotional arousal was found to enhance encoding and retrieval across both positive and negative valence (LaBar & Cabeza, 2006). Previous studies have found that participants were more willing to pass on stories which were positively valenced than negatively valenced, with the possible exception of when it is negatively valenced due to disgusting content (Eriksson & Coultas, 2014; Peters et al., 2009). The transmission chain design presented here revealed that positive valence lends no advantage in the encode-and-retrieve phase of transmission, perhaps explaining why negatively valenced legends are so pervasive in the cultural environment. Future research should examine the differing levels of arousal of specific emotions in cultural transmission. If negatively valenced content is more likely to arouse strong emotions it could have an advantage at the encode-and-retrieve phase of transmission. Future research should also focus on the effects of positive or negative valence in the chose-to-receive phase and focus on examining the consumption of negatively valenced material.

Much of the existing research into emotional content bias has focused on disgust (e.g. Eriksson & Coutlas, 2014; Heath et al., 2001; Nichols, 2002). For example, Nichols (2002) found that 16th century etiquette norms which prohibited disgust evoking actions were more likely to survive in the social environment than other etiquette norms. Similarly, Heath et al. (2001) found that participants preferred, and were more likely to pass on, legends which produced the highest level of disgust even though these stories were also less plausible and featured higher mean levels of other negative emotions such as anger and sadness. Heath et al. (2001) also found that urban legends which featured a greater

number of disgust evoking motifs were more widely distributed on urban legend websites. Disgust does make an interesting case study when examining the role of emotional content in the cultural transmission of narrative, largely because of the question: why would people choose to receive or transmit content which is negatively valenced? However, disgust is somewhat uniquely affective as an emotion. It arouses powerful behavioural responses and impacts on human society through our individual moral choices and public policy on issues such as health, justice, social exclusion and warfare (Curtis, 2011). This may make the findings of Nichols (2002) and Heath et al. (2001) more difficult to generalise to an overall bias for emotional content rather than a specific effect of disgust evoking content as it would be reasonable to expect disgust to be uniquely effective in cultural transmission compared to other emotions.

In this study, the emotion of disgust was shown to confer no particular advantage in transmission compared to other emotions at the encode-and-retrieve phase. The legend which featured disgusting content, Tumour-HN, was recalled with equal fidelity to an amusing legend, Dinner-HP, suggesting that the transmission fidelity was driven by the degree of emotion felt rather than the specific emotion evoked. This also suggests that disgust is not special in terms of cultural transmission and supports Heath at al.'s (2001) argument that emotional selection is a general bias. The emotions of interest and surprise were evoked by all the legends used in this study and in previous research they have been shown to grant a transmission advantage and increase the communicability of anecdotes (Peters et al., 2009). Both surprise and interest are unique in that they are fairly neutral in terms of valence but may add more to the effect of a narrative in terms of activation of the autonomic nervous system, a more surprising story would be more arousing and likely to be more memorable or transmissible (Berger, 2011; LaBar & Cabeza, 2006). The results of this study show no particular advantage to surprise or interest as the results were driven more by the degree of emotion evoked rather than specific emotions. Future research could

examine how different emotions combine: do neutrally valenced emotions like surprise bolster other emotions and increase their effectiveness?

Following previous research into emotional bias in cultural transmission (Eriksson & Coultas, 2014; Heath et al, 2001) but unlike previous research examining other biases in cultural transmission that has used original material (i.e. Mesoudi et al., 2006) this study used real urban legends. There are a number of benefits to using 'real world' material in such an experiment but this can come at the cost of full control over the features of the material. In this experiment efforts were made to control for any confounding variables in terms of content. As mentioned in the results section, survival information was found to be negatively correlated with recall. This contradicts previous research which has found an advantage for survival related information in recall (e.g. Nairne 2010; Nairne & Pandeirada, 2008). It is unclear why that would be the case here; one possible explanation is that recall of survival information in a narrative context does not operate in the same manner as word list-based recall. Future research should examine the effects of survival information on cumulative recall. The results of the regression show that the degree to which the legends were rated as containing survival information explained far less of the variance in the percentage of propositions recalled than the emotion level, suggesting that it is correct to attribute the variation in recall to the different levels of emotion.

The results suggest that in general terms, material which evokes greater levels of emotion will be more successful in cultural transmission due to an advantage in cumulative recall. It is expected that, for an urban legend to be successful over other urban legends in the social environment it must evoke a greater degree of emotion. This is supported by a content analysis of 256 urban legends, which found emotional content bias to be one of the most frequently coded biases, being found in the majority of legends, with all of the emotions coded being characterised by high arousal (Stubbersfield, Tehrani & Flynn,

under review a, presented in Chapter 2). Emotional content is clearly a highly effective bias in the cultural transmission of urban legends.

While the aim of this study was to examine emotional content bias as a general phenomenon without focusing on a specific emotion, the range of emotions evoked by the urban legends used was still fairly narrow. The emotions are all characterised by high arousal for example. This is in part due to the use of urban legends as material as these narratives will tend to evoke more arousing emotions than some other narratives. Nevertheless, these results further support the argument that, urban legends provide a fruitful avenue for research into the effects of content biases on the cultural transmission and the evolution of narratives. Emotional content bias is clearly effective in transmission and research should look beyond the emotion of disgust to take into account other emotions and consider if the efficacy of the bias varies between emotions, the study presented here represents a significant step in that direction.

References

Bangerter, A. (2000). Transformation between scientific and social representations of conception: The method of serial reproduction. *British Journal of Psychology*, 97, 405-423.

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

Berger, J. (2011). Arousal increases social transmission of information. *Psychological Science*, 22, 891-893.

Berger, J., & Milkman, K. (2010). Social transmission, emotion, and the virality of online content.*Wharton Research Paper*.

Brunvand, J.H. (2000). *The Truth Never Stands in the Way of a Good Story*. Chicago: University of Illinois Press.

Christophe, V., & Rimé, B. (1997). Exposure to the social sharing of emotion: Emotional impact, listener responses and secondary social sharing. *European Journal of Social Psychology*, 27, 37-54.

Claidière, N., & Sperber, D. (2007). The role of attraction in cultural evolution.*Journal of Cognition and Culture*, 7, 89-111.

Curtis, V. (2011). Why disgust matters. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366, 3478-3490.

Fox Tree, J.E., & Weldon, M.S. (2007). Retelling urban legends. *The American Journal of Psychology*, 120, 459-476.

Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14, 1-26.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

Herrmann, E., Call, J., Hernández-Lloreda, M. V., Hare, B., & Tomasello, M. (2007). Humans have evolved specialized skills of social cognition: the cultural intelligence hypothesis. *Science*, 317, 1360-1366.

Kashima, Y. (1997). Culture, narrative, and human motivation. In D. Munro, J.F. Schumaker, & S.C. Carr (Eds.). *Motivation and Culture* (pp. 16-30). New York: Routledge.

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

Kintsch, W. (1974). *The Representation of Meaning in Memory*. Oxford: Erlbaum.

LaBar, K.S., & Cabeza, R. (2006). Cognitive neuroscience of emotional memory. *Nature Reviews Neuroscience*, 7, 54-64.

Luminet, O., Bouts, P., Delie, F., Manstead, A. S. R., & Rimé, B. (2000). Social sharing of emotion following exposure to a negatively valenced situation. *Cognition & Emotion*, 14, 661–688.

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

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.

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

Nairne, J.S. (2010). Adaptive memory: Evolutionary constraints on remembering. *Psychology of Learning and Motivation*, 53, 1-32.

Nairne, J.S., & Pandeirada, J.N.S. (2008). Adaptive memory: Is survival processing special? *Journal of Memory and Language*, 59, 377-385.

Nichols, S. (2002). On the genealogy of norms: a case for the role of emotion in cultural evolution. *Philosophy of Science*, 69, 234-255.

Nielsen, M., Cucchiaro, J., & Mohamedally, J. (2012). When the transmission of culture is child's play. *PLoS One*, 7, e34066.

Peters, K., Kashima, Y., & Clark, A. (2009). Talking about others: Emotionality and the dissemination of social information. *European Journal of Social Psychology*, 39, 207–222.

Richerson, P. & Boyd, R. (2005). *Not by Genes Alone: How culture transformed human evolution*. Chicago: Chicago University Press.

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

Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (under review a). Santa Crucified and Death by Lollypop: Culture, Cognition and the Epidemiology of Urban Legends. *Current Anthropology*.

Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (under review c). Serial killers, spiders and cybersex: social and survival information bias in the transmission of urban legends. *British Journal of Psychology*.

van Schaik, C. P., & Burkart, J. M. (2011). Social learning and evolution: the cultural intelligence hypothesis. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366, 1008-1016.

Chapter 5

Serial killers, spiders and cybersex: social and survival information bias in the transmission of urban legends.

This chapter presents a study examining social information and survival information bias across three stages of transmission. It also examines the effect on transmission of combining both of these biases. A version of this chapter has undergone two rounds of peer-review in *British Journal of Psychology* as 'Study 2' and 'Study 3' of an article. The authorship will be as follows: Joseph M. Stubbersfield[1 2], Jamshid J. Tehrani[1] and Emma G. Flynn[2]

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Abstract

This study uses urban legends to examine the effects of the social information bias and survival information bias on cultural transmission across three phases of transmission: the choose-to-receive phase, the encode-and-retrieve phase and the choose-to-transmit phase. In line with previous research into content biases, a linear transmission chain design with 60 participants aged 16-52, was used to examine the encode-and-retrieve phase, while participants were asked to rank their interest in reading a story behind a headline and passing a story on for the other two phases. Urban legends which contained social information (Social Type), legends which contained survival information (Survival Type) and legends which contained both forms of information (Combined Type) were all recalled with significantly greater accuracy than control material but Social and Combined Type legends were recalled with significantly greater accuracy than Survival Type legends. In another study with 30 participants aged 18-22, no significant differences were found between legend types in either the choose-to-receive phase or the choose-to-transmit phase.

5.1 Introduction

A growing body of research suggests that when information is transmitted from one person to another, it is subjected to cognitive selection pressures that alter its content and structure to make it maximally transmittable (Bartlett, 1932; Barrett & Nyhof, 2001; Mesoudi & Whiten, 2008; Mesoudi, Whiten & Dunbar, 2006; Sperber, 1996). The extent to which information is transmittable is affected by three factors: its salience (i.e. its ability to attract attention), the accuracy with which it is recalled, and the motivation of adopters to pass it on to others. While the second factor has been studied quite extensively (Bartlett 1932, Mesoudi & Whiten 2008), the first and third have received comparatively little attention (Eriksson & Coultas, 2014). Here, I investigate the impact of cognitive biases in all three phases of cultural transmission, specifically focusing on the roles of social information bias, (Mesoudi et al., 2006), and survival information bias (Nairne & Pandeirada, 2008; Nairne, Thompson & Pandeirada, 2007) in the spread of urban legends.

Survival Information Bias

Nairne and colleagues argue that, as human memory is an evolved trait that must have been shaped by selection pressures to achieve specific fitness-related goals, memory should display functional specialisation (Nairne, 2010; Nairne & Pandeirada, 2008; Nairne, Thompson & Pandeirada, 2007). They argue that human memory is unlikely to have evolved to be domain general, as some information such as the locations of food sources or predators would be more beneficial to remember than random events (Nairne & Pandeirada, 2008). Human memory, therefore, has evolved to be 'tuned' towards encoding and recalling fitness related information better than other forms of information (Nairne & Pandeirada, 2008).

To test this hypothesis Nairne et al. (2007) had participants imagine themselves stranded in a foreign grassland scenario and then rate the relevance of words to finding

food, water and protection from predators, they refer to this as 'survival processing'. Later, surprise free-recall tests revealed an advantage for survival processing. Nairne, Pandeirada and Thompson (2008) also found a similar result, words processed within a survival context (e.g. relating to food and predators) were more likely to be recalled than those same words processed in a non-survival context. Similarly, in Nairne and Pandeirada (2008), participants were asked to make either survival relevant decisions or pleasantness ratings about words in the same categorised list. They found that survival processing produced the best recall in both within- and between-subject designs, despite previous findings suggesting that the pleasantness rating of words in a categorised list is considered one of the best methods for enhancing free-recall (Packman & Battig, 1978). Kang, McDermott and Cohen (2008) found that survival processing produced better recall than a control scenario chosen to match the novelty and potential excitement of the survival scenario.

A number of studies, using a variety of experimental designs and materials, have demonstrated the strong mnemonic advantage that survival processing grants participants compared to other forms of processing and show this effect to be robust in both within- and between-participants designs (Nairne, et al., 2007; Nairne & Pandeirada, 2008, 2010; Kang, et al., 2008; Otgaar, Smeets, & van Bergen, 2010; Weinstein, Bugg, & Roediger, 2008). The recall advantage for ecological survival information found in these studies suggests a potential bias for ecological information relevant to survival in human cultural transmission. Just as they have been used in assessing social information biases, transmission chain experiments can be used to empirically test if the bias for survival information in recall goes beyond the individual and would operate on cultural transmission.

Social Information Bias

The *Machiavellian Intelligence* (Byrne & Whiten, 1988, Whiten 1999) or *Social Brain* (Dunbar, 1998, 2003) hypothesis suggests that primates evolved greater intelligence in order to deal with complex social interactions, rather than to deal with non-social challenges in their ecological environment. These hypotheses oppose an ecological hypothesis of primate intelligence evolution (Clutton-Brock & Harvey, 1980) by emphasising the importance of social interaction. Further, Dunbar's *Social Gossip Theory* (1993) of human language evolution argues that language evolved as a means to maintain social cohesion in the complex social groups which are characteristic of modern humans. Together, the *Machiavellian Intelligence*, *Social Brain* and *Social Gossip Theory* suggest that greater intelligence and language were necessary for tracking social relationships and interactions in complex social groups, and therefore evolved in response to natural selection.

Based on these evolutionary theories, Mesoudi et al. (2006) argue that if human cognition evolved to deal with social relationships and interaction, then humans should preferentially attend to, recall and transmit social information over equivalent non-social information. They empirically tested for this by comparing the transmission of social and equivalent non-social information along linear transmission chains. The transmission chain method, in which some form of information is passed from one participant to another along a 'chain' of individuals, was first developed by Bartlett (1932) and has been used successfully to reveal cumulative and systematic biases in recall that influence cultural transmission and evolution (Mesoudi et al., 2006; Mesoudi & Whiten, 2008). Mesoudi et al. (2006) defind social as information which concerned the interactions and relationships between a number of third parties, while non-social information was defined as a single individual's interactions with the physical environment, or solely concerning the physical

environment. For the purposes of the study social information was divided into two categories: gossip, which involved intense and salient social interactions or relationships, for example an illicit sexual affair, and social non-gossip, which involved 'everyday' interactions and relationships, for example someone receiving directions.

Mesoudi et al. (2006) found that social information was transmitted with greater accuracy and in greater quantity than equivalent non-social information. Perhaps unexpectedly, social non-gossip was transmitted just as well as gossip, suggesting that the intensity of the social relationships described in the information has no effect on the fidelity of transmission; instead what is important is that the information detailed some form of third party interaction. The results were consistent with predictions based on the *Machiavellian Intelligence* or *Social Brain* hypotheses and suggest that humans are cognitively biased towards social information. Mesoudi et al. (2006) argued that this bias for social information explains the nature of some popular media, such as gossip magazines, reality television and tabloid newspapers.

An advantage for social information in transmission was also found by McGuigan and Cubillo (2013). They used an open diffusion paradigm to explore the transmission of social and non-social information within two groups of children aged ten to eleven years. Two children in each group were told one piece of social information and one piece of general knowledge and this information was allowed to naturally diffuse within the group. They found that social information was transmitted more frequently within the group than non-social information. This is supported by the findings of Reysen, Talbert, Dominko, Jones and Kelley (2011) who conducted three experiments exploring the influence of collaboration on memory for social information and found that both individuals and collaborative groups recalled more social information than non-social information.

Despite it not being a focus of their research, Owens, Bower and Black (1979) also found a bias for social information in recall. In their study, participants were asked to read and recall five episodes describing a female student completing everyday events. The experimental group were given a social motive for the student, that she was pregnant by her professor, which connected the five episodes into a narrative. The control group were not provided with this motive, leaving the episodes as independent events. The experimental group recalled significantly more of the five episodes than the control group, suggesting that the social nature of the material given to the experimental group exploited a bias for social information in encoding and recall.

Mar and Oatley (2008) argue that the function of fictional narratives is not merely to entertain but that fiction offers a simulation of social relationships and interactions that can facilitate the communication and understanding of social information. Given this argument, even overtly fictional narratives that feature social interaction should exploit the social bias suggested by Mesoudi et al. (2006) and feature an advantage in transmission and recall.

Social and Survival Biases in Urban Legends

Evidence of social and survival biases can be found in the kinds of stories propagated by the tabloid press and gossip magazines, and in narratives transmitted from person-to-person – most notably in so-called "urban legends". Urban legends, also referred to as 'modern legends' (Mullen, 1972), 'urban belief tales' (Fine, 1979) and 'contemporary legends' (Simpson, 1981) are generally defined as apocryphal stories which are told as true (Brunvand, 2000; Heath, Bell & Sternberg, 2001, Tangherlini, 1990), involve an urban or suburban contemporary setting (Brunvand, 2000), and feature a single event, usually an individual experience, as the core of the narrative (Tangherlini, 1990). Successful legends often share a number of features, such as a suspenseful or humorous narrative (Brunvand,

2000), which contains surprising information or a twist ending (Fox Tree & Weldon, 2007), a warning or moral message that is either explicit or implied, and they are often attributed to a "friend of a friend" (Brunvand, 2000). While they have been traditionally transmitted orally, urban legends are now spread through a combination of oral transmission, electronic communication and publication in mass media (Brunvand, 2000). Traditional, longer forms of oral narrative such as epic ballads or counting-out rhymes often feature mnemonic advantages such as repetition or poetics that enhance recall and lead to less variation between generations (Rubin, 1995). Urban legends, however, rarely feature these elements, meaning they are more subject to the effects of recall. The analysis of urban legends can offer a unique means of studying the concerns of modern populations (Brunvand, 2000) and therefore provide an opportunity to study content biases such as social or survival bias.

A wide range of social information can be found in urban legends. These legends are frequently built around intense social interaction that could easily be defined as gossip, such as the accidental cybersex between a father and daughter, or actual accidental incest in some instances (Brunvand, 1999). Urban legends can also be attached to real people in a manner that clearly acts as gossip, for instance, the legend of a film star having to have a gerbil (or hamster) removed from their rectum (Brunvand, 1986) has been said of several real life film stars over the past thirty years. In these instances the social information contained in the legend would appear to be the sole reason for the legend's success in transmission. Many urban legends also clearly feature ecological survival information. Food contamination is a common feature, whether it is deliberate, such as in the 'Razor blade in the apple' legend (Best & Horiuchi, 1985), or accidental, such as in the 'Kentucky fried rat' legend (Fine, 1980). These food contamination legends are often localised (Fine, 1980) and as such provide survival information directly relevant to the receivers' environments. Violence at the hands of other humans is also a common feature and often

the perpetrators of this violence are from minorities within a society (Ellis, 1983; Victor, 1990), once again providing information directly relevant to the receivers' environments. Unlike the oral narratives of forager populations (discussed by Sugiyama, 2001), these stories are apocryphal and do not contain information that could be used for survival in a modern environment, however, they could still be exploiting a cognitive susceptibility for survival-relevant ecological information. Urban legends frequently exploit more than one content bias and they often feature both social and survival relevant information (Stubbersfield, Tehrani & Flynn, under review a, presented in Chapter 2). An example of this being the common 'gang initiation' legends, where the social context of a violent action is explained, giving the receiver information relevant to their survival within a social context. As yet no studies have examined how different biases interact when combined within a narrative and urban legends offer an excellent means to investigate this.

The Present Research

The studies presented in this chapter use real urban legends, which have been or are actively transmitted between people, as a means to investigate social bias and survival bias. In the first study a linear transmission chain design is used to examine the effects of social information, survival information and combining both types of information on the cultural transmission of an urban legend narrative. These experiments aimed to test the hypothesis that legends containing content relevant to survival and social information biases are transmitted with higher fidelity than control material lacking such content. It was further hypothesised that legends containing both types of content should have an even greater advantage in transmission. The second study goes beyond the 'encode-and-retrieve' phase of transmission tested in the transmission chain to examine the effects of this content on two other phases of transmission: 'choose-to-receive' and 'choose-to-transmit'.

5.2 Study 1

5.2.1 Methods

This study uses the ratings from Chapter 3 to select survival type, social type and combined type legends to be passed along a linear transmission chain. Previous research has successfully used this design to demonstrate a social information bias (Mesoudi, et al., 2006), while individual memory experiments have demonstrated an advantage for survival information in recall (Nairne et al., 2007; Nairne & Pandeirada, 2008). This study makes a direct comparison between both proposed biases and also examines the effects of combining both biases in a single narrative. The primary focus of this study is the potential effects of these biases on cumulative recall in a micro-culture in the absence of communicative intent, as communicative intent has been shown to affect the emergence of biases in transmission (Lyons & Kashima, 2006)

Participants

Sixty participants (48 females) took part in Study 1. Their ages ranged from 16 to 52 years with a mean age of 22.52 years (SD = 8.72). The majority (57%) were undergraduate students studying psychology, and others were prospective students and parents attending a Psychology Department Open Day; all participants under the age of 18 took part with their parents' consent.

Design

A linear transmission chain design was used, in which the first participant in each of the twenty chains received three legends, one of each type (social, survival and combined, based on the results of Study 1) and the control material. A within-groups design was used so that each participant would contribute to the cumulative recall of each type of legend. The order in which each chain was presented with these was

counterbalanced so no legend type or the control material appeared in the same position more than any other. The next participant was presented with the material that had been recalled by the previous participant. Each of the twenty chains comprised of three participants or 'generations'. A chain of three generations was judged to be an optimum length, capable of capturing long-term cumulative effects of cultural transmission but short enough to be practical in terms of participant recruitment. This length of chain has been used successfully in previous research (Barrett & Nyhof, 2001; Nielsen, Cucchiaro & Mohamedally, 2012). Each individual legend and the control material was passed along ten chains.

Material

From the seventeen original legends rated in Chapter 3, two social type legends, two survival type legends and two combined type legends were selected (see Table 1 for an overview and Appendix A for the full text of the urban legends used) these legends were matched for plausibility, emotional content and gender stereotyped behaviour where possible (see Appendix F for the mean differences between the legends). In Chapter 3 the legends were grouped into homogenous subsets using stepwise step-down multiple comparisons (see Chapter 3 for the full details and Appendix D for tables showing homogenous subsets for each scale). The two social type legends appear in the highest social score subset and the lowest survival score subset. The two survival type legends appear in the highest survival score subset and the second lowest social score subset. One combined type legend (Combined-Gang) appears in both the highest social score and highest survival score subsets, the other combined type legend (Combined-Killer) appears in the highest survival score subset and the third highest social score subset. No legend other than Combined-Gang appeared in the highest subsets for both social and survival

scores so Combined-Killer represents the best choice for combining social and survival scores.

The strong correlation between social information and gender stereotypical content found in Chapter 3 means that one potentially conflicting bias was gender stereotype consistency. Social-Birthday scored significantly higher in gender stereotype than Survival-Cyst and Combined-Gang (*ps* < .05). Combined-Killer also scored significantly higher than Survival-Cyst ($p < .05$) and the control material was rated significantly lower in gender stereotype than all legends accept for Survival-Cyst (*ps* < .05). As such legends were categorised as either stereotype low (control material, Survival-Cyst), stereotype medium (Social-Cybersex, Combined-Gang, Combined-Killer, Survival-Spiders) or stereotype high (Social-Birthday) according to their position in the homogenous subsets and relationship to each other in terms of gender stereotype score.

