

Running head: *Social and survival information bias in the transmission of urban legends.*

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

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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 18-52, was used to examine the encode-and-retrieve phase, while participants were asked to rank their interest in reading the story behind a headline and passing a story on for the other two phases. 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 while 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.

23

Introduction

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

36 **Survival Information Bias**

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

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

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

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

69 **Social Information Bias**

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

81 Based on these evolutionary theories, Mesoudi, Whiten and Dunbar (2006) argue that
82 if human cognition evolved to deal with social relationships and interaction, then humans
83 should preferentially attend to, recall and transmit social information over equivalent non-
84 social information. They empirically tested for this by comparing the transmission of social
85 and non-social information along linear transmission chains. The transmission chain method,
86 in which some form of information is passed from one participant to another along a 'chain'
87 of individuals, was first developed by Bartlett (1932) and has been used successfully to reveal
88 cumulative and systematic biases in recall that influence cultural transmission and evolution
89 (Mesoudi et al., 2006; Mesoudi & Whiten, 2008). In Mesoudi, Whiten and Dunbar (2006)
90 social information was defined as information which concerned the interactions and
91 relationships between a number of third parties, while non-social information was defined as
92 a single individual's interactions with the physical environment, or solely concerning the
93 physical environment. For their purposes of the study social information was divided into two
94 categories: gossip, which involved intense and salient social interactions or relationships, for

95 example an illicit sexual affair, and social non-gossip, which involved ‘everyday’ interactions
96 and relationships, for example someone receiving directions.

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

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

117 Despite it not being a focus of their research, Owens, Bower and Black (1979) also
118 found a bias for social information in recall. In their study, participants were asked to read

119 and recall five episodes describing a female student completing everyday events. The
120 experimental group were given a social motive for the student, that she was pregnant by her
121 professor, which connected the five episodes into a narrative. The control group were not
122 provided with this motive, leaving the episodes as independent events. The experimental
123 group recalled significantly more of the five episodes than the control group, which suggested
124 that the social nature of the material given to the experimental group exploited a bias for
125 social information in encoding and recall.

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

131 **Social and Survival Biases in Urban Legends**

132 Evidence of social and survival biases can be found in the kinds of stories propagated
133 by the tabloid press and gossip magazines, and in narratives transmitted from person-to-
134 person – most notably in so-called ‘urban legends’. Urban legends, also referred to as
135 ‘modern legends’ (Mullen, 1972), ‘urban belief tales’ (Fine, 1979) and ‘contemporary
136 legends’ (Simpson, 1981) are generally defined as apocryphal stories which are told as true
137 (Brunvand, 2000; Heath, Bell & Sternberg, 2001; Tangherlini, 1990), involve an urban or
138 suburban setting (Brunvand, 2000), and feature a single event, usually an individual
139 experience, as the core of the narrative (Tangherlini, 1990). Successful legends often share a
140 number of features, such as a suspenseful or humorous narrative (Brunvand, 2000), which
141 contains surprising information or a twist ending (Fox Tree & Weldon, 2007), a warning or
142 moral message that is either explicit or implied, and they are often attributed to a “friend of a

143 friend” (Brunvand, 2000). While they have been traditionally transmitted orally, urban
144 legends are now spread through a combination of oral transmission, electronic
145 communication and publication in mass media (Brunvand, 2000). Traditional, longer forms
146 of oral narrative such as epic ballads or counting-out rhymes often feature mnemonic
147 advantages such as repetition or poetics that enhance recall and lead to less variation between
148 generations (Rubin, 1995). Urban legends, however, rarely feature these elements meaning
149 they are more subject to the effects of recall. The analysis of urban legends can offer a
150 unique means of studying the concerns of modern populations (Brunvand, 2000) and
151 therefore provide an opportunity to study content biases such as social or survival
152 information bias.

153 A wide range of social information can be found in urban legends. These legends are
154 frequently built around intense social interaction that could easily be defined as gossip, such
155 as the accidental cybersex between a father and daughter, or actual accidental incest in some
156 instances (Brunvand, 1999). Urban legends can also be attached to real people in a manner
157 that clearly acts as gossip, for instance, the legend of a film star having to have a gerbil (or
158 hamster) removed from their rectum has been said of several real life film stars over the past
159 thirty years (Brunvand, 1986). In these instances the social information contained in the
160 legend would appear to be the sole reason for the legend’s success in transmission. Many
161 urban legends also clearly feature ecological survival information. Food contamination is a
162 common feature, whether it is deliberate, such as in the ‘Razor blade in the apple’ legend
163 (Best & Horiuchi, 1985), or accidental, such as in the ‘Kentucky fried rat’ legend (Fine,
164 1980). These food contamination legends are often localised (Fine, 1980) and as such provide
165 survival information directly relevant to the receivers’ environments. Violence at the hands of
166 other humans is also a common feature and often the perpetrators of this violence are from
167 minorities within a society (Ellis, 1983; Victor, 1990), once again providing information

168 directly relevant to the receivers' environments. Unlike the oral narratives of forager
169 populations (discussed by Sugiyama, 2001), these stories are apocryphal and do not contain
170 information that could be used for survival in a modern environment, however, they could
171 still be exploiting this bias. Urban legends, however, frequently exploit more than one content
172 bias (Stubbersfield, Tehrani & Flynn, 2014). Legends frequently feature both social and
173 survival relevant information, such as the common 'gang initiation' legends, where the social
174 context of a violent action is provided, giving the receiver information relevant to their
175 survival within a social world. As yet no studies have examined how different biases interact
176 when combined within a narrative and urban legends offer an excellent means to investigate
177 this.