Table 1. *Legends used in Study 1 with their legend types and the codes used to refer to them in the chapter (see Appendix A for full text)*

Legend	Legend Type	Code used in chapter	Mean Score (SD)	
			Social	Survival
Steroids in chicken cause ovarian cysts.	Survival	Survival-Cyst	2.50(1.76)	4.90(2.00)
Woman killed by spiders in her hair.	Survival	Survival-Spiders	2.50(1.61)	4.05(1.93)
Naked boss caught by surprise birthday party.	Social	Social-Birthday	5.45(1.32)	1.85(.99)
Father and daughter accidental cybersex.	Social	Social-Cybersex	5.85(1.04)	2.55(1.70)
Little boy attacked as part of a gang initiation.	Combined	Combined-Gang	4.90(1.21)	4.25(1.70)
Serial killer using recorded baby crying to trap women.	Combined	Combined-Killer	3.45(1.70)	5.05(1.96)

Procedure

Participants were asked to take part in a study regarding the cultural transmission of urban legends. Participants were individually presented with the experimental materials on a computer. They were asked to read the material (legend or control), then on a new page they had to type what they remembered of this material; they then repeated this for all material presented to them. No distracter task was performed and no time limit for recall was set. As previous research has demonstrated that communicative intent can alter the content of material transmitted in a diffusion chain, including altering the degree to which

content biases are represented (Lyons and Kashima, 2006), participants were not told that the material had come from a previous participant or that their recall would be presented to another participant. This was done with the intention of focusing on the effects of cumulative recall rather than communicative choice (which would be examined in Study 2 of this chapter).

Coding

Following previous studies which used a linear transmission chain design (Bangerter, 2000; Kashima, 2000; Mesoudi, et al., 2006; Mesoudi & Whiten, 2004), a propositional analysis (Kintsch, 1974) was performed on each participant's recall. In propositional analysis the text is divided into separate propositions, defined as a predicate (a verb, adjective, or other relational term) with a series of ordered arguments (the complementary noun/s). As previous research has demonstrated that information relevant to the plot of a narrative is better recalled than background details (Kashima, 1997) only propositions central to the narrative (central propositions) were coded so as to avoid legends with more background details appearing to have poorer recall (see Appendix A for the full text of the legends used). This propositional analysis was used to calculate the percentage of original central propositions correctly recalled. Percentages were used instead of total number as the original texts varied between five and six central propositions. No significant difference in the percentage of central propositions recalled was found between legends with five central propositions and legends with six.

To assess coder reliability, an independent coder blind to the study hypothesis coded two chains of each legend and the control material (20% of all material). There was a significant correlation between the coding of the independent coder and the original coder ($r_{40} = .83$, $p < .01$).

5.2.2 Results

A general linear mixed multilevel binomial regression model was used to analyse the data using the lme4 software package (Bates, Maechler, Bolker, & Walker, 2008) in R version 3.0.2 (R Core Team, 2013). The initial full model had legend type (social, survival, combined), stereotype level (high, medium, low), participant age, participant gender and generation as fixed effects without interaction, assuming a nested randomised structure of legend type within participant within generation and stereotype level within participant within generation. In this full model coefficients for age, gender and stereotype level were not significant. As such a second legend type based model was used with legend type and generation as fixed effects without interaction, assuming a nested randomised structure of legend type within participant within generation. This legend type based model showed a significantly better fit than a generation only model ($X^2_4 = 45.5$, $p < .01$) and a stereotype level based model ($X^2_1 = 16.39$, $p < .01$). The full model did not significantly improve the model fit over the legend type based model ($X^2_7 = 4.89$, $p > .05$). Table 2 shows a comparison between the models (see Appendix G for full comparisons between the models). See Table 3 for the results of the type based mode.

Table 2. *Model comparison with goodness-of-fit tests*

Model	Df	AIC	BIC	Log Likelihood	Test	X^2
1. Full	16	201.34	254.89	-84.67		
2. Legend Type	9	192.22	222.35	-87.11	1 vs. 2	4.89
3. Generation Only	5	229.72	246.46	-109.86	3 vs. 2	45.5***
4. Stereotype Level	8	206.61	233.39	-95.31	4 vs. 2	16.39***

Significance codes: ***<0.001, **<0.01, *<0.05

Table 3. *Results of the best fitting model (legend type based). Results show comparisons to the baseline. In the case of the legend types the baseline is the control and in the case of the generations the baseline in generation 1.*

Predictor	Coefficient	SE	*Z*
(Intercept)	0.26	0.5	0.52
Social	3.24	0.63	5.14***
Survival	1.69	0.52	3.23**
Combined	3.24	0.63	5.14***
Generation 2	-1.18	0.54	-2.19*
Generation 3	-2	0.53	-3.75***
Model Fit			
AIC	192.22		
BIC	222.35		
Log Likelihood	-87.11		

Significance codes: ***<0.001, **<0.01, *<0.05

In addition to the model, orthogonal planned contrasts were used to examine the differences between generations. *Z*-tests revealed that mean recall was significantly higher in generation 1 than generation 2 ($z = 3.19$, $p < .005$) and recall in generation 2 was significantly higher than generation 3 ($z = 3.34$, $p < .001$). Figures 1 and 2 show the pattern of recall for legend type along the chains for each generation.

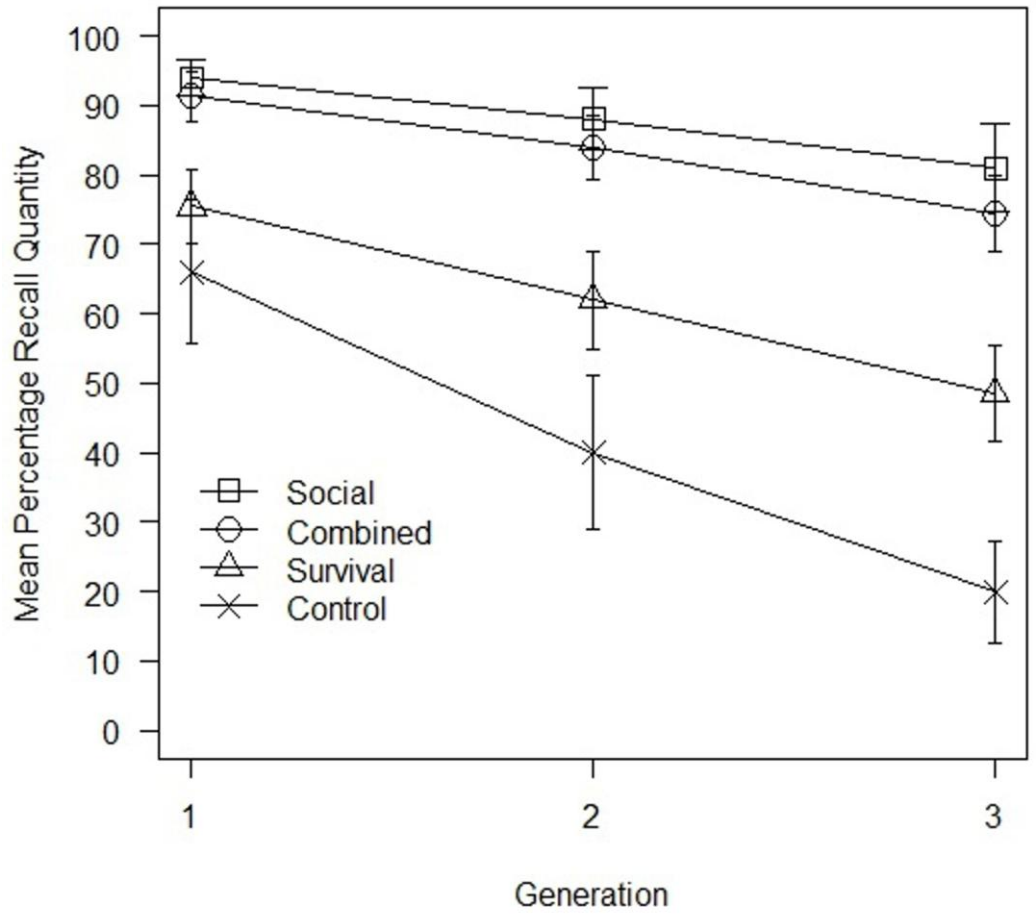

Figure 1. Mean percentage of original central propositions recalled by each generation for each type of legend used in study 1. Error bars show standard errors.

To examine the differences in recall between legend types multiple comparisons with a Tukey's HSD correction were conducted using the multcomp software package for R (Horthorn, Bretz, & Westfall, 2008). Recall for social type and combined type legends was not significantly different ($z = .00$, $p > 0.05$) but recall for both of these legend types was significantly greater than recall for the survival type legends ($zs = 2.91$, both tests $p < .05$) and the control material ($zs = 5.14$, both tests $p < .001$). Recall of the survival type legends was also significantly higher than recall of the control material ($z = 3.23$, $p < 0.01$).

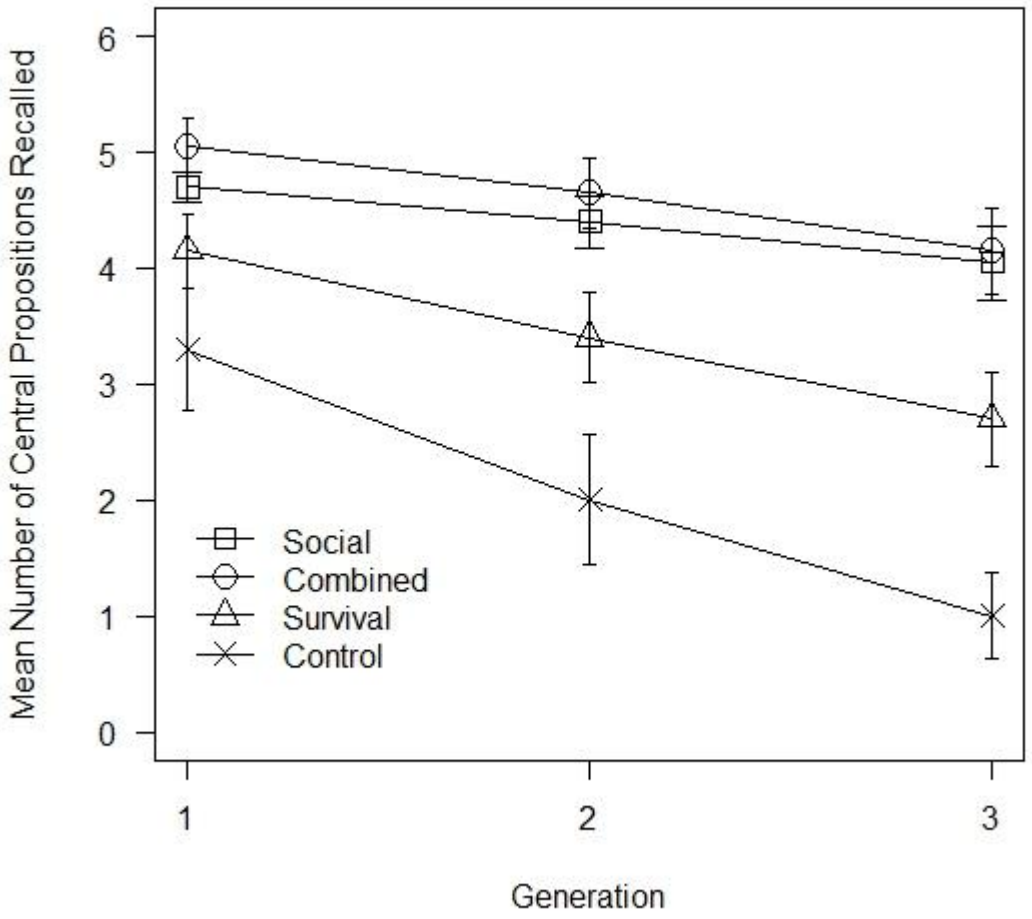

Figure 2. Mean number of central propositions recalled by each generation in Study 1 (error bars show standard errors).

5.2.3 Discussion

The Cumulative Effects of Recall

The aim of Study 1 was to examine the effects of different informational content on cumulative recall along a transmission chain. Previous research has suggested two potential content biases in cultural transmission: social information bias and survival information bias. This study compared the cumulative recall of urban legends featuring both types of content and a third legend type which combined both. The results show that

legends that contained information regarding the interaction between third parties (the social type legends and the combined type legends) were recalled with significantly greater fidelity than the control material and the legends that contained information relevant to survival (survival type legends). This finding is consistent with previous research (Mesoudi et al., 2006) which also found social information to feature an advantage in recall in comparison to equivalent non-social information through a transmission chain. This result provides further evidence for the concept of a content bias for social information in cultural transmission.

Survival-type legends were not recalled with significantly greater accuracy than legends which featured social information but were recalled with greater accuracy than the control material. This suggests that survival information alone does confer a mnemonic advantage in cumulative recall but not as great an advantage as social information. This supports previous finding by Nairne and colleagues who found that survival processing conferred a mnemonic advantage in individual memory experiments, compared to other forms of mnemonic processing (Nairne, 2010; Nairne et al., 2007; Nairne & Pandeirada, 2008). The results of Study 1 suggest that this mnemonic advantage granted by survival processing for an individual translates into a cumulative recall advantage for survival information across microcultures.

An objection could be raised with regard to the distinction being made between social and survival information. Nairne (2010) argues that the 'fitness-relevant' information that should feature an advantage in recall includes both ecological survival information, such as the presence of predators, and social information, such as third party interactions; however, the results of Study 1 suggest that the distinction between social and survival information should be made. The results suggest that social information is

particularly salient compared to other forms of fitness-relevant information and as a result may be unique in the way humans preferentially attend, recall and transmit it.

That the combined type legends were recalled with the same accuracy as the social type legends suggests that social information is key to the success of the cultural transmission of an urban legend narrative. There were no apparent recall benefits to combining two potential content biases. This could be a result of the nature of the bias it was combined with; survival information on its own did not grant as much of an advantage in recall across the chains as social information, so it may not confer a greater advantage in a narrative which also contains social information. Future studies could examine how different potential content biases interact and effect transmission when they are combined.

That legends high in gender stereotype consistent behaviour also featured high levels of recall could be considered support for previous research which has suggested a content bias for gender stereotype consistent information in cultural transmission (Bangerter, 2000; Kashima, 2000). However, Lyons and Kashima (2006) found that stereotype consistency bias only emerged in a transmission chain when there was communicative intent rather than just recall as in Study 1. As the legend type model was a significantly better fit for the data than a stereotype level model, it is likely that the observed pattern of recall is driven by the different types of information (survival, social, both combined) rather than the level of stereotype consistent behaviour. Gender stereotype consistent content was not the focus of the study so any evidence from the results can only be considered inconclusive with regards to true support for gender stereotype bias. It does suggest, however, that future studies examining gender stereotype or social information bias should consider if both biases are being exploited by the material at once and this is particularly pertinent if the material is ‘gossip’ involving sexual behaviour.

Transformations

As demonstrated by Bartlett (1932), one advantage to using the transmission chain design is that the recall of participants can transform the original material in interesting ways that reflect cognitive biases. In Study 1 a number of transformations were observed. In the combined-gang legend, the last sentence – "Apparently, the poor boy had been attacked as part of a gang initiation" was frequently transformed. In the majority of chains, the word "apparently" was lost in the first or second generation. This is consistent with theories regarding the development of rumour; where ambiguous information is transformed to become fact (Shibutani, 1966). The ambiguous word "attacked" was also transformed in a number of cases to something more specific and emotive such as "stabbed" (chains 7 and 9) or "murdered" (chain 10). This could be explained by the content evolving through transmission to become increasingly emotive, and therefore further exploit the high emotion bias suggested by Heath, Bell and Sternberg (2001).

Another interesting transformation was found in the social-birthday legend. In the first generation of one chain the sentence – "The boss of a small company took *his* attractive secretary out for a long lunch on his birthday [emphasis mine] " was transformed into this sentence – "The boss of a small company took *her* attractive secretary out for lunch on his birthday [emphasis mine]". This is essentially a gender-swap that changes the narrative from being gender stereotype consistent to being gender stereotype inconsistent. This change is inconsistent with research suggesting a bias for gender stereotype consistent narratives (e.g. Bangerter, 2000; Kashima, 2000), however, by the second generation the gender of the boss character had returned to being male. This transformation is an example of a copying error being 'corrected' or conventionalised by a content bias.

The results of Study 1 provide further evidence for the presence of a social information bias in human cultural transmission at the level of recall. It suggests that this is

true of narratives where the social information is the primary narrative focus and of narratives that also contain survival information. Evidence was also found for a survival information bias in cultural transmission at the level of recall, although not to the same extent as social information. These findings provide support for the *Machiavellian* and *Social Brain* hypotheses of human intelligence evolution and to a lesser extent provide support for the concept that human memory evolved to preferentially recall fitness-related ecological information.

5.3 Study 2

While previous research into content biases in cultural transmission has largely relied on the transmission chain paradigm (Mesoudi & Whiten, 2008), in true cultural transmission, selection is not limited by recall ability alone. While memory is important, as an oral narrative must be recalled to be retold, audience feedback and choice as well as the teller's own preferences will affect the transmission of a narrative (Dégh & Vazsonyi, 1975; Lyons & Kashima, 2006; Rubin, 1995; von Sydow, 1948/1965). The choice of the teller can be particularly pertinent as they will not always transmit everything they remember and may refrain from transmitting information if they doubt its truthfulness (Lyons & Kashima, 2003). Tellers are also likely to prefer to transmit information which will keep their audience entertained and/or intrigued (Kashima, Lyons & Clark, 2012). Eriksson and Coultas (2014) argue that research should distinguish between three distinct phases of cultural transmission: 'choose-to-receive', 'encode-and-retrieve' and 'choose-to-transmit'. In using the transmission chain paradigm previous content bias research has demonstrated biases in one phase, encode-and-retrieve, but not the other two. Previous research into emotional bias by Heath et al. (2001) demonstrated an advantage for disgusting material in a choose-to-transmit paradigm and Eriksson and Coultas (2014) expanded this to investigate emotional biases in the two other phases: encode-and-retrieve

and choose-to-receive. They found an advantage across all three phases of transmission for urban legends which evoked higher levels of disgust. Lyons and Kashima (2006) found that stereotype consistency bias only emerged in a transmission chain when there was communicative intent as opposed to just recall, suggesting that the choose-to-transmit phase plays an important part in how this stereotype consistency bias operates. This second study importantly extends previous work examining social information bias and survival information bias by looking beyond the encode-and-retrieve phase and by comparing how these biases operate across the choose-to-receive and choose-to-transmit phases.

5.3.1 Methods

Participants

Thirty participants (24 females) took part. Their ages ranged from 18 to 22 years with a mean age of 19.43 years (SD = .97). These were all undergraduate students studying psychology.

Material

For the *choose-to-receive phase*, six 'headlines' were produced from the legends used in Study 1, describing the key elements of each legend (two each of survival type, social type and combined type; see Table 4 for the six headlines used). The material for the *choose-to-transmit* phase was the same six legends used in Study 1.

Table 4. *The headlines used as experimental material in Study 2 with the legend code used to refer to them in the chapter (see Table 1).*

Headline	Legend Code
Steroids in chicken cause ovarian cysts.	Survival-Cyst
Woman killed by spiders in her hair.	Survival-Spiders
Man caught naked by surprise birthday party	Social-Birthday
Father and daughter have accidental cybersex	Social-Cybersex
Little boy attacked in gang initiation	Combined-Gang
Serial killer lures women with a recording of a crying baby	Combined-Killer

Procedure

For the *choose-to-receive phase* participants were presented with a list of 'headlines' and were asked to read them all (the order of headlines on the lists was counterbalanced). After reading the headlines they were asked to rank them in the order of their interest in reading the story from which the headline was derived. As assessment of this phase required participants to demonstrate which story they would be most likely to choose to read, a self-report paradigm was thought to be ecologically valid. While the participants could be influenced by experimenter effects, this could be the case in any paradigm examining this phase. In the *choose-to-transmit phase* participants were provided with all six legends (the order in which they received them was counterbalanced and was not the order selected in the choose-to-receive phase). They were asked to read the material and then asked to rank the legends in the order of their interest in passing that story on to another person. Self-report was used in this phase due to practical restrictions and to any potential audience effects that could influence the participants' choice if they expected to actually pass the story on. Urban legends are rarely told to strangers so using a paradigm in

which participants actually passed the story on may not be ecologically valid. This design is consistent with previous research examining participants' willingness to pass a story on such as Heath et al. (2001).

5.3.2 Results

In both the choose-to-receive and choose-to-transmit phases a lower number indicates a higher rank i.e. the highest rank is one.

Choose-to-receive Phase

A Friedman test was used to assess variance in rank across individual's 'choice to receive' for all the individual legends. Mean rank varied significantly across the six legends ($\chi^2_5 = 34.23$, $p < .001$). *Post hoc* analyses with Wilcoxon tests were conducted, with a Bonferroni-Holm correction applied, to examine the differences between legends. This analysis revealed that Combined-Killer (M = 2.5, SD = 1.55) ranked significantly higher than Combined-Gang (M = 3.63, SD = 1.59), Social-Birthday (M = 4.2, SD = 1.42), and Survival-Cyst (M = 4.83, SD = 1.39), *zs* = 370 – 424, *ps* < .05. Social-Cybersex (M = 2.8, SD = 1.56) ranked significantly higher than Social-Birthday and Survival-Cyst, *zs* = 389, 406.5, *ps* < .05, and Survival-Spiders (M = 3.03, SD = 1.63) ranked significantly higher than Survival-Cyst, $z = 394.5$, $p < 0.05$; see Figure 3 (NB – Higher rank denotes more willingness to receive the story, 1 is the highest rank, 6 is the lowest rank).

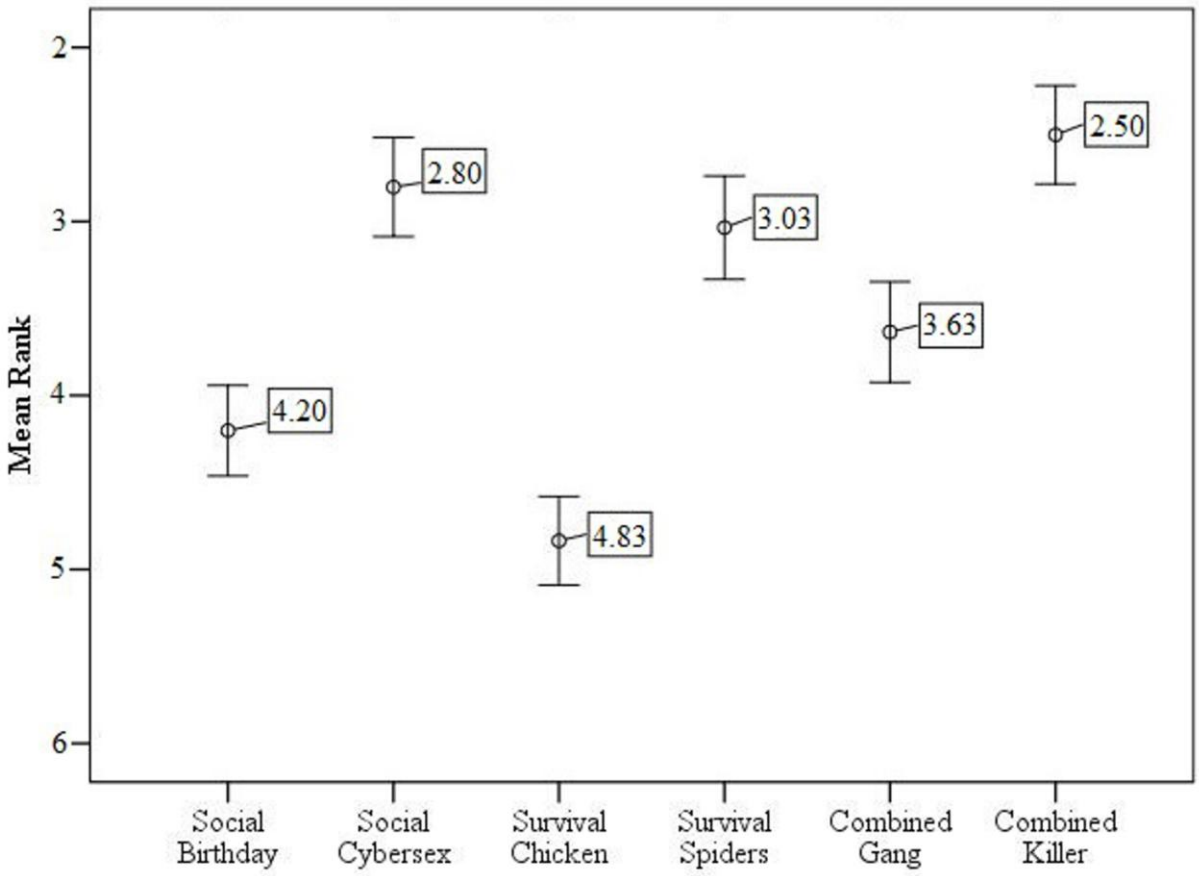

Figure 3. The mean ranks given to each headline in the choose-to-receive phase of study 2 (NB – Higher rank denotes more willingness to receive the story, 1 is the highest rank, 6 is the lowest rank). Error bars show standard errors.

A Friedman test was used to assess variance in rank across individual's 'choice to receive' for the legend types. Mean rank varied marginally signifycantly across legend type ($\chi^2_2 = 5.67$, $p = .06$). *Post hoc* analyses with Wilcoxon tests were conducted, with a Holm-Bonferroni correction applied, to examine the differences between legend types. The largest difference was found between combined type legends (M = 3.07, SD = 1.28) and survival type legends (M = 3.93, SD = .93) but this was not significant ($z = 265$, $p = .069$). All other comparisons were not significant ($zs = 135, 198$, $ps > .05$).

Choose-to-transmit Phase

A Friedman test was used to assess variance in rank across individual's 'choice to transmit' for the individual legends. Mean rank varied significantly across the six legends ($\chi^2_5 = 15.57$, $p < .01$). *Post hoc* analyses with Wilcoxon tests were conducted, with a Bonferroni-Holm correction applied, to examine the differences between legends. This analysis revealed Social-Cybersex (M = 2.93, SD = 1.70) ranked marginally significantly higher than Social-Birthday (M = 4.33, SD = 1.35), $z = 371.5$, $p = .06$. Comparisons between other legends were not significant ($zs = 194.5 – 367$, $ps > .05$). See Figure 4 (NB – Higher rank denotes more willingness to receive the story, 1 is the highest rank, 6 is the lowest rank).

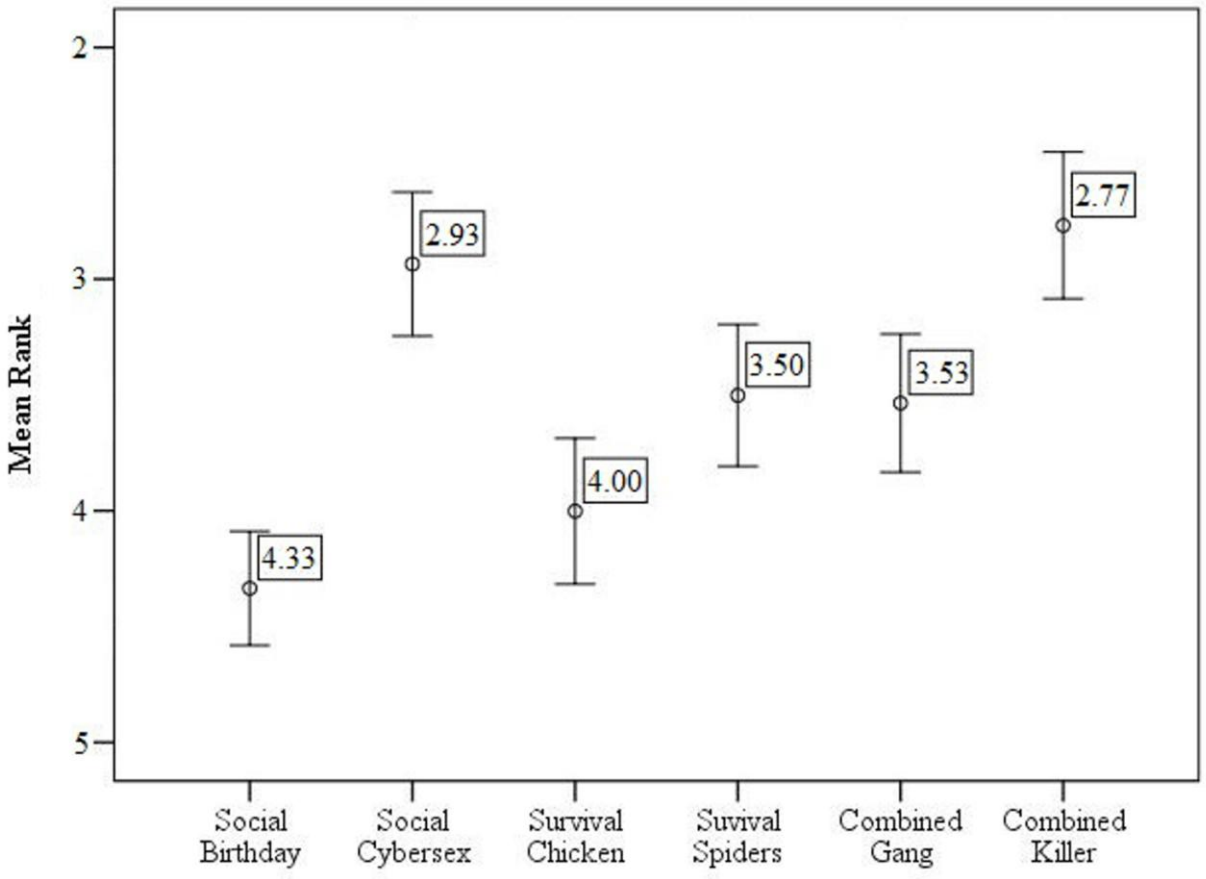

Figure 4. The mean ranks given to each legend in the choose-to-transmit phase of study 2 (NB – Higher rank denotes more willingness to receive the story, 1 is the highest rank, 6 is the lowest rank). Error bars show standard errors.

A Friedman test was used to test for variance in rank across individual's 'choice to transmit' for the legend types but no significant variation in mean rank was found (χ^2_2 = 5.41, $p > .05$).

5.3.3 Discussion

The aim of Study 2 was to examine how social information bias and survival information bias operate on two distinct phases of transmission, the choose-to-receive phase and the choose-to-transmit phase. Previous research has demonstrated these biases in the encode-and-retrieve phase, but has not investigated their effect outside of that single phase. The experiment also examined the effect of combining both social and survival

information on transmission across these phases. The results demonstrate no particular preference for either survival or social information at the *choose-to-receive* phase with both being equally preferred as legend types. Legends which combined both showed a slight advantage but this was not significant. Further research should investigate how different combinations of biases operate at this phase of transmission. In the choose-to-transmit phase, no advantage for any legend type was found, suggesting that people are equally willing to pass on legends that contain social information, survival information and combine the two. A possible limitation of the approach used in this study is that the results were based on self-reported data. While self-report may be a plausible means to measure the choose-to-receive phase, it may be less appropriate in the choose-to-transmit phase as participants may not have an accurate perception of which stories they would actually transmit in a real life situation; however, it would be practically challenging to replicate the transmission of urban legends in an experimental setting while remaining ecologically valid.

5.4 General Discussion

The aim of these studies was to examine the effects of social information bias, survival information bias and combining both of these biases on the cultural transmission of urban legends across three distinct phases of transmission: the choose-to-receive phase, the encode-and-retrieve phase and the choose-to-transmit phase. Taken together the results for Studies 1 and 2 demonstrate the importance of examining transmission in all of these different phases when seeking to demonstrate a content bias in cultural transmission. Previous research by Eriksson and Coultas (2014) into emotional bias found a largely consistent transmission advantage for content that evoked high levels of disgust across all three phases of transmission while another study by Lyons and Kashima (2006) found that stereotype consistency bias only emerged when there was communicative intent rather than

emerging from a recall advantage. The results show that social information has an advantage over survival information in the encode-and-retrieve phase, the phase based on recall, but this was not consistent in the other phases. In both the choose-to-receive phase and the choose-to-transmit phase neither bias had an advantage over the other.

The fact that social information was most advantageous in the encode-and-retrieve phase when there was no communicative intent suggests that this bias operates at the level of a recall advantage. This suggests that humans have a predisposition towards preferentially recalling narratives which contain social information over survival information. This result lends partial support to the *Machiavellian Intelligence* (Byrne & Whiten, 1988, Whiten 1999; Whiten & Byrne, 1997) or *Social Brain* (Dunbar, 1998, 2003) hypotheses that intelligence evolved in order to deal with complex social relationships. However, no evidence was found to support the prediction of these hypotheses that humans will also preferentially attend to or choose to transmit social information over survival information. In both these cases there was no apparent preference for social information over survival information. The *choose-to-transmit* phase is the phase most influenced by what the transmitter believes that their audience will respond to and the neutral finding here could be due to participants imagining passing on a story rather than actually doing so. Future experiments could examine audience effects on the choose-to-transmit phase of transmission and communicative intention.

The legends combining both social information and survival information were as successful in recall as the social legends and had a recall advantage over legends containing survival information alone. This suggests that survival information needs to be combined with another bias to be as culturally successful as social information or possibly be exceptionally memorable in order to ‘survive’ the encode-and-retrieve phase. Given these results, in the general corpus of urban legends one could expect to see fewer urban

legends that contain survival information than social information, or for the former to exploit additional biases. This is supported by a content analysis of 256 urban legends, which found a greater number of legends that contained social information than survival information and also found survival information to be commonly combined with other biases (Stubbersfield, Tehrani & Flynn, under review a, presented in Chapter 2). Previous research (Eriksson & Coultas, 2014; Heath et al., 2001) has suggested that urban legends exploit a bias for content that evokes high emotion, particularly disgust. This high emotion bias could explain the prevalence of survival type legends more accurately than survival information bias alone. However, as disgust is so associated with survival mechanisms (avoiding contaminated food, etc.), future research should examine if the high emotion bias is found for emotions other than disgust.

While Mesoudi et al. (2006) used original material created for the purpose of the experiment, Study 1 and 2 used real urban legends. Although they were altered in terms of word length for the purposes of the study multiple versions of any urban legend always exist with no 'true' version, so the material used in the present study is an accurate representation of narratives that are transmitted between people orally and through electronic communication. There are a number of benefits to using 'real world' material in such an experiment but this can come at the cost of full control over the features of the material. In this experiment efforts were made to control for any confounding variables in terms of content and differences in social and survival information provide the best account for the observed differences in recall. The fact that urban legends that contain some social information were found to have an advantage in the encode-and-retrieve phase of transmission in an experimental setting suggests that this is also the case for these legends in the 'real world' and provides an explanation for the large number of legends which feature some form of social information (Stubbersfield et al., under review a, presented in Chapter 2).

The studies presented here demonstrate that social information bias provides a transmission advantage over survival information in the encode-and-retrieve phase of transmission but has no strong advantage in either the choose-to-receive or choose-to-transmit phases. Survival information was found to have an advantage over control material at the encode-and-retrieve phase, although this advantage was not as great as social information. To succeed in cultural transmission, survival information is likely to be combined with a more successful bias, such as social information, although other biases such as emotional bias are also likely candidates. Future research examining content biases in cultural transmission should consider how these biases operate across all three phases of transmission and not just focus on the encode-and-retrieve or choose-to-transmit phases. New experimental paradigms that go beyond the traditional linear transmission chain could be used and developed to allow for further investigation into the effects of content biases on the choose-to-receive and choose-to-transmit phases. By investigating these phases separately new information can be discovered with regard to how the biases operate and new predictions could be made in terms of how biased content is transmitted.

References

Bangerter, A. (2000). Transformation between scientific and social representations of conception: The method of serial reproduction. *British Journal of Psychology*, 97, 405-423.

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

Bartlett, F.C. (1932). *Remembering*. Oxford, UK: Macmillan.

Best, J., & Horiuchi, G.T. (1985). The razor blade in the apple: The social construction of urban legends. *Social Problems*, 32, 488-499.

Blackmore, S. (1999). *The Meme Machine*. New York: Oxford University Press.

Brunvand, J.H. (1986). *The Mexican Pet*. New York: Norton.

Brunvand, J.H. (1999). *Too Good to be True: The Colossal Book of Urban Legends*. New York: Norton.

Brunvand, J.H. (2000). *The Truth Never Stands in the Way of a Good Story*. Chicago: University of Illinois Press.

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

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

Dawkins, R. (1976). *The Selfish Gene*. Oxford: Oxford University Press.

Dégh, L., & Vazsonyi, A. (1975). The hypothesis of multi-conduit transmission in folklore. In D. Ben-Amos & K. S. Goldstein (Eds.), *Folklore: Performance and Communication* (pp. 207-252). Paris: Mouton.

Dunbar, R.I.M. (1993). Coevolution of neocortical size, group size and language. *Behavioural and Brain Sciences*, 16, 681-735.

Dunbar, R.I.M. (1998). The social brain hypothesis. *Evolutionary Anthropology*, 6, 178-190.

Dunbar, R. I. M. (2003). The social brain: Mind, language, and society in evolutionary perspective. *Annual Review of Anthropology*, 32, 163–181.

Ellis, B. (1983). De Legendis Urbis: Modern legends in ancient Rome. *Journal of American Folklore*, 96, 200-208.

Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14, 1-26.

Fine, G.A. 1979. Cokelore and Coke law: urban belief tales and the problem of multiple origins. *Journal of American Folklore* 92:477–482.

Fine, G.A. (1980). The Kentucky Fried Rat: Legends and modern society. *Journal of the Folklore Institute*, 17, 222-243.

Fox Tree, J.E., & Weldon, M.S. (2007). Retelling urban legends. *The American Journal of Psychology*, 120, 459-476.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

Kang, S., McDermott, K. B., & Cohen, S. (2008). The mnemonic advantage of processing fitness-relevant information. *Memory & Cognition*, 36, 1151-1156.

Kashima, Y. (1997). Culture, narrative, and human motivation. In D. Munro, J.F. Schumaker, & S.C. Carr (Eds.). *Motivation and Culture* (pp. 16-30). New York: Routledge.

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

Kashima, Y., Lyons, A., & Clark, A. (2013). The maintenance of cultural stereotypes in the conversational retelling of narratives. *Asian Journal of Social Psychology*, *16*, 60-70.

Kintsch, W. (1974). *The Representation of Meaning in Memory*. Oxford: Erlbaum.

Lyons, A., & Kashima, Y. (2003). How are stereotypes maintained through communication? The influence of stereotype sharedness. *Journal of personality and social psychology*, *85*(6), 989.

Lyons, A., & Kashima, Y. (2006). Maintaining stereotypes in communication: Investigating memory biases and coherence-seeking in storytelling. *Asian Journal of Social Psychology*, *9*, 59-71.

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

McGuigan, N., & Cubillo, M. (2013). Cultural transmission in young children: When social information is more important than non-social information. *The Journal of Genetic Psychology*, 174, 605–619.

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.

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

Mullen , Patrick B. 1972. Modern legend and rumor theory. *Journal of the Folklore Institute* 9:95–109.

Nairne, J.S. (2010). Adaptive memory: Evolutionary constraints on remembering. *Psychology of Learning and Motivation*, 53, 1-32.

Nairne, J.S., & Pandeirada, J.N.S. (2008). Adaptive memory: Is survival processing special? *Journal of Memory and Language*, 59, 377-385.

Nairne, J.S., & Pandeirada, J.N.S. (2010). Adaptive memory: Nature's criterion and the functionalist agenda. *American Journal of Psychology*, 4, 381-390.

Nairne, J.S., Pandeirada, J.N.S., & Thompson, S.R. (2008). Adaptive memory: The comparative value of survival processing. *Psychological Science*, 19, 176-180.

Nairne, J.S., Thompson, S.R., & Pandeirada, J.N.S. (2007). Adaptive memory: Survival processing enhances retention. Journal of Experimental Psychology: Learning, *Memory, and Cognition*, 33, 263-273.

Nielsen, M., Cucchiaro, J., & Mohamedally, J. (2012). When the transmission of culture is child's play. *PLoS One*, 7, e34066.

Otgaar, H., Smeets, T., & van Bergen, S. (2010). Picturing survival memories: Enhanced memory after fitness-relevant processing occurs for verbal and visual stimuli. *Memory and Cognition*, 38, 23–28.

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

Packman, J.L. & Battig, W.F. (1978). Effects of different kinds of semantic processing on memory for words. *Memory and Cognition*, 6, 502–508.

Reysen, M. B., Talbert, N. G., Dominko, M., Jones, A. N., & Kelley, M. R. (2011). The effects of collaboration on recall of social information. *British Journal of Psychology*, *102*, 646-661.

Rubin, D. C. (1995). *Memory in Oral Traditions: The Cognitive Psychology of Epic, Ballads, and Counting-out Rthymes*. Oxford University Press on Demand.

Shibutani, T. (1966). *Improvised News: A Sociological Study of Rumor*. New York: Bobbs-Merrill.

Simpson, J. 1981. Rationalized motifs in urban legends. *Folklore* 92:203–207.

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

Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (under review a). Santa Crucified and Death by Lollypop: Culture, Cognition and the Epidemiology of Urban Legends. *Current Anthropology*.

Tangherlini, T.R. (1990). "It happened not too far from here...": A survey of legend theory and characterization. *Western Folklore*, 49, 371-390.

Victor, J. (1990). Satanic cult rumors as contemporary legend. *Western Folklore*, 49, 51-81.

Von Sydow, C.W. (1965). Folktale studies and philology: Some points of view. In A. Dundes (Ed.), *The Study of Folklore* (pp. 219-242). Englewood Cliffs, N.J.: Prentice-Hall. (Original work published 1948).

Weinstein, Y., Bugg, J. M., & Roediger, H. L. (2008). Can the survival recall advantage be explained by basic memory processes? *Memory & Cognition*, 36, 913–919.

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.

Chapter 6

Justin Bieber and Unicorns: An Examination of Guided Variation and Content Biases in Narratives Using a Transmission Chain Without Recall

This chapter presents a study which uses a transmission chain without recall to examine the process of guided variation in cultural transmission and how it may reflect the cognitive content biases observed in recall-based transmission.

Abstract

To date, most studies of cultural evolution have focused on processes of selection and inheritance, neglecting processes of mutation. Theorists have identified two potential forms of mutation in cultural evolution: 'copying error', where a learner makes unintentional, random modifications to a behaviour, due to distraction, accident or lack of skill, and 'guided variation' where a learner makes non-random modifications to the demonstrated behaviour based on individual experience. While copying error is directly analogous to random genetic mutation, guided variation is a specifically *cultural* process that does not have a close parallel in biological evolution. It has been suggested that the decision-making processes underlying guided variation may produce similar results to cultural transmission as both are likely to be influenced by cognitive biases. So far, this idea has only been explored in relation to context biases in cultural transmission (i.e. whom to copy) and has yet to be investigated in relation to *content* biases (i.e. what to copy). This study addresses the latter by using a unique linear transmission chain design, without any influence of recall, to examine this gap in the literature. Participants were given news stories and asked to alter these stories however they wished in order to make it more interesting, the product of their modification was then passed to the next participant and so on down the chain. The products of the chains were then compared with the original material so as to assess any underlying biases in the changed content. It was found that original material that already exploited content biases was not enhanced by guided variation, however, original material which scored low for biased content was enhanced in at least one known content bias.

6.1 Introduction

In recent years, theories of cultural evolution (e.g. Mesoudi, 2011, Richerson & Boyd, 2005) have become increasingly popular in a number of disciplines, including psychology (e.g. Mesoudi, 2009), anthropology (e.g. Henrich & McElreath, 2003), archaeology (e.g. Shennan, 2002), sociology (e.g. Runciman, 2009) and linguistics (e.g. Gray, Drummond, & Greenhill, 2009). These theories propose that culture represents a second system of heritable variation that evolves through the same Darwinian processes as the genetic system, i.e. mutation, selection and inheritance. To date, most theoretical and empirical work in this field has focused on the latter two processes. For example, researchers have used a range of methods, from mathematical modelling (e.g. Boyd & Richerson, 1985) and controlled experiments (Wood et al., 2013) to ethnographic fieldwork (Henrich & Broesch, 2011), to investigate how one makes decisions about *what* to copy ('content biases') and *who* to copy ('context biases'). Other researchers, meanwhile, have employed techniques of phylogenetic analysis to trace lineages of cultural descent and modification in various socially learned traditions (e.g. Currie, 2013; Lycett, 2009; Lyman & O'Brien, 2003; Tehrani, 2013; Tehrani, Collard & Shennan, 2010), and establish long-term trends in cultural, economic and political systems (e.g. Jordan, Gray, Greenhill & Mace, 2009). However, comparatively little research has been carried out on how the variants of any given behaviour that one chooses to adopt and pass on were initially created. The present study aims to shed more light on this problem by examining processes of innovation in artificially generated narrative traditions.

Current theory (e.g. Mesoudi, 2011) suggests there are two main mechanisms of cultural mutation. The first of these is copying error, which is defined as the non-random, non-intentional modification of a demonstrated behaviour. Copying error can result when a learner is less adept than a model (for example, the father of the bride attempting to imitate

Michael Jackson's 'moonwalk' at his daughter's wedding party), due to an accidental mishap (a pianist accidentally hitting the wrong key during a performance), or as a consequence of the constraints of the human perceptual system (for example, believing two lines to be the same length when they are not). An excellent example of the latter is provided by Eerkens and Lipo's (2005) case study of Paleo-Indian projectile points from Owens Valley, California between 1500 and 650 BCE. Eerkens and Lipo demonstrated that patterns of variance and cumulative change in point forms during this period is consistent with a model of pure copying error derived from research into shape perception, which shows that humans are unable to discriminate between line lengths that differ by less than 3% (known as the Weber Fraction), regardless of scale. The second mechanism for generating cultural variation is known as 'guided variation' (Boyd & Richerson, 1985), which involves the non-random modification of a demonstrated behaviour by the learner. For example, someone may be taught how to cook a particular dish, and decide to alter the recipe to make it tastier or healthier by adding or substituting ingredients. This newly invented recipe might then be copied by other members of the population, or not, depending on whether it is favoured by the cultural selective forces at work (i.e. content and context biases in transmission). This non-random modification can occur in both unintentional and intentional forms and also occur through learning processes such as trial-and-error (Mesoudi, 2013).

Whereas copying error is directly analogous to random mutation in genetics, guided variation is a specifically *cultural* process that does not have a close parallel in biological evolution. Goal-directed guided variation allows individuals to take short-cuts to solving adaptive problems that would take several generations to solve under pure natural selection. As Richerson and Boyd stated, guided variation is "like an imaginary genetic system in which mutations tend to be fitness-enhancing, rather than random" (2005:116). They further suggest that the decision-making processes underlying guided variation may

often produce similar results to biased cultural transmission because both are likely to be based on the same psychological mechanisms (ibid). The same point has been made more forcefully by Claidière, Scott-Phillips and Sperber (2014) who argue that it is impossible to decouple mutational and selective forces in cultural evolution (see also Sperber, 1996).