178 **The Present Research**

179 In these studies we used real urban legends, which have been or are actively
180 transmitted between people, as a means to investigate social bias and survival bias. In the first
181 of the three studies, participants rated urban legends on a number of scales related to
182 suggested content biases in order to provide a means of selecting material that could be used
183 in further studies. This material comprised a selection of three types of legends: legends that
184 scored highly for survival-relevant information, legends that scored highly for social
185 information, and legends that scored highly for both kinds of information. Legends which
186 featured both social and survival information were used to examine how a combination of
187 biases affected recall and transmission. In the second study a linear transmission chain design
188 is used to examine the effects of social information, survival information and combining both
189 types of information on the cultural transmission of an urban legend narrative. These
190 experiments aimed to test the hypothesis that legends containing content relevant to survival
191 and social information biases are transmitted with higher fidelity than control material
192 lacking such content. We further hypothesised that legends containing both types of content

193 should have an even greater advantage in transmission. The third study goes beyond the
194 'encode-and-retrieve' phase of transmission tested in the transmission chain to examine the
195 effects of this content on two other phases of transmission: 'choose-to-receive' and 'choose-
196 to-transmit'.

197 **Study 1**

198 Before conducting the transmission chain study it was necessary to select appropriate
199 legends. Study 1 was conducted with the purpose of gathering data that would allow suitable
200 legends to be selected for Study 2.

201 **Participants**

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

206 **Materials**

207 Seventeen urban legends were collected from the *Urban Legend Reference Pages*
208 (www.snopes.com); five were thought to contain information relevant to survival (survival
209 type), six were thought to contain information relating to social interaction or relationships
210 between third parties (social type) and six were thought to combine both types of information
211 (combined type). These legends were re-written to approximately match for word length (88-
212 93 words) and number of central propositions (5-6). Control material was also created; this
213 was adapted from a description of the formation of Cheddar Gorge from *Wikipedia*
214 (http://en.wikipedia.org/wiki/Cheddar_gorge), re-written to match the legends in terms of
215 word length and central propositions. Questionnaires were created which contained eight

216 questions for each legend asking about familiarity with the legend, emotional content,
217 plausibility, survival information, social information and gender stereotypes (see
218 supplementary material A). These questions were used to collect data on potential content
219 biases that the legends may exploit (see Mesoudi & Whiten, 2008). The order of legends
220 presented was counterbalanced so no two participants received the same legends in the same
221 order.

222 **Procedure**

223 Participants were asked to take part in a study regarding the cultural transmission of
224 urban legends. Each participant was presented with a questionnaire and answered questions
225 on three or four legends, or the control material. Each of the eight questions were asked for
226 each of the legends presented and the control material

227 **Results**

228 Each legend and the control material received 20 ratings on each scale (see
229 supplementary material B for the mean ratings for each legend). Significant variation
230 between legends was found in emotional content (one-way ANOVA, $F_{17, 342} = 2.47$, $p < .01$),
231 plausibility (one-way ANOVA, $F_{17, 342} = 2.09$, $p < .01$), survival information (one-way
232 ANOVA, $F_{17, 342} = 8.20$, $p < .001$), social information (one-way ANOVA, $F_{17, 342} = 21.94$, $p < .001$) and gender stereotyped behaviour (one-way ANOVA, $F_{17, 342} = 10.92$, $p < .001$). A *post hoc* Ryan-Einot-Gabriel-Welsch multiple F test with $\alpha = .05$ was used to group the legends
234 into homogenous subsets. There were five subsets with similar survival scores, with ten
235 legends in the subset with the highest mean survival score. There were seven subsets with
236 similar social scores, with six legends in the subset with the highest mean score. Only one
237 legend was found which featured in both the highest social subset and the highest survival
238 subset. Legends within a subset were considered not significantly different (see
239

240 supplementary material C for tables showing the homogenous subsets for each scale).
241 Legends within the high subsets for survival information were considered ‘survival type’
242 legends, those within the high subsets for social information were considered ‘social type’
243 legends and those which featured in high subsets for both social information and survival
244 information were considered ‘combined type’ legends. Significant correlations were found
245 between social information scores and emotional scores ($r_{358} = .17, p < .005$) and between
246 social information score and gender stereotype score ($r_{358} = .48, p < .001$). No other ratings
247 were significantly correlated ($ps > .05$).