To my knowledge, only one study has directly tested whether traditions that evolve through guided variation exhibit the same dynamics as traditions that evolve through biased cultural transmission. Mesoudi (2008), inspired by Bettinger and Eerkens' (1999) classic archaeological analysis of variation in arrow-head designs in prehistoric Nevada and California, used an artificial hunting experiment to compare the evolution of virtual arrow-head designs under guided variation (in this case intentional modification informed by individual trial-and-error learning) versus a transmission bias for copying successful individuals. Mesoudi found that in simple (unimodal) fitness landscape, participants using guided variation converged on the same optimal design as those who were able to copy the most successful hunters. In a multi-modal landscape, on the other hand, the latter consistently outperformed the former. Consequently, Mesoudi's experiments suggest that guided variation can produce similar outcomes to biased cultural transmission, but only under specific circumstances (i.e. when there is a single best variant of a particular behaviour). However, it is important to emphasise that the study focused specifically on context-based (i.e. copy-who) transmission biases. To date, no similar studies have examined whether guided variation exhibits the same dynamics as *content*-based (i.e. copy what) transmission biases. Here, I present a study that was designed to address this gap.

The Present Research

Our study focuses on several content biases that have been identified in previous research: an ecological survival information bias (Nairne 2010), a social information bias (Mesoudi, Whiten, & Dunbar, 2006); an emotional bias (Heath, Bell, & Sternberg, 2001), a

minimally counter-intuitive (MCI) bias (Boyer & Ramble, 2001), and a stereotype consistency bias (Kashima, 2000). Ecological survival information bias suggests that, as human memory has evolved to be 'tuned' towards encoding and recalling ecological information related to survival and fitness better than other forms of information, humans will be biased towards ecological information relevant to survival (Nairne & Pandeirada, 2008). While social information bias suggests that, as humans evolved greater intelligence in order to deal with complex social interactions they will be biased towards information related to social interaction (Mesoudi et al., 2006). Content which evokes a greater emotional response has been shown to grant a mnemonic advantage in individual recall tests (LaBar & Cabeza, 2006) and content eliciting a greater level of disgust has been shown to have an advantage in cultural transmission (Eriksson & Coultas, 2014; Heath et al., 2001); such emotional content bias suggests that humans are biased in transmission towards content that evokes a greater emotional response. MCI bias suggests that humans are biased towards content which meets a cognitively optimal balance between a small number of counter-intuitive concepts which breach category level expectations (of folk physics, folk biology etc.) and a majority of intuitive concepts (Boyer, 1994). Stereotype consistency bias suggests that humans are biased towards content which is consistent with these cultural stereotypes (Bangerter, 2000; Kashima, 2000).

To investigate these issues more systematically, this study uses a novel experimental paradigm in which participants in a linear transmission chain receive information and then were given the opportunity to alter it however they wished without having to recall it. The next participant in the chain then received the material produced by the previous participant and was asked to alter it, replicating the 'creative transmission' seen in electronic communication in a micro-culture. The nature of this paradigm means that the guided variation studied here is explicitly goal-directed and intentional and as such is not representative of all forms of guided variation, some of which may feature

unintentional but non-random modification. In this sense, the guided variation studied here is similar to the version presented by Claidière, Scott-Phillips and Sperber (2014), who describe it as a constructive mental process which imaginatively anticipates the effects of a modification. The study addressed two key questions:

1. Will the product of guided variation reflect the content biases demonstrated in recall-based experiments such as transmission chains and memory tests?

2. Will the choices made by participants when altering the material reflect the choices made by participants in 'choose-to-transmit'-based experiments?

6.2 Methods

This study involved three distinct phases using different participants in each stage. In Stage 1, participants rated four news stories for various criteria related to their content. Stage 2 took the form of a linear transmission chain where participants were allowed to alter the original material however they wished without having to recall it. In Stage 3 participants rated the material that was produced by the transmission chains using the same questionnaire as Stage 1. For the results the data from the Stage 1 and Stage 3 questionnaires are compared. The methodological details of each stage are provided below, before the results are presented.

6.2.1 Stage 1 – Initial ratings of News Stories

Participants

Eleven participants (10 female) participated. Their ages ranged from 18 to 25 years with a mean age of 20 years (SD = 2.05). All participants were students at Durham University.

Materials

Four news stories were collected from the *BBC News* website (www.bbc.co.uk/news/); two were thought to exploit content biases to a greater degree than the other two providing two groups of stories low-exploit and high-exploit. One story (low-trees) describes a plan to plant thousands of trees on a Cumbrian fell to boost numbers of black grouse. Another (low-bridge) describes delays on the Kessock Bridge at Inverness due to two lorries carrying abnormal loads. Another (high-pea) describes an incident in Massachusetts where a man was found to have a pea plant growing in his lung. The fourth story (high-tiger) describes an incident where a US police sniper sedated a tiger found in a Harlem apartment. These stories were presented as narratives without headlines and were referred to as stories rather than news articles (see Appendix H for the full news stories). Questionnaires were created which contained five questions for each story asking about emotional content, plausibility, relevance, survival information, social information and gender stereotypes. The questions were:

1. What emotion or emotions did you feel while reading this story? (e.g. interest, joy, anger, surprise, sadness, contempt, fear, disgust)

2. Please rate to what extent you felt up to three emotions out of 7

3. Please rate to what extent you believe this story to be plausible out of 7 (1= very unlikely to have taken place, 7= likely to be true)

4. Please rate how relevant you feel this story is to you and your life out of 7

For question five participants were asked to rate ‘to what extent the story contains’ ‘information relevant to health and survival’, ‘information concerning social interaction or relationships’ and ‘behaviour stereotypical for either gender’. Questions one, two, four and five used a seven-point Likert scale from ‘1 = very little’ to ‘7 = very much’. For question

three the Likert ran from '1 = very unlikely to have taken place' to '7 = likely to be true' (see Appendix I for full questions). These questions were used to collect data on potential content biases that the stories may exploit (see Mesoudi & Whiten, 2008). The order of stories presented was counterbalanced to avoid order effects.

Procedure

Participants were asked to take part in a study regarding the cultural transmission of narratives. Each participant was presented with a series of news stories and then had to fill out a questionnaire for each of the four stories. The same set of five questions was asked for each of the stories presented. The questions were related to emotional content, plausibility, relevance, survival information, social information and gender stereotypes. Questions 2-5 involved participants rating the content of the story on a seven point Likert scale (see Appendix I).

6.2.2 Stage 2 – Adaption of the News Stories

Participants

Thirty participants (21 female) participated. Their ages ranged from 19 to 40 with a mean age of 21.67 years (SD = 4.2). All participants were students at Durham University.

Design

A linear transmission chain design was used, in which the first participant in each of the ten chains received the four news stories. Unlike traditional transmission chains, however, participants were not required to recall the material; instead they were asked to alter the stories. The next participant was presented with the material that had been produced by the previous participant. Each of the ten chains comprised of three participants or 'generations'. Three generations was judged to be an optimum chain length,

capable of capturing long-term cumulative effects of 'guided variation' but short enough to be practical in terms of participant recruitment. Three generations have been used successfully in diffusion chains in previous research (Barrett & Nyhof, 2001; Nielsen, Cucchiaro & Mohamedally, 2012). Each individual story was passed along ten chains.

Materials

The material presented to the first generation in each chain was the same four news stories that were used in Stage 1. Again, these were presented as narratives without headlines (See Appendix H).

Procedure

Participants were asked to take part in a study regarding the cultural transmission of narratives. Participants were individually presented with the experimental materials on a computer. The participants were given the following written instructions:

> 'Please edit the story to make it as interesting as possible, so that another person would be likely to tell it to a friend. You have complete freedom to alter the story however you wish but please change at least two aspects of the story.'

Participants were asked to change at least two aspects of the story to ensure that some changes were made. This was repeated for each story presented to them.

6.2.3 Stage 3 – Final ratings of the stories

Participants

One-hundred participants (81 female) participated. Their ages ranged from 17 to 39 with a mean age of 20.48 years (SD = 3.89). The majority (87%) of participants were students at Durham University, others were recruited through opportunity sampling.

Materials

The material used in this stage was the material produced by the final generation of each chain in Stage 2. Participants rated these using the same questionnaire as Stage 1 (see Appendix I)

Procedure

Participants were asked to take part in a study regarding the cultural transmission of narratives. Each participant was presented with an online questionnaire and answered questions on each of the four stories they were presented with. The same set of five questions was repeated for each of the stories presented. Each version of each story (ten chains for each story led to ten versions of each story, totalling 40 final stories) was rated by ten participants (each participant rating four stories).

6.3 Results

Before Transmission

Each news story was rated by eleven participants before being transmitted along the transmission chains. Table 1 presents the mean rating scores for each of the questions in the questionnaire.

Table 1. *Mean and standard deviation rating scores for each news story before transmission.*

Story	Mean (SD)					
	Emotional	Plausibility	Relevance	Survival	Social	Stereotype
Trees	3.73(1.35)	6(1.1)	2.82(1.25)	2.73(1.62)	1.82(1.08)	1.36(.67)
Bridge	3.36(1.57)	4.91(1.87)	1.91(1.45)	1.91(1.22)	2.36(1.03)	1.91(.83)
Pea	5.55(.82)	2.82(2.04)	2.36(1.63)	4.55(1.29)	2.91(1.14)	1.91(.7)
Tiger	5.36(.67)	3.82(1.6)	1.64(.92)	3.55(1.44)	2.45(1.57)	3.09(1.38)

NB - Rating scale ran 1-7. For plausibility low scores represent less plausible.

Variation between the news stories was examined using Kruskal-Wallis one-way ANOVAs. Significant variation was found between the news stories in emotional content ($\chi^2_3 = 20.76$, $p < .001$), plausibility ($\chi^2_3 = 15.02$, $p < .005$), survival information ($\chi^2_3 = 15.12$, $p < .005$) and gender stereotype consistent behaviour ($\chi^2_3 = 11.67$, $p < .01$). There was no significant variation found in relevance ($\chi^2_3 = 5.98$, $p > .05$) or social information ($\chi^2_3 = 4.63$, $p > .05$). Pairwise comparisons using Dunn's (1964) procedure were used to examine the differences between individual stories. It was found that low-trees and low-bridge stories scored significantly lower than high-pea and high-tiger in emotional content ($ps < .05$). Low-trees scored significantly higher than high-pea in plausibility ($p < .005$). Low--bridge scored significantly lower than high-pea in survival information ($p < .005$). High-tiger scored significantly higher in gender stereotyped behaviour than low-trees ($p < .005$). No other significant differences between news stories were found. See Table 2 for the mean differences between all stories on each scale.

Table 2. *Significant mean differences between each story before transmission (at p<.05)*

	Mean Difference		
Story	Low Bridge	High Pea	High Tiger
Low Trees		Em: -1.82 Pl: 3.18	Em: -1.64 St: -1.73
Low Bridge		Em: -2.18 Su: -2.64	Em: -2.00 Su: -1.64
High Pea			

Key:

Em – Emotional content Su – Survival information

Pl – Plausibility St – Stereotype consistency

After Transmission

After being transmitted along the chains, each version of each story was rated by ten participants. Table 2 presents the mean rating scores for each of the questions in the questionnaire.

Table 3. *Mean and standard deviation rating scores for each story after transmission*.

Story	Mean (SD)					
	Emotional	Plausibility	Relevance	Survival	Social	Stereotype
Trees	4.18(1.38)	2.77(1.85)	2.18(1.24)	3.09(1.81)	2.51(1.45)	2.09(1.56)
Bridge	4.21(1.59)	2.89(1.83)	1.91(1.18)	2.45(1.48)	3.56(1.63)	2.39(1.59)
Pea	4.76(1.6)	1.94(1.48)	1.54(.99)	3.59(2.04)	2.66(1.7)	2.14(1.54)
Tiger	4.54(1.45)	2.20(1.57)	1.48(.77)	2.82(1.7)	2.77(1.52)	2.78(1.73)

Variation between the news stories was examined using Kruskal-Wallis one-way ANOVAs. Significant variation was found between the transmitted stories in emotional content ($\chi^2_3 = 10.10$, $p < .05$), plausibility ($\chi^2_3 = 22.59$, $p < .001$), relevance ($\chi^2_3 = 28.47$, $p < .001$), survival information ($\chi^2_3 = 17.46$, $p < .005$), social information ($\chi^2_3 = 25.25$, $p < .001$) and gender stereotyped behaviour ($\chi^2_3 = 13.74$, $p < .005$). Dunn's (1964) procedure for pairwise comparisons was used to compare individual stories. High-pea scored significantly higher than low-trees in emotional content ($p < .05$). Low-bridge scored significantly higher than high-pea and high-tiger in plausibility ($ps < .05$) and high-pea also scored significantly lower than high-trees in the same score ($p < .005$). Low-trees scored significantly higher than high-pea and high-tiger in relevance ($ps < .001$). High-pea scored significantly higher than low-bridge in survival information ($p < .005$). Low-bridge scored significantly higher than all other stories in social information ($ps < .01$). High-tiger scored significantly higher than low-trees and high-pea in gender stereotyped behaviour ($ps < .05$). No other significant differences were found. See Table 4 for the mean differences between all stories on each scale.

Table 4. *Significant mean differences between each story after transmission (at p<.05)*

	Mean Difference		
Story	Low Bridge	High Pea	High Tiger
Low Trees	Su: .64	Em: -.58	Re: .70
	So: -1.05	Pl: .83	St: -.69
		Re: .64	
Low Bridge		Pl: .95	Pl: .69
		Su: -1.14	So: .79
		So: .90	
High Pea			St: -.64

Key:

Em – Emotional content	Re - Relevence	So – Social Information
Pl – Plausibility	Su – Survival information	St – Stereotype consistency

Before and after transmission comparison

Mann-Whitney *U* tests were conducted to examine the differences between before and after transmission for each news story (and the material developed from that story by the chains) in each rating scale.

Low-Trees

The plausibility score was found to be significantly lower after transmission (U = 105, $p < .001$). No other significant differences were found (Us = 690-380, $ps > .05$).

Low-Bridge

The plausibility score was found to be significantly lower after transmission (U = 235, $p < .005$) and the social information score was found to be significantly higher (U = 782.5, $p < .05$). No other significant differences were found (Us = 713-584.5, $ps > .05$).

High-Pea

No significant differences were found (Us = 384.5-502.5, $ps > .05$), although the relevance score was marginally significantly different after transmission (U = 384.5, p = .51).

High-Tiger

The emotional content score was found to be significantly lower after transmission (U = 354, $p < .05$) as was the plausibility score (U = 245.5, $p < .005$). No other significant differences were found (Us = 621.5-394.5, $ps > .05$).

Qualitative Analyses

During coding it was observed that certain additions and changes frequently occurred and were common across the stories. As such a qualitative analysis was conducted using NVivo 10 (QSR International, 2012) to assess the frequency of these common alterations. The common changes or additions considered were:

- The addition of MCI concepts, here defined as concepts which breach category level expectations (of folk physics, folk biology etc.).
- The addition of content intended to be found amusing by the reader.
- Exaggeration of elements in the story, either simply the physical dimensions of an element (e.g. the size of the pea in high-pea) or an exaggeration of the story's events (e.g. the landslide in low-trees being deadly).

- The addition of references to popular culture such as celebrities.
- A change to the location of the story's setting.

The results of this frequency based analysis can be seen in Table 5.

Table 5. *Results of the qualitative analysis. The table shows the percentage frequency of common additions or changes made to the stories.*

Addition / Change	Frequency in each story (% of stories)				Frequency in all stories (%)
	Low-Trees	Low-Bridge	High-Pea	High-Tiger	
MCI content	50	40	80	40	52.5
Amusing content	60	60	50	60	57.5
Exaggeration	40	50	60	60	52.5
'Pop culture'	20	40	20	40	30
Location change	20	10	0	10	10

6.4 Discussion

The aim of this study was to examine the effects of intentional guided variation on the evolution of narratives, in this case news stories. In particular the aim of the study was to test if the product of transmission based solely on individual modification rather than recall would reflect the content biases that have been suggested by previous research. To do this two key questions were addressed:

1. Will the product of guided variation reflect the content biases demonstrated in recall-based experiments such as transmission chains and memory tests?

2. Will the choices made by participants when altering the material reflect the choices made by participants in 'choose-to-transmit'-based experiments?

Previous research using recall-based experiments such as transmission chains and memory tests has given support to a number of content biases in cultural transmission. These recall-based studies have suggested a survival information bias (Nairne, 2010; Nairne & Pandeirada, 2008; Nairne, Thompson & Pandeirada, 2007), a social information bias (McGuigan & Cubillo, 2013; Mesoudi et al, 2006; Owens, Bower & Black, 1979; Reysen, Talbert, Dominko, Jones & Kelley, 2011), a bias for stereotype consistency (Allport & Postman, 1947; Bangerter, 2000; Kashima, 2000), and MCI bias (Barrett, Burdett, & Porter, 2009; Barrett & Nyhof, 2001; Boyer & Ramble, 2001; Norenzayan, Atran, Faulkner, & Schaller, 2006; Upal, 2011; Upal, Gonce, Tweney, & Slone, 2007). Emotional content bias has been demonstrated in studies based on recall and also the 'choose-to-transmit' phases of transmission (Berger & Milkman, 2010; Erikkson & Coultas, 2014; Heath, Bell & Sternberg, 2001; Peters, Kashima and Clark, 2009). While stereotype consistency bias has been demonstrated in recall-based experiments, Lyons and Kashima (2006) found that stereotype consistency bias only emerged in a linear transmission chain where there was communicative intent but did not emerge in a recall-based chain. Here, it was tested whether participants would enhance the degree to which material contained emotionally-arousing information, stereotypically-consistent information, social information, survival information and MCI concepts.

In order to examine these issues, an original experimental paradigm was used. For this study participants in a linear transmission chain were given material (original material being an article from the BBC News website) and were asked to alter this material however they wished, in contrast to having to recall it as in traditional transmission chain experiments. Separate groups of participants were used to rate the original material and the material produced by the chains, which allowed comparison of changes in content biases in the initial and resulting material. The results show that there was significant variation in scores between the stories both before and after transmission. Before transmission the

stories could be separated into two groups: those which were rated as more plausible but less emotive (low-trees and low-bridge) and those which were rated as less plausible but more emotive (high-pea and high-tiger). The high-exploit stories also scored higher for survival information, social information and stereotyped content, although the distinction between the two groups was less distinct for these measures. This is largely consistent with expectations of how the news stories would exploit content biases before transmission and allows for a comparison between the two groups with regards to how they are altered through guided variation in transmission. After the material had been transmitted along the chains and altered by participants, the differences in their scores was less marked, that is, there was less to distinguish the two groups. The low-exploit stories became less plausible and in one case (low-bridge) scores significantly increased in social information. The scores for the high-exploit stories were largely consistent between before and after transmission in versions, the only significant change being that high-tiger's emotion score reduced. The only story not to reduce in plausibility was high-pea, although that story had the lowest plausibility score before transmission and it did reduce, just not to a significant degree.

With regards to whether 'the product of guided variation reflects the content biases demonstrated in recall-based experiments such as transmission chains and memory tests', the results suggest, where biased content did increase, this was consistent with the findings of recall-based experiments and is therefore comparable to unintentional changes in transmission. The biases that increased, social information and stereotyped content, have both been demonstrated in recall-based experiments. The fact that this was not consistent across all stories suggests that while certain biases may provide a recall advantage, both individually and cumulatively, these biases are not deliberately added or enhanced when recall is not necessary for transmission and may be uniquely unintentional changes made in recall-based transmission. The finding that stereotype consistent content increased in one

story is consistent with Lyons and Kashima (2006) who found that this bias emerged when there was communicative intent.

With regards to whether 'the choices made by participants when altering the material reflect the choices made by participants in 'choose-to-transmit'-based experiments', the results were not consistent with these studies. While 'choose-to-transmit' studies have found that more emotive content is more likely to be chosen to be transmitted over less emotive content, the degree to which the stories in this study evoked emotion did not alter. The guided variation transmission process did not increase the degree of emotion evoked to a significant degree and in fact one story (high-tiger) which scored higher for emotion before transmission actually reduced in emotion score.

A more detailed qualitative analysis can provide some insight into how the stories were altered and how this may have affected the individual biases scores. Frequently changes were made with the apparent intention of making the story more amusing, in some cases using deliberate punch lines, (for example, having a clown being taken into "CUSTARDy"). This is consistent with an analysis of content biases in urban legends which found amusement to be the most frequently evoked emotion (Stubbersfield, Tehrani & Flynn, under review a, presented in Chapter 2). These attempts at making the stories funny, however, did not translate to increased emotion scores, suggesting that they were unsuccessful. Another common alteration was to exaggerate elements of the story. This could be either a simple increase of the physical dimensions of a story element (for example, the growth mentioned in high-pea is ½ an inch in the original material but became as large as three miles in one version of the story), or an exaggeration of the events described, (for example, the landslides in low-trees becoming deadly). Again, however, these exaggerations did not appear to increase the degree to which the stories evoked emotion and are likely to have contributed to the reduction in plausibility scores.

Exaggeration of narrative elements has been observed in a recall-based transmission chain study, with elements becoming more explicitly violent (Stubbersfield, Tehrani & Flynn, under review c, presented in Chapter 5). This suggests that the intentional exaggeration found in guided variation is comparable to unintentional changes made in recall-based transmission.

Another common alteration that may have reduced plausibility scores was the inclusion of MCI elements (here defined as content which breaches category level expectations, such as acting against folk physics or folk biology, e.g. supernatural elements), which were found in close to half of the material produced by the chains. The MCI elements ranged from mythical creatures, such as unicorns, to more sci-fi like elements, such as space-craft or superheroes. Although this is likely to have reduced the plausibility scores, the inclusion MCI elements could enhance the transmission success of the stories. The introduction of MCI elements (where there were none before) has not been observed in recall-based transmission studies suggesting that it is a uniquely intentional change. The fact that MCI elements are preserved in recall-based transmission, however, suggests that this intentional inclusion of MCI elements reflects cognitive biases. Other, less frequently observed changes reflect tropes commonly seen in urban legends. These include references to popular culture (multiple references were made to the internet 'meme', the 'Harlem Shake'), references to celebrities such as actor Charlie Sheen and location changes. The introduction of celebrities appears to reflect social information bias. By introducing real people likely to be known to the reader, the author of these changes increases the social relevance of the information provided in the narrative, thereby exploiting social information bias.

One of the more unexpected results of the study was that there was not a general increase in the biased content across all the stories. Instead it was found that only one

exploit-low story showed an increase in biased content and that this was not across all biases. This story only increased in social information but in a number of examples both low-exploit and high-exploit stories had MCI elements added to them. One might expect guided variation to work in a similar manner to traditional recall-based transmission and enhance how transmissible the material is by increasing all biases. However, an analysis of urban legends found that even in narratives which have been transmitted multiple times in an online environment the majority only exploited between one and three content biases (Stubbersfield et al, under review a, presented in Chapter 2) so this low degree of change reflects what is observed in 'real world' material. This suggests that there may be an optimum number of biases for a narrative to be maximally transmissible and the findings of this study are consistent with this. Future research should examine the effect of multiple biases by examining which combination of biases make a narrative more memorable and more transmittable, and whether a large number of biases actually make material less transmissible.

The finding that the exploit-high group did not increase in any biases (although MCI content was added to a number of versions) could be explained in a number of ways. First, the participants may not be very skilled in creatively making stories that already exploited biases even more entertaining. Altering a narrative that may already be successful in transmission so that it is even more appealing to an audience could be a challenge and in a real environment only the most successful versions would be selected for transmission by readers. A second explanation draws on a methodological issue. The use of a Likert scale to assess the content means that material which already scored high on this scale had less opportunity to increase after transmission.

Cognitive content biases in guided variation have particular relevance to electronic communication, where recall is not necessary to transmit information. Despite having the

ability to accurately replicate the received information by forwarding it as they received it, people often alter the information before transmitting it themselves. This phenomenon is particularly common in the transmission of urban legends where people may alter the location of a story to make it appear more relevant to those they are transmitting it to, or alter a risqué story into something much more explicit, or include references to a popular celebrity (Brunvand, 2000). An example of this is the 'Written by a Cop' document which has been transmitted through electronic media such as email and *Facebook*. This document began in 2001 as a list of twelve crime safety tips apparently based on a seminar given by personal safety expert Pat Malone. Since then, despite the ease by which it could be simply replicated through copying and pasting, or forwarding, it has changed significantly. A number of the items on the list have been removed and new ones have been added, with one new item being a version of a widely circulated urban legend. As such it has gone from being a list of genuine advice to a list containing both true and false information which is incorrectly attributed to a police officer (see www.snopes.com/crime/prevent/ninetips.asp for more details of this document).

This study is the first to examine how transmission without recall, allowing participants to deliberately alter the material however the wish, may reflect cognitive content biases found in recall-based transmission. As such it is also the first study to explicitly examine content biases in guided variation. Previous research by Mesoudi (2008) compared arrow-head designs produced through context bias and through guided variation and found that under certain circumstances guided variation can produce similar outcomes to cultural transmission. This study found that guided variation is effective in increasing the degree to which material exploits content biases to some extent but only when the original material does not exploit biases to a great extent. Only the suggested content biases of social information and MCI were found to be increased. No other content biases were increased. Unlike recall-based experiments where aspects of material either are

retained or degrade, here new material was introduced increasing the number of biases that material may exploit. Material which already exploits biases to a greater degree was found not to be enhanced by guided variation. The results of this study suggest the importance of both deliberate changes and selection in the evolution of a culturally successful narrative as intentional guided variation alone appears not to enhance narratives to any great degree in terms of their exploitation of content biases.

Future research should examine the effects of motivation on this process as perhaps one of the most interesting aspects of the alterations made to electronic material when it is transmitted is why some would change it at all, rather than simply forwarding it or choosing not to transmit it. With specific audiences or motivations in mind the creative changes made by participants could be very different to those made in this study. Another potential avenue for future research would be to examine the interaction between the choose-to-receive phase of transmission and guided variation in transmission so as to investigate the roles of both selective and mutational processes in cultural evolution.

References

Allport, G.W., & Postman, L. (1947). *The Psychology of Rumor*. New York: Holt, Rinehard and Winston.

Bangerter, A. (2000). Transformation between scientific and social representations of conception: The method of serial reproduction. *British Journal of Psychology*, 97, 405-423.

Barrett, J.L., Burdett, E.R., & Porter, T.J. (2009).Counterintuitiveness in folktales: Finding the cognitive optimum. *Journal of Cognition and Culture*, 9, 271-287.

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

Berger, J., & Milkman, K. (2010). Social transmission, emotion, and the virality of online content. *Wharton Research Paper*.

Bettinger, R. L., & Eerkens, J. (1999). Point typologies, cultural transmission, and the spread of bow-and-arrow technology in the prehistoric Great Basin. *American Antiquity*, 231-242.

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

Boyer, P. (1994). *The Naturalness of Religious Ideas: A Cognitive Theory of Religion*. Berkeley, CA: University of California 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.

Brunvand, J.H. (2000). *The Truth Never Stands in the Way of a Good Story*. Chicago: University of Illinois Press.

Claidière, N., Scott-Phillips, T. C., & Sperber, D. (2014). How Darwinian is cultural evolution?. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *369*(1642), 20130368

Currie T.E., Meade A., Guillon M., & Mace R. (2013) Cultural phylogeography of the Bantu Languages of sub-Saharan Africa. *Proceedings of the Royal Society B: Biological Sciences*, 280.

Dunn, O. J. (1964). Multiple comparisons using rank sums. *Technometrics*, 6, 241-252.

Eerkens, J. W., & Lipo, C. P. (2005). Cultural transmission, copying errors, and the generation of variation in material culture and the archaeological record. *Journal of Anthropological Archaeology*, 24, 316-334.

Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14, 1-26.

Gray R.D., Drummond A.J., & Greenhill S.J. (2009) Language phylogenies reveal expansion pulses and pauses in pacific settlement. *Science*, 323, 479–483.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

Henrich, J., & Broesch, J. (2011). On the nature of cultural transmission networks: evidence from Fijian villages for adaptive learning biases. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366, 1139-1148.

Henrich, J., & McElreath, R. (2003). The evolution of cultural evolution. *Evolutionary Anthropology: Issues, News, and Reviews*, 12, 123-135.

Jordan, F. M., Gray, R. D., Greenhill, S. J., & Mace, R. (2009). Matrilocal residence is ancestral in Austronesian societies. *Proceedings of the Royal Society B: Biological Sciences*, *276*(1664), 1957-1964.

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

LaBar, K.S., & Cabeza, R. (2006). Cognitive neuroscience of emotional memory. *Nature Reviews Neuroscience*, 7, 54-64.

Lycett S.J. (2009). Understanding ancient hominin dispersals using artefactual data: A phylogeographic analysis of Acheulean handaxes. *PLoS One*, 4, e7404.

Lyman, R. L., & O'Brien, M. J. (2003). Cultural traits: Units of analysis in early twentieth-century anthropology. *Journal of Anthropological Research*, 225-250.

Lyons, A., & Kashima, Y. (2006). Maintaining stereotypes in communication: Investigating memory biases and coherence-seeking in storytelling. *Asian Journal of Social Psychology*, *9*, 59-71.

McGuigan, N., & Cubillo, M. (2013). Cultural transmission in young children: When social information is more important than non-social information. *The Journal of Genetic Psychology*, 174, 605–619.

Mesoudi, A. (2008). An experimental simulation of the "copy-successful-individuals" cultural learning strategy: adaptive landscapes, producer–scrounger dynamics, and informational access costs. *Evolution and Human Behavior*, *29*(5), 350-363.

Mesoudi, A. (2009). How cultural evolutionary theory can inform social psychology and vice versa. *Psychological review, 116*(4), 929.

Mesoudi, A. (2011). *Cultural Evolution: How Darwinian Theory Can Explain Human Culture and Synthesize the Social Sciences*. Chicago, IL: University of Chicago Press.

Mesoudi, A. (2013). Studying cultural transmission within an interdisciplinary cultural evolutionary framework. In R. Ellen, S.J. Lycett, & S.E. Johns (Eds.), *Understanding Cultural Transmission in Anthropology: A Critical Synthesis* (pp. 131-147). Oxford, UK: Berghahn Books.

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

Nairne, J.S. (2010). Adaptive memory: Evolutionary constraints on remembering. *Psychology of Learning and Motivation*, 53, 1-32.

Nairne, J.S., & Pandeirada, J.N.S. (2008). Adaptive memory: Is survival processing special? *Journal of Memory and Language*, 59, 377-385.

Nairne, J.S., Thompson, S.R., & Pandeirada, J.N.S. (2007). Adaptive memory: Survival processing enhances retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33, 263-273.

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

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

Peters, K., Kashima, Y., & Clark, A. (2009). Talking about others: Emotionality and the dissemination of social information. *European Journal of Social Psychology,* 39, 207–222.

QSR International.(2012). Nvivo 10 [Computer software].Available from http://www.qsrinternational.com.

Reysen, M. B., Talbert, N. G., Dominko, M., Jones, A. N., & Kelley, M. R. (2011). The effects of collaboration on recall of social information. *British Journal of Psychology*, *102,* 646-661.

Richerson, P. & Boyd, R. (2005). *Not by Genes Alone: How culture transformed human evolution*. Chicago: Chicago University Press.

Runciman, W. G. (2009). *The theory of cultural and social selection*. Cambridge University Press.

Shennan, S. (2002). Genes, memes, and human history: Darwinian archaeology and cultural evolution.

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

Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (under review a). Santa Crucified and Death by Lollypop: Culture, Cognition and the Epidemiology of Urban Legends. *Current Anthropology*.

Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (under review c). Serial killers, spiders and cybersex: social and survival information bias in the transmission of urban legends. *British Journal of Psychology*.

Tehrani, J. J. (2013). The Phylogeny of Little Red Riding Hood. *PloS one*, 8, e78871.

Tehrani, J. J., Collard, M., & Shennan, S. J. (2010). The cophylogeny of populations and cultures: reconstructing the evolution of Iranian tribal craft traditions using trees and jungles. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *365*(1559), 3865-3874.

Upal, M.A. (2011). Memory, mystery and coherence: Does the presence of 2-3 counterintuitive concepts predict cultural success of a narrative? *Journal of Cognition and Culture*, 11, 23-48.

Upal, M.A., Gonce, L.O., Tweney, R.D., & Slone, D.J. (2007). Contextualising counterintuitiveness: How context affects comprehension and memorability of counterintuitive concepts. *Cognitive Science*, 31, 415-439.

Chapter 7

Expect the Unexpected? Testing for Minimally-Counterintuitive (MCI) Bias in the Transmission of Urban Legends. A Computational Phylogenetic Approach.

This chapter expands on the previous studies which have used participant-based experiments by using a computational phylogenetic analysis of MCI concepts in the urban legend 'Bloody Mary'. Phylogenies function as naturally occurring transmission chains and allow the researcher to examine the fidelity in transmission of elements within a story across a greater number of generations. MCI bias was chosen because, although MCI content appears less frequently in urban legends than other biases, it is found in some particularly successful legends such as 'Bloody Mary' and the 'Vanishing Hitchhiker'. A version of this chapter has been published as Stubbersfield, J [1, 2]., & Tehrani, J[1]. (2013). Expect the Unexpected? Testing for Minimally Counterintuitive (MCI) Bias in the Transmission of Contemporary Legends a Computational Phylogenetic Approach. *Social Science Computer Review*, 31, 90-102.

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Abstract

In this study computational methods are used in analysing cultural transmission to examine the role of cognitive selection pressures on the evolution of narratives, the first use of computational phylogenetic analysis in the study of urban legends. It has been suggested that a number of biases in transmission may alter the content and structure of narrative so as to maximise how transmittable it is. One bias that has attracted much attention is Boyer's (1994) Minimally-Counterintuitive (MCI) bias, which suggests that a cognitively optimal number of counterintuitive concepts increase the salience and, therefore, the transmission of a narrative. Previous research has used traditional folklore and religious texts to examine this bias and a cognitively optimum number of 1-2 or 2-3 counterintuitive concepts has been suggested. The present research uses the legend of 'Bloody Mary', an urban legend with MCI elements in a computational phylogenetic analysis to examine the influence of MCI on cultural transmission and evolution. Counterintuitive and intuitive concepts were found to be equally stable in transmission, suggesting that MCI bias may function on the narrative as a whole, rather than individual concepts within it.

7.1 Introduction

Previous research on urban legends has largely been focused on psychoanalytic interpretations of these legends (e.g. Dundes, 1998; Tucker, 2005) and while examples exist (see Eriksson & Coultas, 2014; Heath et al., 2001), relatively little research has utilised these legends as a means to study cultural transmission and evolution. The current study represents the first use of computational phylogenetic analysis in the study of urban legends, and, more generally, demonstrates the important role that computer based techniques can play in the study of cultural transmission and evolution. In this study, it is demonstrated that applications developed to support phylogenetic analysis (in this case PAUP, Swofford, 2003) can be applied to the investigation of how narratives are transmitted and reproduced and potentially to a wide range of cultural forms.

In recent years the study of cultural transmission – i.e. the preservation and modification of socially learned information – has been greatly enhanced by the application of computational quantitative methods, such as mathematical modelling, simulations, and phylogenetic software (see Mesoudi, 2011). The introduction of these techniques has allowed the investigation into the dynamics of cultural evolution to develop from a largely theoretical/philosophical exercise to a fully-fledged empirical research field. In this paper computational phylogenetic methods are adopted to investigate the potential role played by psychological biases on evolution of narratives. It has been proposed that when stories are repeatedly re-told from one person to another they are subjected to cognitive selective pressures which may alter the content and structure so as to make them maximally transmittable (Barrett & Nyhof, 2001). Rather than a process of high fidelity replication, human cultural transmission displays biases and distortions which reflect these cognitive selection pressures. Biases and distortions in recall were first identified by Bartlett (1932) and since then studies have identified a number of potential biases in

transmission. One such bias was suggested by Boyer's (1994) theory of the transmission of counterintuitive ideas, also termed minimally counterintuitive (MCI) bias.

MCI Bias

Boyer (1994) argues that for any category, people hold a host of intuitive assumptions about its member's properties. These intuitive assumptions are generally described as 'folk biology', 'folk physics' and 'folk psychology'. These intuitive assumptions do not involve conscious inspection and are assumed to be cross-cultural (Barrett, 2008). Concepts which violate these category-level expectations are considered to be counterintuitive and feature inherent transmission advantages that can increase the salience of a narrative (Boyer, 1994). Boyer, however, also argues that this effect is not linear and that a balance must be met between satisfying intuitive expectations and violating enough of them to be cognitively optimal. If a narrative features too many counterintuitive concepts it can render it incomprehensible and unmemorable (Boyer & Ramble, 2001). Stories which are considered MCI will balance a minority of counterintuitive concepts with a majority of everyday, intuitive events. Several studies have supported the idea that MCI narratives are cognitively optimal, granting them an advantage in recall and transmission (e.g. Barrett et al., 2009; Barrett & Nyhof, 2001; Boyer & Ramble, 2001; Norenzayan, Atran, Faulkner & Schaller, 2006; Upal, 2011; Upal, Gonce, Tweney, & Slone, 2007). This content bias has been explained in evolutionary terms by Upal et al. (2007), who argues that memory should evolve to preferentially remember and recall events or objects which violate expectations about the future but can be justified once they have been observed. By contrast, Barrett (2000) suggests that MCI concepts hold a transmission advantage because they can be understood and represented without the allocation of too many cognitive resources but are also challenging enough to require increased attention in order to be assimilated into conceptual schemes.

Barrett and Nyhof (2001) used a transmission chain methodology to examine whether MCI narratives have a cognitive advantage. They used traditional Native American folktales (as Bartlett, 1932, had used) and two original stories created for their study, one being a sci-fi style story describing an inter-galactic diplomat's visit to an alien museum and the other being a story describing a brother and sister's journey back home from school. The two original stories were manipulated to vary in the number of counterintuitive and intuitive concepts they described. Barret and Nyhof (2001) found that, after three generations of transmission, counterintuitive and intuitive but bizarre items were recalled in greater proportions than intuitive items. This recall of counterintuitive items was found both immediately and after a three month delay. Barrett and Nyhof (2001) also replicated these findings using oral transmission in a group serving as a mock community. The fact that recall of counterintuitive items was upheld after a three month gap is important, as an idea that is immediately memorable but becomes significantly less memorable with time could not be as culturally successful as those ideas that retain memorability.

Norenzayan et al. (2006) conducted two studies using experimental methodologies other than transmission chains. The first study used lists featuring intuitive and counterintuitive ideas and, while the intuitive ideas were better recalled in the short-term (similarly to the results of Bartlett, 1932) MCI lists had a recall advantage over time. For their second study Norenzayan et al. (2006) used the folktales collected by the Brothers Grimm and had the rated for MCI concepts, memorability and other psychological variables. Norenzayan et al. (2006) found that MCI tales were more likely to be culturally successful (determined by number of hits using a Google web search) and were perceived to be more memorable and more psychologically appealing in terms of understandability and ease of transmission. Norenzayan et al. (2006) suggest that the cognitively optimum level is around two to three counterintuitive objects in a narrative. Norenzayan et al. (2006)

concluded that MCI narratives are culturally successful due to a stronger cognitive advantage in recall compared to other narrative templates.

Barrett (2008) acknowledges some of the issues relating to the empirical study of MCI bias; identifying a difficulty in ascertaining what are and are not counterintuitive concepts in a technical sense and an inability in quantifying just how counterintuitive a concept is. In an attempt to clarify MCI theory and aid the future empirical study of MCI concepts, Barrett (2008) presented a formal system of coding and quantifying the 'counterintuitiveness' of a concept termed the counterintuitiveness coding and quantifying scheme (CI-Scheme). The CI-Scheme uses six steps which include identifying basic level membership and ontological category/categories of a concept and coding for breaches and transfers of expectation sets. Using this scheme a concept can be given a 'counterintuitiveness score'. Barret (2008) suggests that MCI concepts are those which score one for counterintuitiveness and that the cognitive optimum would be a score of one or two, concepts which score three or higher would too counterintuitive to have a transmission advantage and would be discarded for simpler concepts. Barrett et al. (2009) used the CI-Scheme in a study which analysed a cross-cultural selection of seventy-three folktales. Independent coders applied the CI-Scheme to these folktales and it was found that the number of counterintuitive objects ranged from zero to eleven; however, the majority (79.2%) only contained one or two objects. Most of the counterintuitive objects (99%) had a score of one or two, none had a score higher than three. Barrett et al. (2009) uses these findings to argue that the cognitive optimum for the number of counterintuitive concepts in folktales is one or two and that these objects will only violate one or two ontological categories.

MCI in Urban Legends

Previous research into MCI bias has used traditional folklore or religious texts as a means to study its effect on transmission and memorability, however, examples of MCI can also be found in an area of folklore which is less 'canonised'; the urban legend. Urban legends are generally defined as apocryphal stories which are told as true (Brunvand, 2000; Heath, Bell & Sternberg, 2001; Tangherlini, 1990), involve an urban or suburban setting (Brunvand, 2000), and feature a single event, usually an individual experience, as the core of the narrative (Tangherlini, 1990). Other common features are a suspenseful or humorous tone, surprising information, a twist ending, implicit or explicit moral messages and attribution to a "friend of a friend" (Brunvand, 2000; Fox Tree & Weldon, 2007). Urban legends have traditionally been transmitted orally but are now commonly transmitted through electronic media (Brunvand, 2000). The analysis of urban legends can offer a unique means of studying the concerns of modern populations (Brunvand, 2000) and therefore can be a fruitful area to study content biases such as MCI bias.

One example of an urban legend which includes MCI concepts is the legend of 'Bloody Mary'. A wide number of variations of this legend exist but generally the story involves a young girl (the character is female in almost all examples) repeating a certain phrase a specific number of times before a mirror. As a result of the ritual, a frightening, supernatural figure appears and often inflicts violence upon the summoner. Below is a typical example:

> "A long time ago there was a woman named Mary. She was very beautiful and very vain. She had a horrible accident though and her face became so horribly scratched that she bled to death. Her spirit didn't die, she still comes; if you stand in front of a mirror in the dark and say her name three times her face appears. If you do'nt [*sic*]

turn on the light and run away as fast as you can she'll scratch your face off, or some say, drag you into the mirror with her!"

(Collected from http://www.oocities.org/tragicpixie/FLbloodymary.html).

The name and nature of the supernatural figure can vary but most frequently it is a ghost named Mary, with Bloody Mary being the most common variation. Other variations include Mary Worth, Mary Whales, Black Agnes, the White Lady, the Bell Witch (a regional variation specific to Tennessee, USA) and Svarte Madame. Most commonly the summoning phrase is simply the figure's name, and typically it is repeated three times. The figure is sometimes given a back-story, such as being the ghost of a woman executed for witchcraft or a beautiful woman disfigured. If present, the back-story often links to the summoning phrase, for example, the summoning phrase "Bloody Mary, I killed your baby" is often linked to the back-story of Bloody Mary being the ghost of a mother whose children were murdered. The result of the summoning also varies; sometimes the summoner is killed or injured by the supernatural figure, while in other examples a means of escape or protection is present, such as turning on a light or a protective ring of salt.

The Bloody Mary legend is popular and widespread, with similar variations being found in Britain, the USA, Canada, Sweden, Holland, France, Australia, Japan and Thailand (Armitage, 2006). It has also found its way into popular culture, being the focus of horror films such as *Urban Legends: Bloody Mary* (Merrell, Phillips, & Messer, 2005), *Bloody Mary* (Miller & Tyler, 2006), *Dead Mary* (Cameron, Dueck, Glazer, Harrison & Howsam, 2007), *The Legend of Bloody Mary* (Ahrens et al., 2008) and was an influence on the film *Candyman* (Barker & Golin, 1992).

Previous research has suggested that the Bloody Mary legend evolved from much older mirror divination rituals (Armitage, 2006; Klintberg, 1988). In notes on his 1786 poem *Halloween*, Robert Burns (2009) describes a mirror ritual that a woman can use to

see the face of her future husband. This was a popular piece of European folklore from the late 18th to 20th century (Hutton, 2001), with Halloween greetings cards being produced with pictures of the ritual. The results of the ritual could, however, be horrific. It was said that if the woman was destined to die unmarried she would see the face of the Grim Reaper reflected in the mirror (Ellis, 2004). The 19th century ballad *Svetlana* by Vasili Zhukovskii, an example of 'folklore' romanticism (Ryan & Wigzell, 1992) also features the accidental summoning of a horrific supernatural figure; Svetlana is persuaded by her female companions to enact a mirror ritual to see her lover, however, a demon appears in his place. It was also said during the 19th century that if you stare into a mirror for too long the devil would appear (Jones & Kropf, 1883). These examples of traditional folklore are likely to be the ancestors of the modern Bloody Mary legend. It was not until the 1970s, however, that examples of Bloody Mary legends were first published in print. The first examples of 'Mary Worth' legends were published in an anthology of American children's folklore (Knapp & Knapp, 1976) and the first academic writing on the subject was by Longlois (1978). As with any oral tradition, Bloody Mary legends may have existed for many years before they were first published, however, it is argued that the modern Bloody Mary legend originated in the USA (Klintberg, 1988).

Computational Phylogenetic Analysis

The current research uses computational phylogenetic analysis techniques to analyse variations of the Bloody Mary legend. Phylogenetic analysis employs an explicit evolutionary model whereby new entities arise by descent with modification from existing ones. In this context, phylogenetic analysis provides a useful means for estimating relationships of common ancestry among story variants, and examining which traits tend to be preserved and which ones modified. This allows us to explore the influence of MCI elements on the cultural evolution and transmission of a narrative and will particularly

focus on whether the inclusion of an MCI element makes the narrative as a whole more stable, or whether the individual elements vary in stability, with the most stable being those which are MCI. Based on the work of Barrett and Nyhof (2001) and Norenzayan et al. (2006), one would expect the MCI concepts to display greater stability in transmission than the intuitive concepts of the narrative.

The software used for this analysis was Phylogenetic Analysis Using Parsimony (PAUP) (Swofford 2003), a widely used software package for the inference of evolutionary trees that supports a wide range of approaches to phylogenetic analysis and features relatively friendly input for data and output of results. It is proprietary software, but an open source package PHYLIP (PHYLogeny Inference Package, Felsenstein, 1989) is also in common use.

7.2 Methods and Materials

Legend variations were gathered from internet websites (see Appendix J for a full list of sources) using the search key words *bloody mary*. For the purposes of this study, any urban legend which features the purposeful summoning of a supernatural, malevolent figure through a ritual involving a mirror is considered a Bloody Mary legend variation and was included in the dataset. Fragmentary legends were excluded. 45 Bloody Mary legend variations were collected and a total of 36 characters were derived from the sample. These characters included features of the supernatural figure such as appearance, elements of the ritual such as summoning phrase and number of repetitions and other key elements of the narrative (Appendix J for full list of characters). Character states were coded as present or absent.