248 **Discussion**

249 These results indicate that urban legends vary significantly in their content. Of the
250 potential content biases suggested by previous research (see Mesoudi & Whiten, 2008), there
251 was evidence for all such biases across the legends with significantly high ratings in
252 emotional content, survival information, social information and stereotyped behaviour.
253 Significant correlations were found between social information and emotional content and
254 between social information and gender stereotyped behaviour content, suggesting that these
255 biases may often be found together in urban legends. Equally, gender stereotyped behaviour
256 is unlikely to appear without social information as it implicitly requires some form of human
257 interaction in most cases. Of particular relevance to this study, urban legends can be seen to
258 feature content which would exploit a bias for social information and content which would
259 exploit a bias for survival information. These results further support the argument that urban
260 legends provide a fruitful avenue for research into the effects of content biases on the cultural
261 transmission and evolution of narratives.

262 **Study 2**

263 This study uses the ratings from Study 1 to select survival type, social type and
264 combined type legends to be passed along a linear transmission chain. Previous research has
265 successfully used this design to demonstrate a social information bias (Mesoudi, et al., 2006),
266 while individual memory experiments have demonstrated an advantage for survival
267 information in recall (Nairne & Pandeirada, 2008; Nairne, Thompson & Pandeirada, 2007).
268 This study makes a direct comparison between both proposed biases and also examines the
269 effects of combining both biases in a single narrative. The primary focus of this study is the
270 potential effects of these biases on cumulative recall in a micro-culture in the absence of
271 communicative intent, as communicative intent has been shown to affect the emergence of
272 biases in transmission (Lyons & Kashima, 2006)

273 **Participants**

274 Sixty participants (48 females) took part in Study 2. Their ages ranged from 16 to 52
275 years with a mean age of 22.52 years (SD = 8.72). The majority (57%) were undergraduate
276 students studying psychology, and others were prospective students and parents attending a
277 Psychology Department Open Day; all participants under the age of 18 took part with their
278 parents' consent.

279 **Design**

280 A linear transmission chain design was used, in which the first participant in each of
281 the twenty chains received three legends, one of each type (social, survival and combined,
282 based on the results of Study 1) and the control material. A within-groups design was used so
283 that each participant would contribute to the cumulative recall of each type of legend. The
284 order in which each chain was presented with these was counterbalanced so no legend type or
285 the control material appeared in the same position more than any other. The next participant
286 was presented with the material that had been recalled by the previous participant. Each of

287 the twenty chains comprised of three participants or ‘generations’. Three generations was
288 judged to be an optimum chain length, capable of capturing long-term cumulative effects of
289 cultural transmission but short enough to be practical in terms of participant recruitment and
290 has been used successfully in previous research (Barrett & Nyhof, 2001; Nielson, Cucchiaro
291 & Mohamedally, 2012). Each individual legend was passed along ten chains.

292 **Material**

293 From the seventeen original legends used in Study 1, two social type legends, two
294 survival type legends and two combined type legends were selected (see Table 1 for an
295 overview and supplementary material D for the full text of the legends used). Outside of the
296 relevant scales, these legends were matched for plausibility, emotional content and gender
297 stereotyped behaviour where possible (see supplementary material E for the mean differences
298 between the legends used in Study 2). The two social type legends appear in the highest
299 social score subset and the lowest survival score subset. The two survival type legends appear
300 in the highest survival score subset and the lowest social score subset. One combined type
301 legend (Combined-Gang) appears in both the highest social score and highest survival score
302 subsets, the other combined type legend (Combined-Killer) appears in the highest survival
303 score subset and the third highest social score subset. No legend other than Combined-Gang
304 appeared in the highest subsets for both social and survival scores so Combined-Killer
305 represents the best choice for a second legend combining social and survival scores.

306 The strong correlation between social information and gender stereotyped content
307 means that one potentially conflicting bias was gender stereotype. Social-Birthday scored
308 significantly higher in gender stereotype than Survival-Chicken and Combined-Gang ($p <$
309 0.05). Combined-Killer also scored significantly higher than Survival-Chicken ($p <$ $.05$) and
310 the control material was rated significantly lower in gender stereotype than all legends accept

311 for Survival-Chicken ($ps < 0.05$). As such legends were also categorised as either stereotype
312 low (control material, Survival-Chicken), stereotype medium (Social-Cybersex, Combined-
313 Gang, Combined-Killer, Survival-Spiders) and stereotype high (Social-Birthday) according to
314 their position in the homogenous subsets and relationship to each other in terms of gender
315 stereotype score.

316 **[Table 1 about here]**

317 **Procedure**

318 Participants were asked to take part in a study regarding the cultural transmission of
319 urban legends. Participants were individually presented with the experimental materials on a
320 computer. They were asked to read the material (legend or control), then on a new page they
321 had to type what they remembered of this material, they then repeated this for all material
322 presented to them. No distracter task was performed and no time limit for recall was set. As
323 previous research has demonstrated that communicative intent can alter the content of
324 material transmitted in a diffusion chain, including altering the degree to which content biases
325 are represented (Lyons and Kashima, 2006), participants were not told that the material had
326 come from a previous participant or that their recall would be presented to another
327 participant. This was done with the intention of focusing on the effects of cumulative recall
328 rather than communicative choice (which would be examined in Study 3).