Table 1. *Representative characters and coding (see Appendix K for full list)*

Character	Trait	Coded As
1	Mary	0 = Absent; 1 = Bloody Mary; 2 = Mary Worth
2	Satan/Devil	0 = Absent; 1 = Present
3	Bathroom	0 = Absent; 1 = Present
4	Name summons	0 = Absent; 1 = Present
5	Belief summons	0 = Absent; 1 = 'I believe in'; 2 = I don't believe in'
6	'Come to/get me' summons	0 = Absent; 1 = Present
7	Baby summons	0 = Absent; 1 = Present
8	Number of phrase repetitions	0 = Absent; 1 = Three; 2 = Seven; 3 = Thirteen; 4 = Twenty; 5 = Unspecified; 6 = Five; 7 = Six; 8 = Fifty; 9 = Ten
9	Beautiful woman disfigured	0 = Absent; 1 = Present
10	Mother of murdered children	0 = Absent; 1 = Present

In order to examine the hypothesis that MCI concepts within a narrative feature a mnemonic advantage, characters were coded as either counterintuitive or intuitive. Characters were coded as counterintuitive if they breach the folk expectations of the ontological categories suggested by Boyer (1994). Characters were only coded as counterintuitive if the 'counterintuitiveness' was a property of that individual character in itself; characters which brought about counterintuitive events in the context of the narrative but did not breach folk expectations themselves, such as the ritual summoning phrase, were therefore considered intuitive (see Barrett 2008). For example, the ritual taking place in a

bathroom (character 3) would not be coded as counterintuitive, as its presence in the narrative does not breach the folk expectations of any ontological categories, however, the supernatural figure appearing through a mirror or out of a bath or sink (character 16) would be coded as counterintuitive, as it breaches the expectations of 'folk physics'.

The character data were analysed using cladistic phylogenetic reconstruction. Cladistic analysis reconstructs relationships by minimising the number of evolutionary changes required to explain the distribution of character states among a group of taxa. This involves distinguishing characters that are evolutionarily novel (also termed apomorphic or derived), from those that were present in the last common ancestor of all the taxa under study, which are labelled ancestral or plesiomorphic. The presence of a derived trait in two or more taxa provides evidence that they are descended from a common ancestor of more recent origin than the ancestors they share with the other taxa under analysis. There are several methods to identify which traits are derived and which are ancestral, the most popular of which is outgroup analysis. An outgroup is defined as a taxon that shares a common ancestor with the taxa under analysis (the ingroup), but is of more distant origin than the ancestor the analyzed taxa share with each other. Since the outgroup does not share an exclusive common ancestor with any individual member of the ingroup, it follows that when a character occurs in two states among the study group, but only one of the states is found in the outgroup taxon, the former is considered the derived state and the latter the ancestral state. For the purposes of these analyses, the variant which most resembles traditional mirror ritual folklore (T42) was used as an outgroup.

Although the principles of cladistics are relatively simple, actually identifying the shortest, or most parsimonious tree (MPT) is usually impossible without the aid of computers as the number of possible trees for any given dataset increases exponentially with the number of taxa. For three taxa (A, B, C), one only needs to compare the number

of steps for three possible trees (AB-C; AC-B; CB-A). But for four taxa one must consider fifteen trees, for seven taxa ten thousand trees, and for ten taxa one would have to evaluate more than 34 million trees. Therefore, most cladistic analyses require specialised software programs that use algorithms to search for the most parsimonious trees. In this study, the heuristic branch-swapping search function in the program PAUP 4.0 (Swofford 2003) was used.

Once phylogenetic relationships among the variants were estimated, the fidelity of transmission from ancestral to descendent taxa was estimated using a statistic known as the Retention Index (RI). The RI is a measure of the number of homoplastic changes a cladogram requires that are independent of its length (Farris, 1989b; 1989b). The RI of a single character is calculated by subtracting the number of character state changes required by the focal cladogram (s) from the maximum possible amount of change required by a cladogram in which all the taxa are equally closely related (g). This figure is then divided by the result of subtracting the minimum amount of change required by any conceivable tree (m) from g. The RI of two or more characters is computed as (G - S)/(G - M), where G, S and M are the sums of the g, s and m values for the individual characters. A maximum RI of 1 indicates perfect fidelity of character transmission, while the lower the fidelity the closer the RI reaches 0. The RI was used to estimate both the overall fidelity of transmission of characters, and to compare counter-intuitive and intuitive characters.

7.3 Results

The number of counterintuitive characters found in the legend variations ranged from 1 to 4 (M = 2.356, sd = .88) and the number of intuitive characters found in the legend variations ranged from 1 to 10 (M = 5.756, sd = 2.18). 91.12% of legend variations featured between one and three counterintuitive concepts.

The cladistic analysis in PAUP returned 47 most parsimonious trees (MPTs) (i.e. there were 47 trees that required an equal number of evolutionary changes). The character RIs of two consensus trees were used for analysis. One tree represented relationships that occur in the majority of the MPTs, referred to as the Majority Rules Tree (Figure 1), and another tree represented relationships that occur in all of the MPTs, referred to as the Strict Tree (Figure 2).

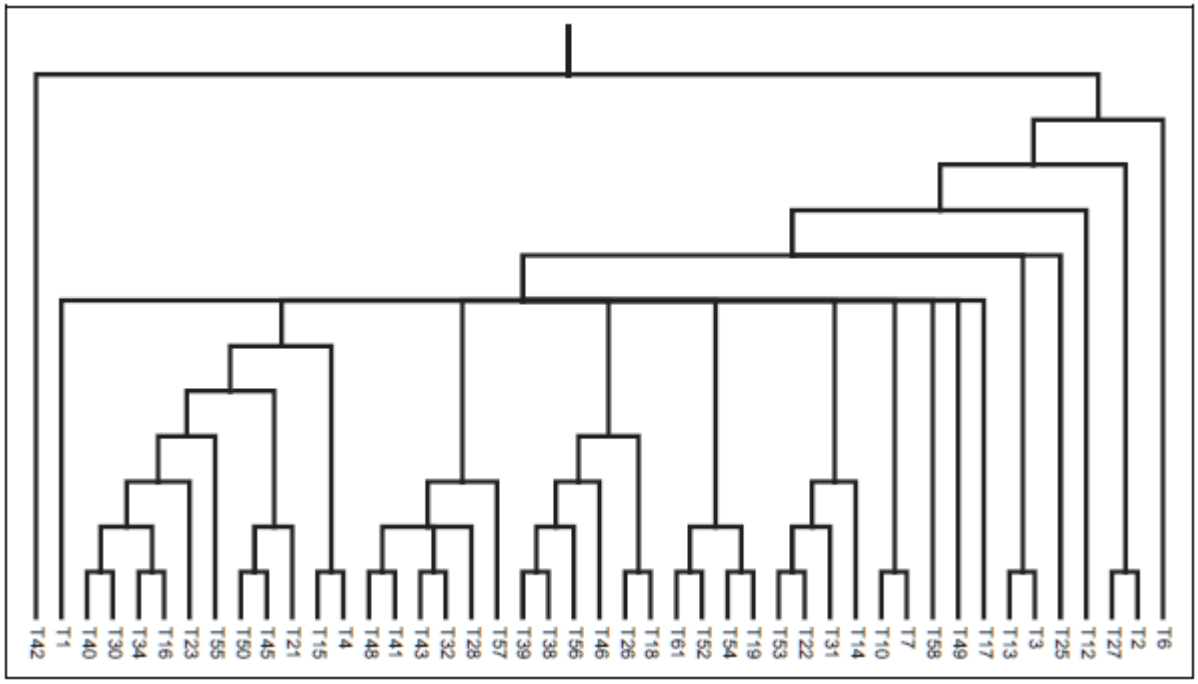

Figure 1. Majority rules consensus of the most parsimonious trees returned by the cladistics analysis.

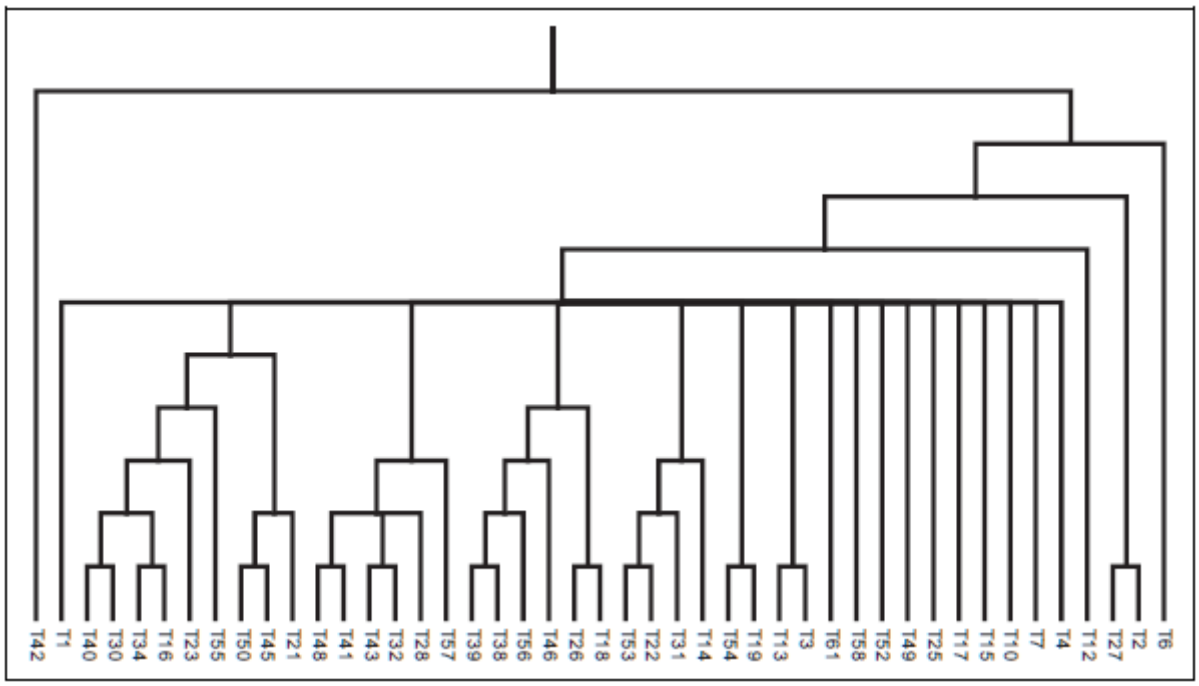

Figure 2. Strict consensus of the most parsimonious trees returned by the cladistics analysis.

The RI of all the characters on the two consensus trees was 0.53. As the data were not normally distributed, a Mann-Whitney *U* test was conducted to compare the individual RIs of counterintuitive and intuitive characters (see Table 2 for the mean RIs of counterintuitive and intuitive characters and Appendix L for the RIs of each individual character). No significant difference was found in either the Majority Tree ($U = 85$, $z = -1.62$, $p > .05$) or the Strict Tree ($U = 80$, $z = -1.82$, $p > .05$). The frequency of appearance in the variations of counterintuitive and intuitive characters was also compared using a Mann-Whitney *U* test but no significant difference in frequency of appearance was found ($U = 105$, $z = -0.89$, $p > .05$).

Table 2. *The mean RIs for counterintuitive and intuitive characters in the Majority Rules and Strict Tree (see Appendix L for the RIs of each individual character).*

	Mean RI (SD)	
	Majority Tree	Strict Tree
Intuitive Characters (N = 10)	.48 (.34)	.42 (.33)
Counterintuitive Characters (N = 26)	.27 (.35)	.21 (.33)

7.4 Discussion and Conclusions

The RIs of all the characters on the two consensus trees are considered low by the standards of other real and simulated cultural datasets (Collard, Shennan, & Tehrani, 2006; Nunn, Arnold, Matthews, & Borgerhoff Mulder, 2010). This indicates that the Bloody Mary story is transmitted with generally poor fidelity from ancestral to descendent version. One explanation for this finding concerns the nature of the legend itself and how it has traditionally been transmitted. For at least thirty years, Bloody Mary legend variations have been more often transmitted orally in a group setting rather than between individuals (Dundes, 1998) suggesting that the most likely form of transmission is non-linear. Rather than one individual passing on their version of the legend to another individual, a group of people may bring together different versions and elements of all of them may be combined and transmitted. At present there has been little research into the effects of group transmission on the cultural evolution of a narrative, the most commonly used experimental paradigm has been the linear transmission chain, where an individual transmits a single narrative to another individual (Eriksson & Coultas, 2012). Barrett and Nyhof (2001) and Marques, Páez, Valencia and Vincze (2006) both used experimental

designs in which multiple cultural parents were used but no analysis was conducted to compare this with a traditional linear design. Eriksson and Coultas (2012) did examine the influence of a two cultural parent design, where each participant receives transmission from two separate sources, and found that recall was greater in the two cultural parent chains than single or double transmission chains. Items which were present in both versions of the story were most stable in transmission and items which were unique to the first story heard had a recall advantage over items which were unique to the second story. How group transmission, where versions are not presented simply one after the other and where items may directly compete with each other, as they may between Bloody Mary legend variations, effects the transmission and evolution of a narrative has not yet been explored but it could explain the weak phylogenetic signal found in these trees.

As the Bloody Mary variations were collected from the internet rather than oral sources, it is possible that this effected their transmission. Unlike oral transmission the electronic transmission of a narrative allows people to copy exactly what has been sent to them, without the limitations of recall. As a means to check if the Bloody Mary legend variations used in analysis appeared to be copied from one another, the variations were entered into *Turnitin* a computer programme designed to compare academic essays and check for plagiarism. None were found share more than 10% similarity except for two pairs which shared around 50%, however, these pairs appeared to just be close variations rather than the result of direct copying. As a result it was deemed that these variations were likely to have been largely derived from orally transmitted versions rather than solely electronically transmitted versions.

Norenzayan et al. (2006) and Barrett (2008) both suggest a fixed cognitive optimum number of counterintuitive concepts to be found in a story. The range of counterintuitive characters present in the Bloody Mary legends was found to be one to

four, with an average of 2.36. This average falls within the cognitive optimum of two to three counterintuitive concepts as suggested by Norenzayan et al. (2006) and comes close to the one to two cognitive optimum suggested by Barrett (2008); the majority of stories (91.12%) featured one to three counterintuitive concepts with very few featuring four; none featured more than this. The research conducted by Norenzayan et al. (2006) and Barrett (2008) used traditional folktales, such as those collected by the Grimm Brothers, to derive their cognitive optimum and suggest that it would be true of all stories. The results of the current research suggest this may be the case, as a similar number of counterintuitive concepts were found in variations of an urban legend. It also suggests that urban legends and traditional folktales may feature structural similarities in terms of MCI content.

The finding that there was no difference in the RIs or appearance frequency of counterintuitive and intuitive characters, however, suggests that the counterintuitive characters were as stable in transmission as the intuitive characters and, therefore, may not be inherently more memorable as individual concepts. Should counterintuitive concepts feature an inherent mnemonic advantage, one would expect them to be more stable in transmission and the RI of counterintuitive characters would be significantly higher than intuitive characters. As this was not the case it suggests that the transmission advantage of MCI bias works as a function of the narrative as a whole rather than the individual concepts within it. Although it could be argued that the weak phylogenetic signal in both sets of characters means that we should not read too much into these findings, it is worth recalling that a comparison of the raw frequencies of counterintuitive and intuitive characters also found no significant difference. Again, this contradicts the prediction that counterintuitive traits are more likely to be copied than intuitive ones.

These findings are supported by Upal et al. (2007; 2011) who refers to the hypothesis that the presence of a specific number of MCI concepts increases the

memorability of a narrative as the Fixed MCI-narrative template (FMNT) hypothesis and conducted a series of studies intended to critically examine this. Upal (2011) found that the inclusion of counterintuitive concepts only increases the memorability of a narrative if the concepts make the story more coherent. He suggests that the global cohesion of the narrative is a key mediating factor in its memorability and calls into question the idea that there is a specific cognitive optimum for all narratives. Upal also argues that memorabilty is not a property of a concept but it is a property of the concept, its context, and the background knowledge of the comprehendor, therefore the memorability of a concept will vary depending upon its context and this context should not be ignored when examining transmission (Upal, 2011). The importance of the context in which counterintuitive concepts are presented is also supported by Atran and Norenzayan (2004) who found that recall for counterintuitive concepts only increased when they were surrounded by intuitive concepts, suggesting that the counterintuitive concepts were not inherently more memorable, they only became more memorable when placed in a context of intuitive concepts. The interaction between counterintuitive and intuitive concepts within a narrative and their joint influence on its cultural transmission is an area that is yet to be fully explored.

In conclusion, this study demonstrates that urban legends provide rich data for studying processes in cultural transmission. Previous research analysing urban legends has primarily been focused on psychoanalytic interpretation of the legends (e.g. Dundes, 1998, Tucker, 2005) and while examples exist (see Heath et al. 2001; Eriksson & Coultas, 2014), relatively little research has utilised these legends to investigate how narratives and other cultural forms might be influenced by cognitive biases such as MCI bias. The phylogenetic analyses of Bloody Mary presented here represent significant steps in that direction and, it is hoped, further underline the important role that computer based techniques can play in the study of cultural transmission and evolution.

References

Ahrens, R., Locke, R.J., Sawyer, G. (Producers), & Stecenko, J. (Producer & Director). (2005). *The Legend of Bloody Mary* [Motion picture]. United States: MK4 Productions.

Armitage, M. (2006). 'All about Mary': Children's use of the toilet ghost story as a mechanism for dealing with fear, but fear of what? *Contemporary Legend*, 9, 1-27.

Atran, S., & Norenzayan, A. (2004). Religion's evolutionary landscape: Counterintuition, commitment, compassion, communion. *Behavioral and Brain Sciences*, 27, 713–770.

Barker, C., Golin, S. (Producers), & Rose, B. (Director). (1992). *Candyman* [Motion picture]. United States: Propaganda Films.

Barrett, J.L. (2000). Exploring the natural foundations of religion. *Trends in Cognitive Sciences*, 4, 29- 34.

Barrett, J.L. (2008). Coding and quantifying counterintuitiveness in religious concepts: Theoretical and methodological reflections. *Method and Theory in the Study of Religion*, 20, 308-338.

Barrett, J.L., Burdett, E.R., & Porter, T.J. (2009). Counterintuitiveness in folktales: Finding the cognitive optimum. *Journal of Cognition and Culture*, 9, 271-287.

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

Bartlett, F.C. (1932). *Remembering*. Oxford, UK: Macmillan.

Boyer, P. (1994). *The Naturalness of Religious Ideas: A Cognitive Theory of Religion*. Berkeley, CA: University of California 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.

Brunvand, J.H. (2000). *The Truth Never Stands in the Way of a Good Story*. Chicago: University of Illinois Press.

Burns, R. (2009). *The Poems and Songs of Robert Burns: The Five Foot Shelf of Classics, Vol. VI*. New York: Cossimo, Inc.

Cameron, P., Dueck, J., Glazer, H., Harrison, K., Howsam, G. (Producers), & Wilson, R. (Director). (2007). *Dead Mary* [Motion picture]. Canada: 235 Films.

Collard, M., Shennan, S.J. & Tehrani, J.J. (2006) Branching, blending and the evolution of cultural similarities and differences among human populations. *Evolution and Human Behavior 27*, 169 – 184.

Dundes, A. (1998). Bloody Mary in the mirror: A ritual reflection of pre-pubescent anxiety. *Western Folklore*, 57, 119-135.

Ellis, B. (2004). *Lucifer Ascending: The Occult in Folklore and Popular Culture*. Lexington, Kentucky: University of Kentucky Press.

Eriksson, K., & Coultas, J. C. (2012). The advantage of multiple cultural parents in the cultural transmission of stories. *Evolution and Human Behaviour*, 33, 251-259.

Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14, 1-26.

Felsenstein, J. 1989. PHYLIP - Phylogeny Inference Package (Version 3.2). Cladistics 5: 164-166. (Software homepage: http://evolution.gs.washington.edu/phylip.html)

Fox Tree, J.E., & Weldon, M.S. (2007). Retelling urban legends. *The American Journal of Psychology*, 120, 459-476.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

Hutton, R. (2001). *Stations of the Sun: A History of the Ritual Year in Britain*. Oxford: Oxford University Press.

Jones, W.H., & Kropf, L.L. (1883). Magyar folk-lore and some parallels. *The Folklore Journal*, 1, 354-362.

Klintberg, B. (1988). "Black Madame, come out!" On school children and spirits. *Arv: Scandanavian Yearbook of Folklore*, 44, 155-167.

Knapp, M., & Knapp, H. (1976). *One potato, two potato.... The secret education of American school children*. New York: W.W. Norton.

Lipo, C., O'Brien, M., Collard, M. & Shennan, S. J. (Eds.) *Mapping our ancestors: phylogenetic approaches in anthropology and prehistory*. New Brunswick: Aldine Transaction

Longlois, J. (1978). Mary Whales, I believe in you: Myth and ritual subdued. *Indiana Folklore*, 9, 5-33.

Marques, J., Páez, D., Valencia, J., & Vincze, O. (2006). Effects of group membership on the transmission of negative historical events. *Psicologia Politica*, 32, 79–103.

Merrell, A., Phillips, L., Messer, S. (Producers), & Lambert, M. (Director). (2005). *Urban Legends: Bloody Mary* [Motion picture]. United States: NPP Productions Inc.

Mesoudi, A. (2011) *Cultural Evolution: How Darwinian Theory Can Explain Human Culture and Synthesize the Social Sciences*. Chicago, IL: University of Chicago Press.

Miller, T.W., Tyler, K. (Producers), & Valentine, R. (Director). (2006). *Bloody Mary* [Motion picture]. United States: KAT Pictures.

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

Nunn, C. L., Arnold, C., Matthews, L. & Borgerhoff Mulder, M. (2010). Simulating trait evolution for cross-cultural comparison. Philosophical Transactions of the Royal Society 364:61–69

Ryan, W.F., & Wigzell, F. (1992). Gullible girls and dreadful dreams. Zhukovski, Pushkin, and popular divination. *The Slavonic and East European Review*, 70, 647-669.

Swofford, D. L. (2003). PAUP*. Phylogenetic Analysis Using Parsimony (*and Other Methods). Version 4. Sinauer Associates, Sunderland, Massachusetts. (Software homepage: http://paup.csit.fsu.edu/)

Tangherlini, T.R. (1990). "It happened not too far from here...": A survey of legend theory and characterization. *Western Folklore*, 49, 371-390.

Tucker, E. (2005). Ghosts in mirrors: Reflections of the self. *The Journal of American Folklore*, 118, 186-203.

Upal, M.A. (2011). Memory, mystery and coherence: Does the presence of 2-3 counterintuitive concepts predict cultural success of a narrative? *Journal of Cognition and Culture*, 11, 23-48.

Upal, M.A., Gonce, L.O., Tweney, R.D., & Slone, D.J. (2007). Contextualising counterintuitiveness: How context affects comprehension and memorability of counterintuitive concepts. *Cognitive Science*, 31, 415-439.

Chapter 8

General Discussion

8.1 Aims and Findings

The key aim of this thesis was to examine the role of content biases in the cultural transmission and evolution of information. As in several previous studies examining content biases (e.g. Bangerter, 2000; Barrett & Nyhof, 2001; Mesoudi, Whiten & Dunbar, 2006) a narrative form was used, in this case urban legends. This research sheds new light on how content biases operate and how they may influence the cultural evolution of a narrative. It also bridges some gaps in the current literature. Previous research has focused on examining a single bias and has mostly used recall-based paradigms; in contrast, some of the studies here examine how biases can be combined in a single narrative and how this affects their transmission. Also, it was considered that a narrative may exploit biases beyond the target bias of research, hence all of the material used in participant experiments was rated for characteristics thought to influence transmission, such as plausibility and biased content. Non-recall based paradigms were used, including both a computational approach and a unique non-recall based transmission chain paradigm. Another aim was that this research would contribute to the body of literature examining the cultural success of urban legends by using theories from cultural evolution, rather than theories taken from the traditions of psychoanalysis, sociology and social-anthropology.