329 **Coding**

330 Following previous studies which used a linear transmission chain design (Bangerter,
331 2000; Kashima, 2000; Mesoudi, et al., 2006; Mesoudi & Whiten, 2004), a propositional
332 analysis (Kintsch, 1974) was performed on each participant's recall. In propositional analysis
333 the text is divided into separate propositions, defined as a predicate (a verb, adjective, or

334 other relational term) with a series of ordered arguments (the complementary noun/s). As
335 previous research has demonstrated that information relevant to the plot of a narrative is
336 better recalled than background details (Kashima, 1997) only propositions central to the
337 narrative were coded so as to avoid legends with more background details appearing to have
338 poorer recall (see supplementary material D for the full text of the legends used with the
339 central propositions highlighted). This propositional analysis was used to calculate the
340 percentage of original central propositions correctly recalled. Percentages were used instead
341 of total number as the original texts varied between five and six central propositions. No
342 significant difference in the percentage of central propositions recalled was found between
343 legends with five central propositions and legends with six.

344 To assess coder reliability, an independent coder blind to the study hypothesis coded
345 two chains of each legend and the control material (20% of all material). There was a
346 significant correlation between the coding of the independent coder and the original coder
347 ($r_{40} = .83, p < .0001$).

348 **Results**

349 To examine whether legend type affected the fidelity of recall, a generalised linear
350 multilevel binomial regression model was used. The analysis was conducted using the lme4
351 software package (Bates, Maechler, Bolker, & Walker, 2008) in R version 3.0.2 (R Core
352 Team, 2013). The initial 'full model' had legend type, stereotype level, participant age,
353 participant gender and generation as fixed effects without interaction, assuming a randomised
354 structure of legend type nested within participant, nested within generation. In this full model
355 coefficients for age, gender and stereotype level were not significant. As such a second
356 legend type based model was used with legend type and generation as fixed effects without
357 interaction, assuming a nested randomised structure of legend type within participant, within

358 generation. This type based model showed a significantly better fit than a generation only
359 model ($X^2, 4 = 45.5, p < .001$) and a stereotype level based model ($X^2, 1 = 16.39, p < .001$).
360 The full model did not significantly improve the model fit over the type based model ($X^2, 7 =$
361 $4.69, p > .05$). Comparisons between the models can be seen in supplementary material F and
362 the equation for the type-based model used in the analyses can be seen in supplementary
363 material G. Table 2 shows the results of the type based model.

364 **[Table 2 about here]**

365 Planned contrasts revealed that recall was significantly higher in generation 1 than
366 generation 2 ($z = 3.19, p < .005$) and recall in generation 2 was significantly higher than
367 generation 3 ($z = 3.34, p < .001$). Figure 1 shows the pattern of recall for legend type along
368 the chains for each generation.

369 **[Figure 1 about here]**

370

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

378 **Discussion**

379 **The Cumulative Effects of Recall**

380 The aim of Study 2 was to examine the effects of different informational content on
381 cumulative recall along a transmission chain. Previous research has suggested two potential
382 content biases in cultural transmission: social information bias and survival information bias.
383 This study compared the cumulative recall of urban legends featuring both types of content
384 and a third legend type which combined both. The results show that legends that contained
385 information regarding the interaction between third parties (the social type legends and the
386 combined type legends) were recalled with significantly greater fidelity than the control
387 material and the legends that contained information relevant to survival (survival type
388 legends). This finding is consistent with previous research (Mesoudi et al., 2006) which also
389 found social information to feature an advantage in recall in comparison to equivalent non-
390 social information through a transmission chain. This result provides further evidence to the
391 concept of a content bias for social information in cultural transmission.

392 Survival type legends were not recalled with significantly greater accuracy than
393 legends which featured social information but were recalled with greater accuracy than the
394 control material. This suggests that survival information alone does confer a mnemonic
395 advantage in cumulative recall but not as great an advantage as social information. This
396 supports previous finding by Nairne and colleagues who found that survival processing
397 conferred a mnemonic advantage in individual memory experiments, compared to other
398 forms of mnemonic processing (Nairne, 2010; Nairne & Pandeirada, 2008; Nairne,
399 Thompson & Pandeirada, 2007). The results of Study 2 suggest that this mnemonic
400 advantage granted by survival processing for an individual translates into a cumulative recall
401 advantage across a microculture.

402 An objection could be raised with regards to the distinction being made between
403 social and survival information. Nairne (2010) argues that the ‘fitness-relevant’ information
404 that should feature an advantage in recall includes both ecological survival information, such

405 as the presence of predators, and social information, such as third party interactions; however,
406 the results of Study 2 suggest that the distinction between social and survival information
407 should be made. The results suggest that social information is particularly salient compared to
408 other forms of fitness-relevant information and as a result may be unique in the way humans
409 preferentially attend to, recall and transmit it.

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

418 That legends high in gender stereotyped behaviour also featured high levels of recall
419 could be considered support for previous research which has suggested a content bias for
420 gender stereotype consistent information in cultural transmission (Bangerter, 2000; Kashima,
421 2000). Although, Lyons and Kashima (2006) found that stereotype consistency bias only
422 emerged in a transmission chain when there was communicative intent rather than just recall
423 as in study 2. As the gender stereotype content in the legends was not the focus of the study
424 the evidence from the results can only be considered inconclusive with regards to true support
425 for gender stereotype bias and the level of social information is likely to be a better
426 explanation of the results. It does suggest, however, that future studies examining gender
427 stereotype or social information bias should consider if both biases are being exploited by the
428 material at once, this is particularly pertinent if the material is ‘gossip’ or involves sexual
429 behaviour.

430 **Transformations**

431 As demonstrated by Bartlett (1932), one advantage to using the transmission chain
432 design is that the recall of participants can transform the original material in interesting ways
433 that reflect cognitive content biases. In Study 2 a number of transformations were observed.
434 In the combined-gang legend, the last sentence – “Apparently, the poor boy had been
435 attacked as part of a gang initiation” was frequently transformed. In the majority of chains,
436 the word “apparently” was lost in the first or second generation. This is consistent with
437 theories regarding the development of rumour; where ambiguous information is transformed
438 to become fact (Shibutani, 1966). The ambiguous word “attacked” was also transformed in a
439 number of cases to something more specific and emotive such as “stabbed” (chains 7 and 9)
440 or “murdered” (chain 10). This could be explained by the content evolving through
441 transmission to become increasingly emotive, and therefore further exploit the high emotion
442 bias suggested by Heath et al. (2001).

443 Another interesting transformation was found in the social-birthday legend. In the first
444 generation of one chain the sentence – “The boss of a small company took *his* attractive
445 secretary out for a long lunch on his birthday [emphasis ours] ” was transformed into the
446 sentence – “The boss of a small company took *her* attractive secretary out for lunch on his
447 birthday [emphasis ours]”. This is essentially a gender-swap that changes the narrative from
448 being gender stereotype consistent to being gender stereotype inconsistent. By the second
449 generation the gender of the boss character had returned to being male. This change in the
450 second generation is consistent with research suggesting a bias for gender stereotype
451 consistent narratives (e.g. Bangerter, 2000; Kashima, 2000).

452 The results of Study 2 provide further evidence for the presence of a social
453 information bias in human cultural transmission at the level of recall. It suggests that this is

454 true of narratives where the social information is the primary narrative focus and of narratives
455 that also contain survival information. Evidence was also found for a survival information
456 bias in cultural transmission at the level of recall, although to the same extent as social
457 information. These findings provide support for the *Machiavellian* and *Social Brain*
458 hypotheses of human intelligence evolution and to a lesser extent provide support for the
459 concept that human memory evolved to preferentially recall fitness-related ecological
460 information.

461 **Study 3**

462 While previous research into content biases in cultural transmission has largely relied
463 on the transmission chain paradigm (Mesoudi & Whiten, 2008), in true cultural transmission,
464 selection is not limited by recall ability alone. While memory is important, as an oral
465 narrative must be recalled to be retold, audience feedback and choice as well as the teller's
466 own preferences will affect the transmission of a narrative (Dégh & Vazsonyi, 1975; Lyons
467 & Kashima, 2006; Rubin, 1995; von Sydow, 1948/1965). The choice of the teller can be
468 particularly pertinent as they will not always transmit everything they remember and may
469 refrain from transmitting information if they doubt its truthfulness (Lyons & Kashima, 2003).
470 Tellers are also likely to prefer to transmit information which will keep their audience
471 entertained and/or intrigued (Kashima, Lyons & Clark, 2012). Eriksson and Coultas (2014)
472 argue that research should distinguish between three distinct phases of cultural transmission:
473 'choose-to-receive', 'encode-and-retrieve' and 'choose-to-transmit'. In using the transmission
474 chain paradigm previous content bias research has demonstrated biases in one phase, encode-
475 and-retrieve, but not the other two. Previous research into emotional bias by Heath et al.
476 (2001) demonstrated an advantage for disgusting material in a choose-to-transmit paradigm
477 and Eriksson and Coultas (2014) have expanded this to investigate emotional biases in the
478 two other phases encode-and-retrieve and choose-to-receive. They found an advantage across

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

486 **Participants**

487 Thirty participants (24 females) took part. Their ages ranged from 18 to 22 years with
488 a mean age of 19.43 years ($SD = .97$). These were all undergraduate students studying
489 psychology. No participants taking part in Study 3 had taken part in either Study 1 or Study
490 2.

491 **Material**

492 For the *choose-to-receive phase*, six ‘headlines’ were produced from the legends used
493 in Study 2, describing the key elements of each legend (two each of survival type, social type
494 and combined type; see Table 3 for the six headlines used). The material for the *choose-to-*
495 *transmit* phase was the same six legends used in Study 2.

496 **[Table 3 about here]**

497 **Procedure**

498 For the *choose-to-receive phase* participants were presented with a list of ‘headlines’
499 and were asked to read them all (the order of headlines on the lists was counterbalanced).
500 After reading the headlines they were asked to rank them in the order of their interest in
501 reading the story from which the headline was derived. As assessment of this phase required

502 participants to demonstrate which story they would be most likely to choose to read, a self-
503 report paradigm was thought to be ecologically valid. While the participants could be
504 influenced by experimenter effects, this could be the case in any paradigm examining this
505 phase. In the *choose-to-transmit phase* participants were provided with all six legends (the
506 order in which they received them was counterbalanced and was not the order selected in the
507 *choose-to-receive phase*). They were asked to read the material and then asked to rank the
508 legends in the order of their interest in passing that story on to another person. Self-report
509 was used in this phase due to practical restrictions and to any potential audience effects that
510 could influence the participants' choice if they expected to actually pass the story on. Urban
511 legends are rarely told to strangers so using a paradigm in which participants actually passed
512 the story on may not be ecologically valid.