Chapter 2 presented analyses of 254 randomly selected urban legends taken from the internet. The study found that over 90% of the legends exploited at least one of the known content biases. Emotional content bias and social information bias were found to be the most frequently exploited biases, being coded as present in 78% and 77% of the legends respectively. Based on the range of the number of biases exploited by the legends it was suggested that a 2-3 biases within a narrative may be cognitively optimal in cultural

transmission. **Chapter 3** presented a study in which legends were rated by participants on scales relevant to content biases. This was done with the intention of providing information that could be used to select legends for the transmission chain experiments presented in the thesis. **Chapter 4** presented a linear transmission chain study examining emotional content bias which found that a higher level of emotion granted an advantage in cumulative recall along the chains. This was true regardless of the emotion evoked demonstrating this bias operates on content which evokes emotions other than disgust, with amusement, interest and surprise also granting an advantage. The emotional valence of content had no effect. **Chapter 5** presented a study in which the transmission of urban legends containing social information, survival information and combining both were compared at three stages of transmission: choose-to-receive, encode-and-retrieve (using a linear transmission chain design) and choose-to-transmit. It was found that legends containing social information had an advantage over legends containing survival information at the encode-and-retrieve phase of transmission but there was no significant difference between them at the other two stages. Combining both types of information had no apparent effect, with the combined legends operating in the same manner as social information legends. **Chapter 6** presented a study which examined intentional guided variation and how it may reflect the cognitive content biases seen in recall-based transmission. Previous research has found that the product of guided variation can resemble the product of context biased transmission in certain circumstances. This study found that the product of guided variation can enhance the degree to which material exploits content biases to some extent but only when the original material did not already exploit biases to a great extent. **Chapter 7** extended on the previous micro-culture style experiments to a phylogenetic analysis of the urban legend 'Bloody Mary'. This allowed the examination of the fidelity in transmission of MCI elements across many generations. It found that intuitive and counterintuitive concepts were equally stable in transmission and suggested that it is the narrative as a whole which

gains a transmission advantage with MCI content rather than the individual concepts within it.

8.2 Overview and Implications

Taken together the results of these studies have a number of implications for understanding how cognitive content biases operate in cultural transmission and provide a greater understanding of the cultural success of urban legends. The importance of social information in cultural transmission was suggested by a number of studies. Social information was (i) shown to have an advantage over survival information in Chapter 5, (ii) one of two biases enhanced by guided variation in Chapter 6 and (iii) the one of the two most frequently present biases in Chapter 2. Together, these results suggest that social information bias is highly effective in cultural transmission and is likely to grant a greater advantage in transmission than other suggested content biases (with the exception perhaps of emotional content bias). In order to be culturally successful, urban legends are likely to exploit this bias by featuring social interaction at the core of the narrative. Other biases, which may be less effective in enhancing the transmission of a narrative, are likely to 'piggy-back' on social information, as in the combined social-survival legends used in Chapter 5 or those described in Chapter 2. It is probable that this result is not unique to urban legends and would also be true of other narratives. The success of social information in cultural transmission (especially over survival information at the level of recall) provides excellent support for the *Machiavellian Intelligence* (Byrne & Whiten, 1988, Whiten 1999) or *Social Brain* (Dunbar, 1998, 2003) hypotheses of human intelligence evolution and that social information is an evolved heuristic in social learning.

Another bias that emerged as a candidate for being particularly effective in cultural transmission was emotional content bias. This bias was the most frequently present in the urban legends analysed in Chapter 2 and was shown to grant an advantage in cumulative

recall in Chapter 4, regardless of the specific emotion evoked or its emotional valence. Given the well-established role of emotion in memory in individual recall tests (LaBar & Cabeza, 2006) this finding is not surprising; however, it has not been clearly demonstrated with regards to cultural transmission (outside of disgust) prior to the studies presented here. It is also worth investigating as studies have shown that cumulative recall tests may not necessarily replicate individual recall tests; for example, studies into stereotype consistency bias have found that stereotype inconsistent information is recalled better than stereotype consistency bias at the individual level (Dijksterhuisand & van Knippenberg, 1995; Kashima, 2000; Macrae, Hewstone, & Griffiths, 1993) but in cumulative recall, stereotype consistent information is recalled better (Allport & Postman, 1947; Bangerter, 2000; Kashima, 2000). The finding that valence had no effect on the cumulative recall of legends explains the prevalence of legends which evoke negative emotions such as disgust. Despite this finding, however, the positively valenced emotion of amusement was the most frequently evoked emotion in the urban legends analysed in Chapter 2. This is perhaps counter to the typical image of urban legends, which are often portrayed as evoking disgust or fear and suggests that urban legends exploit a wide range of emotions including amusement, surprise and interest. Previous research has not examined what other types of biased content may be linked to particular emotions and a key finding of Chapter 2 was the frequent combination of social information and content evoking amusement in urban legends. The findings suggest that a narrative describing social interaction which evokes amusement is likely to be particularly salient in cultural transmission; this is true of urban legends and is likely to be true of other forms of narrative.

Survival information bias has been previously suggested by results demonstrating that survival processing grants a mnemonic advantage in individual recall experiments compared to other forms of processing. The studies presented here represent the first time survival information bias has been demonstrated in cultural transmission based

experiments. It was shown to have a transmission advantage over control material in the study presented in Chapter 5, although not to the same extent as social information at the encode-and-retrieve phase. Survival information was also the third most frequently present bias in Chapter 2, although it was far behind social information and emotional content. The prevalence of survival information in urban legends could be explained by these legends exploiting other biases to gain an advantage in transmission that survival information alone would not grant. This finding in particular could have 'real world' applications. It would be worth examining how information is transmitted in public health campaigns, if it is presented as survival information alone, its success may be enhanced by adding some form of social information or social context to the survival information.

An interesting contradiction when comparing the results is with regards to MCI bias. In the analyses of urban legends presented in Chapter 2, MCI was shown to be the least frequently present bias, being present in only 6% of the legends analysed. In Chapter 6, however, close to half of the material was modified by participants through intentional guided variation to include MCI concepts. As the legends analysed in Chapter 2 were collected from the internet, their evolution is likely to have been influenced by both guided variation and copying error, so one might expect a higher number of legends containing MCI elements than were found, based on the results of Chapter 6. A possible explanation for the relative scarcity of MCI urban legends is the potential reduction in plausibility or coherence that adding MCI elements could bring, as suggested in Chapter 6. As urban legends are told as true, implausible legends once generated may not be selected for by audiences or tellers and therefore will either be altered to become more successful or stop being transmitted. Heath, Bell and Sternberg (2001) found that plausibility increased participants' willingness to pass an urban legend on, although this was less important than emotional content, so it is feasible that as plausibility reduces urban legends are transmitted less. However, when considering MCI in urban legends, it is worth noting that one of the

most culturally successful urban legends, 'Bloody Mary' (used in analysis for Chapter 7), contains MCI elements, it is also one of the few urban legends suggested to have ancestors originating before WWII. It may be the case that, while MCI urban legends are less frequent, those that survive transmission are highly successful in the cultural landscape. It is also worth considering that MCI elements are much more common in traditional folklore, which is also much older, suggesting that folktales which contain MCI elements, if successful, can retain their cultural success for hundreds or even thousands of years. It may be the case that urban legends which exploit MCI, such as Bloody Mary, will survive in culture for much longer than those which exploit other biases. The questions raised here with regards to MCI and urban legends suggest that examining MCI bias in a contemporary non-religious context would be an interesting area for future research.

Taken in the broader context of content biases in cultural transmission these results have a number of implications. From a theoretical standpoint the results demonstrate that content biases may not each operate in the same way and may differ in the degree of transmission advantage that they grant material. This, in turn, may suggest that different biases are operating differently at a cognitive level. They also demonstrate that cognitive biases may be reflected in guided variation but not necessarily in the same manner as in transmission which involves recall. It may be possible that guided variation in general is actually less successful at producing narratives which successfully exploit content biases than recall-based transmission. There also may be a strong influence of individual differences in producing successful narratives through guided variation, as some individuals may be more creative or more 'in tune' with what will be culturally successful in transmission. Another interesting implication is that there may be a cognitive optimum for the number of content biases that material exploits. Previous research has suggested that there may be a cognitive optimum for counterintuitive elements in a narrative but no research has examined the potential for a cognitive optimum for content biases in general.

This cognitive optimum may operate in a similar manner to MCI, in that simply adding more biased content will reduce the coherence of the narrative and make it less memorable or appealing.

In practical terms these studies have a number of implications for future research examining content biases in cultural transmission. First, they demonstrate the efficacy of using 'real world' material in experiments. However, this does present its own challenges in terms of controlling for confounding variables, in that the urban legends used are different stories and can vary in a number of ways that could impact on the results of the experiment. Here, emphasis was placed on how the urban legends varied in ways that one would expect to impact on their recall, based on previous research. As such, efforts were made to gather data about the content of the urban legends that could predict recall, largely the extent to which each legend exploited known content biases. With this done, when the legends were selected an informed choice could be made and so when examining the results, informed interpretations of the data could be made with potentially confounding content controlled for. It is worth noting that even original material created for an experiment may exploit content biases outside of that bias of interest and that this should be considered when examining content biases in cultural transmission experiments. Thorough assessment of the biases exploited by material of any kind allows the experimenter to control for confounding biases and provide a rigorous explanation of the results. Despite the practical challenges presented by using real world material, using urban legends provided an ecologically valid model of transmission as participants were transmitting the same kind of material in an experimental setting that is actively transmitted between people in the real world and may better reflect this transmission.

Second, urban legends were shown to be particularly useful as they exploit all biases that have been demonstrated by previous studies. This also means they can be useful

in examining how biases can be combined into a single narrative. Third, the studies presented here also demonstrate the efficacy of using methods drawn from cultural evolution to examine folklore (urban legends can be considered a contemporary form of folklore). Traditionally the study of folklore has been dominated by psychoanalytic interpretation and theories drawn from socio-cultural anthropology or sociology, the studies presented here are among other more recent studies (such as Tehrani, 2013) that have used modern techniques influenced by cultural evolution theory to provide further insight into the cultural success of folklore. Fourth, the results of Chapter 5 demonstrate the importance of considering different phases of transmission. In that chapter, social information was shown to have an advantage over survival information, but only at the encode-and-retrieve phase of transmission, not in either the choose-to-receive or choose-to-transmit phases. Future research should consider all three phases when demonstrating a content bias in transmission as doing so can provide greater insight into how the bias operates. It may just operate as a recall effect for example, or only be present when there is communicative intent, as was found for stereotype consistency bias by Lyons and Kashima (2006). By doing this it may be possible to classify content biases into two categories – recall-based and audience-based, although some biases could be considered both (emotional bias for example has been demonstrated across all three phases of transmission by Eriksson and Coultas, 2014).

8.3 Avenues for Future Research

The studies presented in this thesis suggest a number of avenues for future research. Guided variation and how it may resemble content biased transmission offers a number of interesting avenues for research, especially given that guided variation is unique to cultural evolution. Future research could examine the differences and similarities between content produced by recall-based transmission chains and material produced by guided variation

chains. This would provide an excellent insight into how guided variation operates with regards to content biases. Guided variation is particularly pertinent when considering the electronic transmission of narratives as recall is not required for transmission and yet transformation of material does occur. Examining the manner in which information is deliberately changed in electronic communication and the motivation behind these changes would be an interesting avenue for future research. This may be something that could not be done experimentally but could be done in conjunction with experiments examining guided variation in transmission.

Emotional content bias is also an area where further research would be highly beneficial. Despite being well established in relation to memory (Labar & Cabeza, 2006), except for a few cases (Eriksson & Coultas, 2014; Heath et al., 2001), emotional content bias in cultural transmission has not been thoroughly researched, especially given the wide range of emotions that could be evoked by material and the level of influence it has on transmission. One potential method would be to use more experimental means of testing for the degree of emotion evoked, such as galvanic skin response, rather than self-report measures. These methods have been used to great success in individual recall experiments but have not been used in transmission based experiments.

The results of the studies presented here could provide assumptions for the computer modelling of cultural transmission with different assumptions for different phases of transmission. Rather than a single probability of information being transmitted, there could be distinct probabilities for receiving information, retaining information and transmitting information. The results of this modelling could be compared to the analysis of urban legends presented in Chapter 2 and could be used to examine, for instance, the relative prevalence of social and survival information in urban legends. The suggestion that there may be a cognitive optimum for the number of biases in a narrative also presents an

interesting area for future research. This could be approached in a similar manner to those studies which have examined a cognitive optimum for the number of MCI elements within a narrative by manipulating how many biases the experimental material exploits. The differences between recall-based and non-recall-based transmission could also be compared with regards to this cognitive optimum as it may be that without recall cognitive limits may not be relevant.

The interaction between content and context biases would be another interesting avenue for further research as no material is transmitted in a vacuum, the influence of context biases on how biased content is transmitted would be fascinating to examine. Model based biases, such as prestige bias, may have an effect on the transmission of an urban legend, in that learners may be more credulous of information provided by a high status individual. The degree to which a model influences transmission may depend on the content of the information being transmitted, for instance a doctor may by more influential in transmitting health-related survival information compared to other types of content. The relative effectiveness in transmission of content biases and context biases could be investigated by having material which exploits content biases to a greater and lesser degree transmitted along a transmission chain featuring high and low prestige individuals. The interaction between content and context biases could also be examined through network analysis by examining how the relative prestige of different nodes effects the transmission of different types of content through the network.

Cross-cultural studies could also provide interesting insights into how content biases operate, especially comparisons between social and survival bias. For example, survival information may be more salient in cultures where people's survival is less secure. Ethnographies of traditional folklore of foraging peoples have found that they contain both ecological formation relevant to survival, such as foraging and hunting information, and

information relevant to social interaction, such as kinship, deception and interpersonal conflict (Sugiyama, 2001) but it would be interesting to examine these biases experimentally with participants whose survival is less secure than western students. Cross-cultural studies could also be used to examine cultural differences across the three phases of transmission and how this impacts on what kind of information is successful in different cultural environments. Culture may have a large impact on the choose-to-receive and choose-to-transmit phases of transmission as, even if material has an advantage at the encode-and-retrieve phase, if it is not culturally acceptable to transmit these stories they will not be successful across all three phases. Sexually explicit material for example may exploit emotional bias or social information bias and be well recalled but in a number of cultures its transmission would be restricted and may not be visibly culturally successful.

8.4 Conclusions

In conclusion the studies presented in this thesis demonstrate that content biases are an effective force in the cultural transmission of information. Humans exhibit cognitive biases towards preferentially receiving, recalling and transmitting certain types of information over others, however, these biases may not operate in exactly the same manner as each other. Some biases, such as social information bias and emotional content bias, were shown to be particularly salient. Also, content biases are unlikely to appear alone in naturally occurring material and are more likely to be found in combination with other biases. There may be a cognitive optimum for the number of biases that can be combined in a successful narrative. The studies also suggest that the cultural success of urban legends can be adequately explained by humans' susceptibility to content biases and that the psychology of individuals should be considered when explaining the success of cultural artefacts. Urban legends have been shown to exploit known biases, often multiple ones, and as such are evidence of the selective pressures that these cognitive biases create.

References

Allport, G.W., and Postman, L. (1947).*The Psychology of Rumor*. New York: Holt, Rinehard and Winston.

Bangerter, A. (2000). Transformation between scientific and social representations of conception: The method of serial reproduction. *British Journal of Psychology*, 97, 405-423.

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

Dijksterhuis, A., and van Knippenberg, A. (1995). Memory for stereotype-consistent and stereotype-inconsistent information as a function of processing pace.*European Journal of Social Psychology*, 25, 689-693.

Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14, 1-26.

Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

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

LaBar, K.S., & Cabeza, R. (2006). Cognitive neuroscience of emotional memory. *Nature Reviews Neuroscience*, 7, 54-64.

Lyons, A., & Kashima, Y. (2006). Maintaining stereotypes in communication: Investigating memory biases and coherence-seeking in storytelling. *Asian Journal of Social Psychology, 9*, 59-71.

Macrae, C.N., Hewstone, M., and Griffiths, R.J. (1993).Processing load and memory for stereotype-based information.*European Journal of Social Psychology*, 23, 77-87.

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

Sugiyama, M.S. (2001). Food, foragers, and folklore: The role of narrative in human subsistence. *Evolution and Human Behaviour*, 22, 221-240.

Tehrani, J. J. (2013). The Phylogeny of Little Red Riding Hood. *PloS one*, 8, e78871.

Appendices

A. Complete text of the legends used and the control material

1. Tumour (used in Chapter 4)

A woman went into a takeaway and ordered a chicken burger but asked for it without mayonnaise. After leaving the restaurant she bit into the burger and discovered that there was mayonnaise in it after all, but she finished the burger anyway. Later that evening, she checked herself into the local hospital after falling violently ill with food poisoning. Her stomach was pumped and the doctors discovered that the chicken in her burger had contained a tumour and that the sauce wasn't mayonnaise, it was pus from the tumour.

2. Noodles

A UK student who couldn’t cook resorted to eating instant noodles every day. When he developed terrible stomach aches he went to the doctor who found a layer of wax lining the wall of his stomach. The doctor told him that instant noodles are coated in edible wax to prevent them from sticking together during cooking but that your body needs two days to clear the wax or it can build up and cause problems. The student had to have an operation to remove the wax from his stomach.

3. Cyst (used in Chapter 4 and Chapter 5)

A woman underwent an operation to remove an ovarian cyst but just a few months later she relapsed and was rushed to her gynaecologist. The gynaecologist asked her if she often ate chicken wings, when she said yes he explained that, today, chickens are injected with steroids to accelerate growth. These steroids can have a terrifying effect on the body and are most dangerous in the presence of female hormones. Exposure to these steroids can lead to women being more prone to the growth of cysts in her womb.

4. Cybersex (used in Chapter 5)

A student broke up with her boyfriend after they started university. Feeling lonely, she started to use internet dating and met a new guy online who she began to share flirtatious messages with before eventually winding up having fully fledged cybersex. After months of an online relationship they eventually decided to meet and arranged to spend the weekend together. She waited for him in the hotel room and when her dream man came in through the door, she was horrified to discover it had been her dad all along!

5. Dinner (used in Chapter 4)

A man was having dinner with his girlfriend's parents when he was suddenly gripped by terrible flatulence. He excused himself from the table and went in search of a toilet, however, he couldn't find one in time so instead he farted through an open window out of the parent's earshot. Much relieved, he returned to the table and continued the meal. Later, he asked his girlfriend how the night had gone, expecting a good response, however, she replied "it was going fine until you farted through the serving hatch!"

6. Birthday (used in Chapter 5)

The boss of a small company took his attractive secretary out for a long lunch on his birthday and they enjoyed some drinks together. Afterwards, the secretary invited the boss up to her apartment for a few more drinks and which he readily agreed to. At her apartment she left the room to 'slip into something more comfortable'. When she returned a few minutes later with a birthday cake, surrounded by the man's friends, family, and his wife, they found the surprised man waiting in nothing but his socks!

7. Gang (used in Chapter 5)

A little boy was out shopping with his mum and needed the toilet, so she let him use the gents' toilet on his own rather than going into the ladies' with her. When he didn't come back, his mum began to get worried and asked a passing policeman to check in the toilet for her son. The policeman found the little boy almost immediately, lying in a pool of blood in one of the cubicles. Apparently, the poor boy had been attacked as part of a gang initiation.

8. Caller

A babysitter was watching TV after putting the kids to bed when the phone rang. She picked up the phone and a man shouted "check the children!" After another call from the same caller, she rang the operator and asked them to trace the location of the next call. When the caller rang again the girl kept him talking. After she put the phone down the operator rang back saying "get out of the house! He's on the upstairs extension!" When the police arrived they found the children murdered and the killer gone!

9. Hitcher

A woman was driving home one night and saw an old lady hitch-hiking, feeling sorry for her, she picked the old lady up. While driving along the woman noticed that the old lady had unusually hairy, manly arms and began to feel anxious. She pretended that there was something wrong with her brake lights and asked the "old lady" to check them but as soon as the old lady was out of the car the woman drove off. Later she checked inside the "old lady's" bag and found a blood-stained knife!

10. Powder

A girl was having dinner with her boyfriend's rich parents and needed to use the toilet. Not wanting to be indiscreet she asked for the 'powder room.' Inside she found only a vanity table and sink. Not wanting to embarrass herself by asking for the toilet she tried to use the sink but slipped and fell, hitting her head on the towel rack and knocking herself unconscious. On hearing a loud thump from above the family rushed upstairs to find the sink broken and girl passed out with her pants down.

11. Fish (used in Chapter 4)

A woman caught her boyfriend with another woman and decided to get revenge. She cut open the passenger seat of his car and hid fish inside before neatly restitching along the seam. As the fish rotted his car was filled with a terrible smell that he couldn't get rid of no matter what he did. He had no luck finding a new girlfriend because no woman would set foot in his car. He finally gave up and sold the car at a huge loss because of the horrible smell.

12. Choke

A woman kept on returning a new car to the dealer, complaining that the engine was overheating and was high on fuel consumption. The mechanics could not find anything wrong with the car but the woman still insisted there was a problem. The dealer asked the woman to drive the car for him. The woman got the car keys out of her handbag, pulled the choke lever out to its full position, hung her handbag on the choke lever, started the car and proceeded to drive it with the choke pulled.

13. Skin

A young woman saw a blind man picking his way through a crowd. They talked and afterwards the man asked her to deliver a letter to the address on the envelope. She agreed but while leaving she turned around and saw the man hurrying through the crowd without his glasses or white cane. Suspicious, she went to the police, who raided the address on the envelope, where they found heaps of human flesh for sale. And what was in the envelope? "This is the last one I am sending you today."

14. Spiders (used in Chapter 5)

When beehive hair styles were in fashion it was almost a competition to see which girl could get her hair the highest. There was one girl who got her hair so high, and put so much hair spray on it, that she never took it down, combed it or washed it. One day she suddenly fell ill and died. They found out that a deadly spider had nested in her hair and laid eggs. When the eggs hatched the baby spiders bit into her scalp and poisoned her.

15. Snake

A mother took her son to a fast food restaurant and let him play in the ball pit after their meal. The boy played for a while and then began to whimper that he was hurt. She took him home and an hour later the boy died. She went back to the restaurant to try and find out what could have happened and the employees discovered that there were venomous snakes living in the ball pit area. The snakes crawled in there because it is dark and warm.

16. Killer (used in Chapter 5)

One night a woman heard a baby crying outside her door. She rang the police because it was late and she thought it was weird. The police told her "whatever you do, do NOT open the door." The woman said that she was worried that the baby would crawl into the street and get run over but the police then told her that a serial killer has a baby's cry recorded and has been using it to coax women out of their homes so he can kill them.

17. Clown

A teenager was babysitting for a family. After putting the children to bed she rang the parents to ask if she could watch satellite TV upstairs in their bedroom. "Well of course she could" they replied. The babysitter made another request; could she put a sheet or blanket over the clown statue that was in the bedroom? It was making her nervous. "Take the children, go to the neighbours and call the police!" said the parent "We don't own a clown statue!" The statue was a serial killer in disguise!

18. Control (used in Chapter 5)

Cheddar Gorge is a rock formation formed by melt water floods at the end of the last Ice Age. The limestone rock was blocked with ice which prevented water from flowing through it, so melting water was forced to flow over the surface, carving out the gorge. During warmer periods the ice melted and water flowed underground through the limestone, creating the caves and leaving the gorge dry. Today much of the gorge has no river until an underground river emerges in the lower part from a cave.

B. Questionnaire used in Chapter 3

1. Are you familiar with this story? (please tick as appropriate)
    a. Yes, I have heard it before □
    b. I have heard a similar story □
    c. No, I am not at all familiar □

    If you answered a. or b., please complete question 2. If you answered c., please continue to question 3.

2. a. What relationship did you have with the person telling you the story? (Please circle as appropriate)

    Parent / Other relative / Partner / Friend / Stranger / Not Sure

    b. Was this person older or younger than you? (Please circle as appropriate)

    Older / Younger / Same Age / Don't Know

    c. What gender was the person telling you the story? (Please circle as appropriate)

    Male / Female / Don't Know

    d. What medium did the teller use to tell you the story? (Please circle as appropriate)

    Orally / Email / Other internet / Text message / Other Media / Not Sure

3. What emotion or emotions did you feel while reading this story? (e.g. interest, joy, anger, surprise, sadness, contempt, fear, disgust)

    .....