513 **Results**

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

516 **Choose-to-receive Phase**

517 A Friedman test was used to assess variance in rank across individual's 'choice to
518 receive' for all the individual legends. Mean rank varied significantly across the six legends
519 ($\chi^2_5 = 34.23, p < .001$). *Post hoc* analyses with Wilcoxon tests were conducted, with a
520 Bonferroni-Holm correction applied, to examine the differences between legends. This
521 analysis revealed that Combined-Killer (M = 2.5, SD = 1.55) ranked significantly higher than
522 Combined-Gang (M = 3.63, SD = 1.59), Social-Birthday (M = 4.2, SD = 1.42), and Survival-
523 Chicken (M = 4.83, SD = 1.39), $z_s = 370 - 424, p_s < .05$. Social-Cybersex (M = 2.8, SD =
524 1.56) ranked significantly higher than Social-Birthday and Survival-Chicken, $z_s = 389, 406.5,$

525 $ps < .05$, and Survival-Spiders ($M = 3.03$, $SD = 1.63$) ranked significantly higher than
526 Survival-Chicken, $z = 394.5$, $p < 0.05$; see Figure 2.

527 **[Figure 2 about here]**

528 A Friedman test was used to assess variance in rank across the *choose-to-receive*
529 *phase* for the legend types. Mean rank varied marginally significantly across legend type (χ^2_2
530 $= 5.67$, $p = .06$). *Post hoc* analyses with Wilcoxon tests were conducted, with a Holm-
531 Bonferroni correction applied, to examine the differences between legend types. The largest
532 difference was found between combined type legends ($M = 3.07$, $SD = 1.28$) and survival
533 type legends ($M = 3.93$, $SD = .93$) but this was not significant ($z = 265$, $p = .069$). All other
534 comparisons were not significant ($zs = 135, 198$, $ps > .05$).

535 **Choose-to-transmit Phase**

536 A Friedman test was used to assess variance in rank across the *choose-to-transmit*
537 *phase* for the individual legends. Mean rank varied significantly across the six legends ($\chi^2_5 =$
538 15.57 , $p < .01$). *Post hoc* analyses with Wilcoxon tests were conducted, with a Bonferroni-
539 Holm correction applied, to examine the differences between legends. This analysis revealed
540 Social-Cybersex ($M = 2.93$, $SD = 1.70$) ranked marginally significantly higher than Social-
541 Birthday ($M = 4.33$, $SD = 1.35$), $z = 371.5$, $p = .06$; see Figure 3. Comparisons between other
542 legends were not significant ($zs = 194.5 - 367$, $ps > .05$).

543 **[Figure 3 about here]**

544 A Friedman test was used to test for variance in rank across the *choose-to-transmit*
545 *phase* for the legend types but no significant variation in mean rank was found ($\chi^2_2 = 5.41$, p
546 $> .05$).

547 **Discussion**

573 Eriksson and Coultas (2014) into emotional bias found a largely consistent transmission
574 advantage for content that evoked high levels of disgust across all three phases of
575 transmission while another study by Lyons and Kashima (2006) found that stereotype
576 consistency bias only emerged when there was communicative intent rather than emerging
577 from a recall advantage. Our results show that social information has an advantage over
578 survival information in the *encode-and-retrieve phase*, the phase based on recall, but this was
579 not consistent in the other phases. In both the *choose-to-receive phase* and the *choose-to-*
580 *transmit phase* neither bias had an advantage over the other.

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

595 The legends combining both social information and survival information were as
596 successful in recall as the social legends and had a recall advantage over legends containing
597 survival information alone. This suggests that survival information needs to be combined

598 with another bias to be as culturally successful as social information or possibly be
599 exceptionally memorable in order to ‘survive’ the encode-and-retrieve phase. Given these
600 results, in the general corpus of urban legends one could expect to see fewer urban legends
601 that contain survival information than social information, or for the former to exploit
602 additional biases. This is supported by a content analysis of 256 urban legends, which found a
603 greater number of legends that contained social information than survival information and
604 also found survival information to be commonly combined with other biases (Stubbersfield,
605 Tehrani & Flynn, 2014). Previous research (Eriksson & Coultas, 2014; Heath et al., 2001) has
606 suggested that urban legends exploit a bias for content that evokes high emotion, particularly
607 disgust. This high emotion bias could explain the prevalence of survival type legends more
608 accurately than survival information bias. However, as disgust is so associated with survival
609 mechanisms (avoiding contaminated food, etc.), future research should examine if the high
610 emotion bias in transmission is found for emotions other than disgust.

611 While Mesoudi et al. (2006) used original material created for the purpose of the
612 experiment, Study 2 and 3 used real urban legends. Although they were altered in terms of
613 word length for the purposes of the study multiple versions of any urban legend always exist
614 with no ‘true’ version, so the material used in the present study is an accurate representation
615 of narratives that are transmitted between people orally and through electronic
616 communication. There are a number of benefits to using ‘real world’ material in such an
617 experiment but this can come at the cost of full control over the features of the material. In
618 this experiment efforts were made to control for any confounding variables in terms of
619 content and differences in social and survival information provide the best account for the
620 observed differences in recall. The fact that urban legends that contain some social
621 information were found to have an advantage in the encode-and-retrieve phase of
622 transmission in an experimental setting suggests that this is also the case for these legends in

623 the ‘real world’ and provides an explanation for the large number of legends which feature
624 some form of social information (Stubbersfield, Tehrani & Flynn, 2014).

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

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- 647 Bangerter, A. (2000). Transformation between scientific and social representations of
648 conception: the method of serial reproduction. *British Journal of Psychology*, 97, 405-
649 423.
- 650 Barrett, J.L., & Nyhof, M.A. (2001). Spreading of non-natural concepts: the role of intuitive
651 conceptual structures in memory and transmission of cultural materials. *Journal of*
652 *Cognition and Culture*, 1, 69-100.
- 653 Bartlett, F.C. (1932). *Remembering*. Oxford: Macmillan.
- 654 Best, J., & Horiuchi, G.T. (1985). The razor blade in the apple: the social construction of
655 urban legends. *Social Problems*, 32, 488-499.
- 656 Blackmore, S. (1999). *The Meme Machine*. New York: Oxford University Press.
- 657 Brunvand, J.H. (1986). *The Mexican Pet*. New York: Norton.
- 658 Brunvand, J.H. (1999). *Too Good to be True: The Colossal Book of Urban Legends*. New
659 York: Norton.
- 660 Brunvand, J.H. (2000). *The Truth Never Stands in the Way of a Good Story*. Chicago:
661 University of Illinois Press.
- 662 Byrne, R.W., & Whiten, A. (Eds.). (1988). *Machiavellian Intelligence: Social Expertise and*
663 *the Evolution of Intellect in Monkeys, Apes and Humans*. Oxford: Clarendon Press.
- 664 Clutton-Brock, T. H., & Harvey, P. H. (1980). Primates, brains and ecology. *Journal of the*
665 *Zoological Society of London*, 190, 309–323.
- 666 Dawkins, R. (1976). *The Selfish Gene*. Oxford: Oxford University Press.

- 667 Dégh, L., & Vazsonyi, A. (1975). The hypothesis of multi-conduit transmission in folklore.
668 In D. Ben-Amos & K. S. Goldstein (Eds.), *Folklore: Performance and*
669 *Communication* (pp. 207-252). Paris: Mouton.
- 670 Dunbar, R.I.M. (1993). Coevolution of neocortical size, group size and language.
671 *Behavioural and Brain Sciences*, 16, 681-735.
- 672 Dunbar, R.I.M. (1998). The social brain hypothesis. *Evolutionary Anthropology*, 6, 178-190.
- 673 Dunbar, R. I. M. (2003). The social brain: mind, language, and society in evolutionary
674 perspective. *Annual Review of Anthropology*, 32, 163–181.
- 675 Ellis, B. (1983). De legendis urbis: modern legends in ancient Rome. *Journal of American*
676 *Folklore*, 96, 200-208.
- 677 Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: emotional
678 selection operating in three phases of cultural transmission of urban legends. *Journal*
679 *of Cognition and Culture*, 14, 1-26.
- 680 Fine, Gary A. 1979. Cokelore and Coke law: urban belief tales and the problem of multiple
681 origins. *Journal of American Folklore* 92:477–482.
- 682 Fine, G.A. (1980). The Kentucky fried rat: legends and modern society. *Journal of the*
683 *Folklore Institute*, 17, 222-243.
- 684 Fox Tree, J.E., & Weldon, M.S. (2007). Retelling urban legends. *The American Journal of*
685 *Psychology*, 120, 459-476.
- 686 Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: the case of urban
687 legends. *Journal of Personality and Social Psychology*, 81, 1028-1041.

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

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

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

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

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

697 Lyons, A., & Kashima, Y. (2003). How are stereotypes maintained through communication?
698 The influence of stereotype sharedness. *Journal of personality and social psychology*,
699 85(6), 989.

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

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

705 McGuigan, N., & Cubillo, M. (2013). Cultural transmission in young children: when social
706 information is more important than non-social information. *The Journal of Genetic*
707 *Psychology*.