4. Please rate to what extent you felt each emotion (1= very little, 7 = very much)

Emotion 1. : _____	1	2	3	4	5	6	7
Emotion 2. : _____	1	2	3	4	5	6	7
Emotion 3. : _____	1	2	3	4	5	6	7

5. Please rate to what extent you believe this story to be plausible (1= likely to be true, 7= very unlikely to have taken place)

1 2 3 4 5 6 7

6. Please rate to what extent the story contains (1 = very little, 7 = a lot)

   a. Information relevant to health and survival

   1 2 3 4 5 6 7

   b. Information concerning social interaction or relationships

   1 2 3 4 5 6 7

   b. Behaviour stereotypical for either gender

   1 2 3 4 5 6 7

7. Please rate how likely you would be to pass this story on as: (1 = not likely, 7 = very likely):

A true story	1	2	3	4	5	6	7
An interesting story	1	2	3	4	5	6	7
A funny story	1	2	3	4	5	6	7

8. Please complete these details:
   a. Your age
      .....
   b. Your gender Male / Female

C. Table showing Legends' mean scores.

Legend	Percentage Unfamiliar	Mean Rating (SD)				
		Emotional	Plausibility	Survival	Social	Gender Stereotype
1. Tumour	80%	6.50 (.89)	5.00 (1.95)	4.05 (2.11)	1.90 (1.17)	2.25 (1.65)
2. Noodles	95%	5.30 (1.38)	3.80 (2.12)	4.15 (1.60)	1.70 (.98)	2.45 (1.79)
3. Cyst	95%	5.50 (1.19)	4.25 (1.86)	4.90 (2.00)	2.50 (1.76)	3.00 (1.38)
4. Cybersex	90%	6.00 (1.12)	3.75 (1.94)	2.55 (1.70)	5.85 (1.04)	3.75 (1.71)
5. Dinner	75%	5.80 (1.44)	3.50 (2.09)	1.80 (1.24)	5.20 (1.32)	4.55 (1.57)
6. Birthday	75%	5.55 (1.05)	4.40 (1.98)	1.85 (.99)	5.45 (.95)	4.90 (1.41)
7. Gang	85%	5.90 (1.17)	4.85 (1.39)	4.25 (1.70)	4.90 (1.21)	3.25 (1.74)
8. Caller	45%	5.75 (1.37)	3.85 (1.95)	3.95 (1.88)	3.35 (1.66)	3.10 (1.86)
9. Hitcher	85%	5.05 (1.50)	4.60 (1.27)	4.10 (1.74)	3.90 (1.77)	3.30 (1.95)
10. Powder	95%	5.50 (1.32)	4.75 (1.25)	2.10 (1.21)	5.15 (1.53)	3.95 (1.73)
11. Fish	60%	5.00 (1.45)	4.10 (1.62)	2.30 (1.34)	5.75 (1.12)	5.10 (1.17)
12. Choke	100%	4.80 (1.32)	4.35 (1.81)	1.90 (.97)	3.20 (1.47)	5.30 (1.84)
13. Skin	85%	5.60 (1.39)	5.60 (1.31)	2.80 (1.88)	3.50 (1.32)	2.25 (1.59)
14. Spiders	70%	5.35 (1.35)	3.95 (2.14)	4.05 (1.93)	2.50 (1.61)	4.10 (1.52)
15. Snake	100%	5.65 (1.09)	5.20 (1.80)	4.20 (2.02)	2.25 (.97)	1.9 (.85)
16. Killer	75%	5.50 (.95)	4.15 (1.63)	5.05 (1.96)	3.45 (1.70)	4.65 (1.63)
17. Clown	55%	5.75 (1.21)	5.15 (2.08)	3.40 (2.16)	3.25 (1.86)	2.50 (1.50)
18. Control	75%	4.70 (1.17)	3.75 (2.50)	2.50 (1.70)	1.40 (.82)	1.45 (1.15)

D. Tables showing homogenous subsets and means.

NB – Homogenous subsets were determined by the Campbell and Skillings (1985) stepwise step-down multiple comparison procedure. A non-parametric test based on mean rank (as determined by a Kruskal-Wallis test), as such, position in the subsets is based on mean rank rather than mean score, mean scores are presented for illustrative purposes.

Emotion score homogenous subsets and means.

Legend	Homogenous Subsets (p = .05) with mean scores		
	1	2	3
18. Control	4.70		
12. Choke	4.80	4.80	
11. Fish	5.00	5.00	
9. Hitcher	5.05	5.05	5.05
2. Noodles	5.30	5.30	5.30
14. Spiders	5.35	5.35	5.35
16. Killer	5.50	5.50	5.50
6. Birthday	5.55	5.55	5.55
3. Cyst	5.50	5.50	5.50
10. Powder	5.50	5.50	5.50
15. Snake	5.65	5.65	5.65
13. Skin	5.60	5.60	5.60
17. Clown	5.75	5.75	5.75
8. Caller	5.75	5.75	5.75
5. Dinner	5.80	5.80	5.80
7. Gang		5.90	5.90
4. Cybersex		6.00	6.00
1. Tumour			6.50

Plausibility score homogenous subsets and means.

Legend	Homogenous Subsets (p = .05) with mean scores	
	1	2
5. Dinner	3.5	
4. Cybersex	3.75	
2. Noodles	3.80	
8. Caller	3.85	
18. Control	3.75	3.75
14. Spiders	3.95	3.95
11. Fish	4.10	4.10
16. Killer	4.15	4.15
3. Cyst	4.25	4.25
12. Choke	4.35	4.35
6. Birthday	4.40	4.40
9. Hitcher	4.60	4.60
10. Powder	4.75	4.75
7. Gang	4.85	4.85
1. Tumour	5.00	5.00
17. Clown	5.15	5.15
15. Snake	5.20	5.20
13. Skin		5.60

Survival information score homogenous subsets and means.

Legend Code	Homogenous Subsets (p = .05) with mean scores				
	1	2	3	4	5
5. Dinner	1.80				
6. Birthday	1.85				
12. Choke	1.90				
10. Powder	2.10				
11. Fish	2.30	2.30			
18. Control	2.50	2.50			
4. Cybersex	2.55	2.55	2.55		
13. Skin	2.80	2.80	2.80	2.80	
17. Clown	3.40	3.40	3.40	3.40	3.40
8. Caller		3.95	3.95	3.95	3.95
1. Tumour			4.05	4.05	4.05
14. Spiders				4.05	4.05
9. Hitcher				4.10	4.10
15. Snake				4.20	4.20
2. Noodles				4.15	4.15
7. Gang				4.25	4.25
3. Cyst				4.90	4.90
16. Killer					5.05

Social information score homogenous subsets and means.

Legend Code	Homogenous Subsets (p = .05) with mean scores					
	1	2	3	4	5	6
18. Control	1.40					
2. Noodles	1.70	1.70				
1. Tumour	1.90	1.90				
15. Snake	2.25	2.25	2.25			
3. Cyst	2.50	2.50	2.50	2.50		
14. Spiders	2.50	2.50	2.50	2.50		
17. Clown		3.25	3.25	3.25		
12. Choke			3.20	3.20		
8. Caller			3.35	3.35		
13. Skin				3.50		
16. Killer				3.45		
9. Hitcher				3.90	3.90	
7. Gang					4.90	4.90
10. Powder					5.15	5.15
5. Dinner					5.20	5.20
6. Birthday						5.45
11. Fish						5.75
4. Cybersex						5.85

Gender stereotype behaviour score homogenous subsets and means.

Legend	Homogenous Subsets (p = .05) with mean scores									
	1	2	3	4	5	6	7	8	9	10
18. Control	1.45									
15. Snake	1.90	1.90								
1. Tumour	2.25	2.25								
13. Skin	2.25	2.25	2.25							
2. Noodles	2.45	2.45	2.45	2.45						
17. Clown	2.50	2.50	2.50	2.50	2.50					
3. Cyst		3.00	3.00	3.00	3.00					
8. Caller		3.10	3.10	3.10	3.10	3.10				
7. Gang		3.25	3.25	3.25	3.25	3.25	3.25			
9. Hitcher		3.30	3.30	3.30	3.30	3.30	3.30			
4. Cybersex			3.75	3.75	3.75	3.75	3.75	3.75		
10. Powder				3.95	3.95	3.95	3.95	3.95	3.95	
14. Spiders					4.10	4.10	4.10	4.10	4.10	4.10
5. Dinner						4.55	4.55	4.55	4.55	4.55
16. Killer							4.65	4.65	4.65	4.65
6. Birthday								4.90	4.90	4.90
11. Fish									5.10	5.10
12. Choke										5.30

E. Table showing the mean differences between the legends used in Chapter 4 (column – row).

	Cyst-LN (2)	Dinner-HP (3)	Fish-LP (4)
Tumour-HN	E 1.00	E .70	E 1.50*
(1)	P .75	P 1.50	P .90
	G -.75	G -2.30*	G -2.85*
	S -.60	S -3.30*	S -3.85*
	V -.85	V 2.25*	V 1.75*
2		E -.30	E .50
		P .75	P .15
		G -1.55*	G -2.10*
		S -2.70*	S -3.25*
		V 3.10*	V 2.60*
3			E .80
			P -.60
			G -.55
			S -.55
			V -.50

* Indicates legends are found is different subsets ($p \leq .05$)

Key:

E = Emotion score

P = Plausibility score

G = Gender stereotype score

S = Social information score

V = Survival information score

F. Table showing the mean differences between the legends used in Chapter 5 (column – row).

	Cybersex Social	Birthday Social	Gang Combined	Spiders Survival	Killer Combined	Control
Cyst	E -.50	E -.05	E -.40	E .15	E .00	E .80
Survival	P .50	P -.15	P -.60	P .3	P .10	P .50
	G -.75	G -1.90*	G -.25	G -1.10	G -1.65*	G 1.55*
	S -3.35*	S -2.95*	S -2.40*	S .00	S -.95	S 1.1
	V 2.35*	V 3.05*	V .65	V .85	V -.15	V 2.40*
Cybersex		E .45	E .10	E .65	E .50	E 1.30*
Social		P -.65	P -1.1	P -.20	P -.40	P.00
		G -1.15	G .50	G -.35	G -.90	G 2.30*
		S .40	S .95	S 3.35*	S 2.40*	S 4.45*
		V .70	V -1.70*	V -1.50*	V -2.50*	V .05
Birthday			E -.35	E .20	E -.05	E .85
Social			P -.45	P .45	P .25	P .65
			G 1.65*	G .80	G .25	G 3.45*
			S .55	S 2.95*	S 2.00*	S 4.05*
			V -2.40*	V -2.20*	V -3.20*	V -.65
Gang				E .55	E .40	E 1.20*
Combined				P .90	P .70	P 1.10
				G -.85	G -1.40	G 1.80*
				S 2.40*	S 1.45*	S 3.50*
				V .20	V -.80	V 1.75*
Spiders					E -.15	E .65
Survival					P -.20	P .20
					G -.55	G 2.65*
					S -.95	S 1.1
					V -1.00	V 1.55*
Killer						E .80
Combined						P .40
						G 3.20*
						S 2.05*
						V 2.55*

Key: E = Emotion
P = Plausibility
G = Gender stereotype
S = Social info
V = Survival info

* Indicates legends are found is different subsets ($p \leq .05$)

G. Table showing the results of each model with predictor coefficients from Chapter 5.

Model	AIC	Predictor	Coefficient	SE	*z*
Full	201.34	(Intercept)	2.55	1.63	1.56
		Age	-0.04	0.03	-1.46
		Gender=Male	-0.53	0.56	-0.95
		Stereotype=Low	-1.46	1.29	-1.14
		Stereotype=Medium	-1.29	1.02	-1.27
		Type=Social	2.94	1.05	2.81**
		Type=Survival	1.97	0.69	2.84**
		Type=Combined	3.51	0.99	3.55***
		Generation=2	-1.35	0.61	-2.21*
		Generation=3	-2.22	0.63	-3.53***
Generation Only	229.72	(Intercept)	2.05	0.38	5.45***
		Generation=2	-0.91	0.47	-1.95
		Generation=3	-1.52	0.45	-3.38***
Type Based	192.22	(Intercept)	0.26	0.5	0.52
		Type=Social	3.24	0.63	5.14***
		Type=Survival	1.69	0.52	3.23**
		Type=Combined	3.24	0.63	5.14***
		Generation=2	-1.18	0.54	-2.19*
		Generation=3	-2	0.53	-3.75***
Stereotype Based	206.11	(Intercept)	3.93	0.86	4.57***
		Stereotype=Low	-2.92	0.81	-3.61***
		Stereotype=Medium	-1.13	0.79	-1.42
		Generation=2	-1.07	0.52	-2.05*
		Generation=3	-1.83	0.51	-3.57***

Significance codes: ***<0.001, **<0.01, *<0.05

H. News stories used as original material in Chapter 6

1. Low-Trees (http://www.bbc.co.uk/news/uk-england-cumbria-20928042)

Thousands of trees will be planted on a Cumbrian fell in a scheme to boost numbers of an endangered bird.

Farmer Paul Stobbart will receive £130,000 from the Forestry Commission for the scheme to help black grouse.

It will involve planting 16,000 trees such as oak, birch and rowan in a 25-hectare wood.

Another aim of the scheme will be to tackle landslides, with the new trees helping to bind the soil together to prevent erosion.

The Forestry Commission said 80% of the black grouse population was concentrated in the North Pennines Area of Outstanding Natural Beauty.

It said the population in the area was about 1,000 adult males, which showed a recovery after numbers fell following recent hard winters.

Forestry Commission woodland officer Jim O'Neill said: "The North Pennines has very low levels of native woodland cover, so a scheme of this size makes a real impact."

Mr Stobbart said: "It's good to boost wildlife like black grouse, but planting is also a sound option for the land in economic as well as environmental terms.

"Long-term I also hope trees will provide hillside shelter for livestock."

2. Low-Bridge (http://www.bbc.co.uk/news/uk-scotland-highlands-islands-21524978)

Drivers of two lorries carrying abnormal loads have been accused of causing delays on the Kessock Bridge at Inverness.

The crossing is being upgraded and measures have been put in place to help HGVs to negotiate the road works.

Other motorists complained to the police after the two lorries crossed the bridge at about 09:00.

Police said the drivers had failed to stop at a designated lay-by before being escorted across the bridge.

Northern Constabulary said a report would be made to the procurator fiscal about the incident.

Lorries carrying a load with a width of 2.9m (9.6ft) or more must stop before crossing and request an escort.

Designated abnormal load lay-bys on the approach to the Kessock Bridge are near the Munlochy junction, at Drumossie Brae, Morayhill, and Woody's car park in Inverness.

Road works will be on the bridge until June.

3. High-Pea (http://www.bbc.co.uk/news/world-us-canada-10945050)

Can the humble pea grow anywhere?

A Massachusetts man who was rushed to hospital with a collapsed lung came home with an unusual diagnosis: a pea plant was growing in his lung.

Ron Sveden had been battling emphysema for months when his condition deteriorated.

He was steeling himself for a cancer diagnosis when X-rays revealed the growth in his lung.

Doctors believe that Mr Sveden ate the pea at some point, but it "went down the wrong way" and sprouted.

"One of the first meals I had in the hospital after the surgery had peas for the vegetable. I laughed to myself and ate them," Mr Sveden told a local Boston TV reporter.

Mr Sveden said the plant was about half an inch (1.25cm) in size.

"Whether this would have gone full-term and I'd be working for the Jolly Green Giant, I don't know. I think the thing that finally dawned on me is that it wasn't the cancer," Mr Sveden said.

He is currently recovering at home with his wife Nancy, who joked that God must have a sense of humour.

4. High-Tiger (http://news.bbc.co.uk/1/hi/world/americas/3166010.stm)

A US police sniper has accomplished a daring operation in an urban housing complex - sedating and removing a 350-pound (160 kg) Bengal tiger from a New York flat.

Police were alerted to go to the flat - in a 21-storey block in the Harlem area after the animal's owner, Antoine Yates, checked into hospital with bites he said were caused by a pit bull.

When they arrived at the scene, they found a three-to-five-foot-long (1-1.5m) caiman alligator as well.

The animals have been temporarily taken to an animal care centre.

Mr Yates was meanwhile arrested in Philadelphia and police said he would be charged with "reckless endangerment".

Police Commissioner Raymond Kelly said two callers had directed them to the exact address - and they had confirmed the existence of the orange-and-white tiger after cutting a hole through the door.

After evacuating the building, they trained a camera to observe the movement of the animal through a window and policeman Martin Duffy abseiled to the fifth floor with a tranquiliser gun.

"I saw him eye to eye, to say the least," Mr Duffy was quoted as saying by the Associated Press news agency. "He charged twice and I shot him."

Police then went into the five-bedroom flat and tied the sedated tiger to a stretcher before carrying it away.

It was then they came across the caiman - and carried it away too.

"This is an only-in-New-York story," Commissioner Kelly said.

Police suspected Mr Yates of having kept the tiger in his flat since it was a cub.

It appears to have been one of an estimated 10,000 tigers kept by private citizens in America - that is more than remain in the wild.

I. Questions used in questionnaires for Stage 1 and Stage 3 of Chapter 6

1. What emotion or emotions did you feel while reading this story? (e.g. interest, joy, anger, surprise, sadness, contempt, fear, disgust)

2. Please rate to what extent you felt up to three emotions out of 7 (1= very little, 7 = very much)

3. Please rate to what extent you believe this story to be plausible out of 7 (1= very unlikely to have taken place, 7= likely to be true)

4. Please rate how relevant you feel this story is to you and your life out of 7 (1 = very little, 7 = very much)

5. Please rate to what extent the story contains out of 7 (1 = very little, 7 = a lot)

    a. Information relevant to health and survival
    b. Information concerning social interaction or relationships
    b. Behaviour stereotypical for either gender

J. List of legends sources for Chapter 7

www.allpoetry.com/contest/638007-__blood_covered_mirror__

www.americanfolklore.net/folklore/2009/10/bloody_mary.html

www.halloween-website.com/bloody_mary_stories.htm

www.halloween-website.com/bloody_mary_stories2.htm

www.iusedtobelieve.com/make_believe/ghosts/bloody_mary/

www.oocities.org/tragicpixie/FLbloodymary.html

www.project2067.com/Urban%20Legends/Classic%20Horror/Bloody%20Mary.htm

www.retrocrush.com/100monsters/69.html

www.sfogszero.com/stories/bloody-mary

www.snopes.com/horrors/ghosts/bloodymary.asp

www.soccerpluscrap.8.forumer.com/viewtopic.php?t=196

www.unsolvedmysteries.com/usm22697.html

www.urbanlegends.about.com/od/horrors/a/bloody_mary.htm

www.urbanlegends.about.com/u/ua/horrors/your_favorite_scary_urban_legends.03.htm

www.urbanlegends.about.com/u/ua/horrors/your_favorite_scary_urban_legends.04.htm

www.web.archive.org/web/20020602081747/http://www.mythologyweb.com/bloodymary.html

K. List of characters and coding used in Chapter 7.

Character	Trait	Coded As
1	Mary	0 = Absent; 1 = Bloody Mary; 2 = Mary Worth
2*	Satan/Devil	0 = Absent; 1 = Present
3	Bathroom	0 = Absent; 1 = Present
4	Name summons	0 = Absent; 1 = Present
5	Belief summons	0 = Absent; 1 = 'I believe in'; 2 = I don't believe in'
6	'Come to/get me' summons	0 = Absent; 1 = Present
7	Baby summons	0 = Absent; 1 = Present
8	Number of phrase repetitions	0 = Absent; 1 = Three; 2 = Seven; 3 = Thirteen; 4 = Twenty; 5 = Unspecified; 6 = Five; 7 = Six; 8 = Fifty; 9 = Ten
9	Beautiful woman disfigured	0 = Absent; 1 = Present
10	Mother of murdered children	0 = Absent; 1 = Present
11*	Appearance of supernatural figure	0 = Absent; 1 = Facially disfigured; 2 = Scissors in neck; 3 = Headless; 4 = Eyeless; 5 = Covered in blood; 6 = Old
12	Fingernail scratches injury	0 = Absent; 1 = On Limbs; 2 = On Body; 3 = On Face
13	Face scratched off	0 = Absent; 1 = Present
14	Clenched fist draws blood	0 = Absent; 1 = Present
15	Spinning/turning around	0 = Absent; 1 = Present
16*	Supernatural figure appears from	0 = Absent; 1 = Mirror; 2 = Bath/Sink/Toilet
17	Ritual takes place at midnight/specific time	0 = Absent; 1 = Present

18	Silence from room	0 = Absent; 1 = Present
19	Flushing toilet	0 = Absent; 1 = Present
20	Summoner dies/killed	0 = Absent; 1 = Present
21*	Room goes cold	0 = Absent; 1 = Present
22*	Something appears on mirror	0 = Absent; 1 = Blood; 2 = Writing
23	Holding weapon	0 = Absent; 1 = Knife; 2 = Axe; 3 = Hooked Hand
24*	Fingernails reach out of mirror	0 = Absent; 1 = Present
25	Holding baby	0 = Absent; 1 = Dead baby; 2 = 'Live' baby; 3 = Doll
26*	Actions predicted by colour	0 = Absent; 1 = Present
27	Water thrown on mirror	0 = Absent; 1 = Present
28	Test to see if figure attacks you	0 = Absent; 1 = Given baby; 2 = Asked question(s)
29	Candle(s) used in ritual	0 = Absent; 1 = Present
30*	Means of protection/escape	0 = Absent; 1 = Turning on light; 2 = Ring of salt
31	Holding rose	0 = Absent; 1 = Present
32	Candle is blown out	0 = Absent; 1 = Present
33*	Blood flows from sink/bath	0 = Absent; 1 = Present
34	Slumber party/sleepover	0 = Absent; 1 = Present
35	Summoner is locked in room	0 = Absent; 1 = Present
36*	Figure descends down stairs in mirror	0 = Absent; 1 = Present

* Indicates characters coded as counterintuitive.

L. Table showing the individual RIs of each character in the Majority Rules and Strict Trees.

Character	Majority Tree RI	Strict Tree RI	counter/intuitive	Frequency
1	0.5	0.5	Intuitive	41
2	1	1	Counterintuitive	2
3	0.692	0.538	Intuitive	31
4	0.786	0.643	Intuitive	30
5	1	1	Intuitive	3
6	0	0	Intuitive	2
7	0.75	0.75	Intuitive	5
8	0.385	0.385	Intuitive	40
9	0.5	0.5	Intuitive	3
10	0	0	Intuitive	2
11	0.6	0	Counterintuitive	11
12	0.333	0.222	Intuitive	12
13	0.5	0.5	Intuitive	3
14	1	0	Intuitive	2
15	0.5	0.333	Intuitive	13
16	0.385	0.385	Counterintuitive	33
17	0.333	0.333	Intuitive	4
18	0.5	0.5	Intuitive	5
19	0	0	Intuitive	4
20	0.647	0.647	Intuitive	18
21	0	0	Counterintuitive	2
22	0	0	Counterintuitive	4

23	0.714	0.714	Intuitive	9
24	0.5	0.5	Counterintuitive	3
25	0	0	Intuitive	1
26	0	0	Counterintuitive	2
27	0	0	Intuitive	2
28	0	0	Intuitive	3
29	0.375	0.375	Intuitive	9
30	0.25	0.25	Counterintuitive	10
31	1	1	Intuitive	2
32	1	1	Intuitive	3
33	0	0	Counterintuitive	2
34	0.5	0.5	Intuitive	7
35	0.5	0.5	Intuitive	5
36	0	0	Counterintuitive	3