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

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

713 Mullen, Patrick B. 1972. Modern legend and rumor theory. *Journal of the Folklore Institute*
714 9:95-109.

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

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

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

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

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

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

- 728 Otgaar, H., Smeets, T., & van Bergen, S. (2010). Picturing survival memories: enhanced
729 memory after fitness-relevant processing occurs for verbal and visual stimuli. *Memory*
730 *and Cognition*, 38, 23–28.
- 731 Owens, J., Bower, G. H., & Black, J. B. (1979). The soap opera effect in story recall. *Memory*
732 *and Cognition*, 7, 185–191.
- 733 Packman, J.L. & Battig, W.F. (1978). Effects of different kinds of semantic processing on
734 memory for words. *Memory and Cognition*, 6, 502–508.
- 735 Reysen, M. B., Talbert, N. G., Dominko, M., Jones, A. N., & Kelley, M. R. (2011). The
736 effects of collaboration on recall of social information. *British Journal of Psychology*,
737 102, 646-661.
- 738 Rubin, D. C. (1995). *Memory in Oral Traditions: The Cognitive Psychology of Epic, Ballads,*
739 *and Counting-out Rhymes*. Oxford: Oxford University Press on Demand.
- 740 Shibutani, T. (1966). *Improvised News: A Sociological Study of Rumor*. New York: Bobbs-
741 Merrill.
- 742 Simpson, Jacqueline. (1981). Rationalized motifs in urban legends. *Folklore*, 92, 203–207.
- 743 Sperber, D. (1996). *Explaining Culture: A Naturalistic Approach*. Oxford: Blackwell
744 Publishing.
- 745 Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (2014). *Santa Crucified and Death by*
746 *Lollypop: Culture, Cognition and the Epidemiology of Urban Legends*. Manuscript
747 submitted for publication.
- 748 Tangherlini, T.R. (1990). “It happened not too far from here...”: a survey of legend theory
749 and characterization. *Western Folklore*, 49, 371-390.

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

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

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

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

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770 Table 1

771 *Legends used in Study 2 with their respective legend types and codes (see supplementary*
772 *material D for full text of legends).*

Legend	Legend Type	Code used in article	Mean Score (SD)	
			Social	Survival
Steroids in chicken cause ovarian cysts.	Survival	Survival-Chicken	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)

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779 Table 2.

780 Results of the best fitting model (type based)

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		

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

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794 Table 3.

795 *The headlines used as experimental material in Study 3 with their legend code (see Table 1).*

Headline	Legend Code
Steroids in chicken cause ovarian cysts.	Survival-Chicken
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

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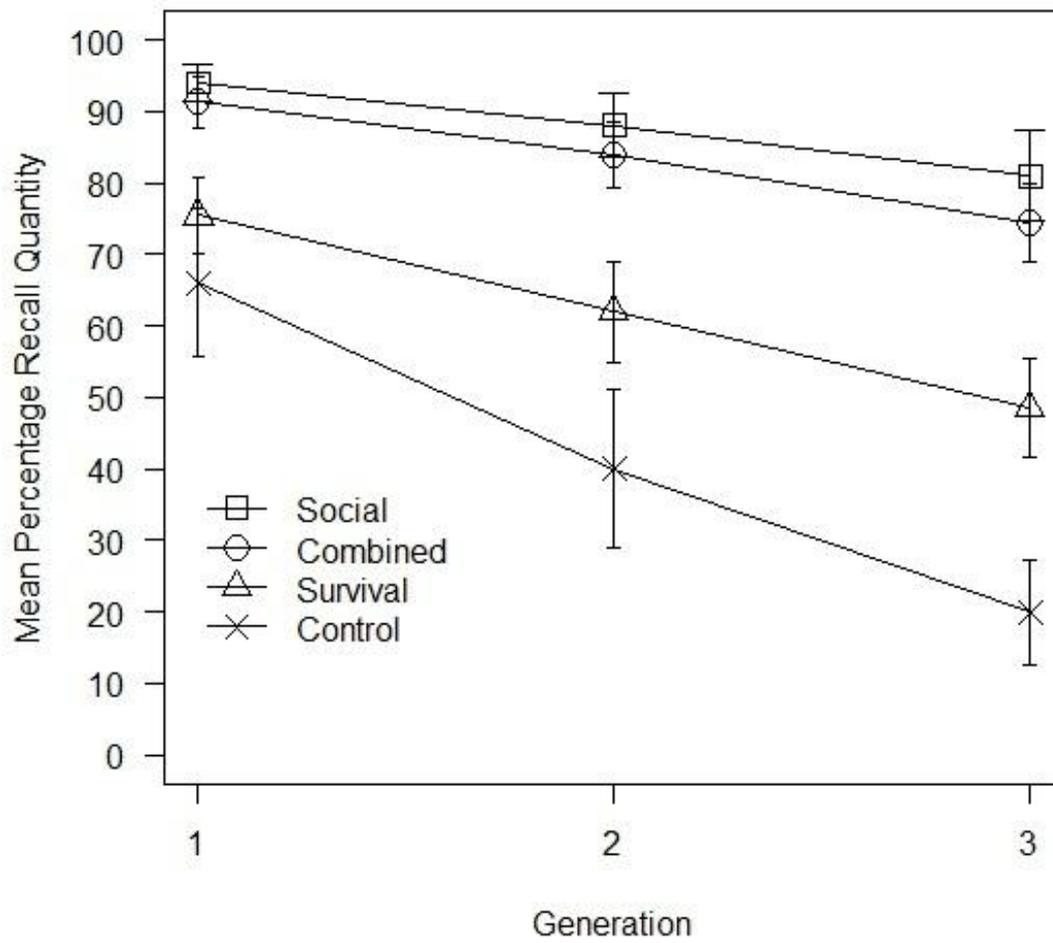


Figure 1. The mean percentage of original propositions recalled over the three generations by legend type.

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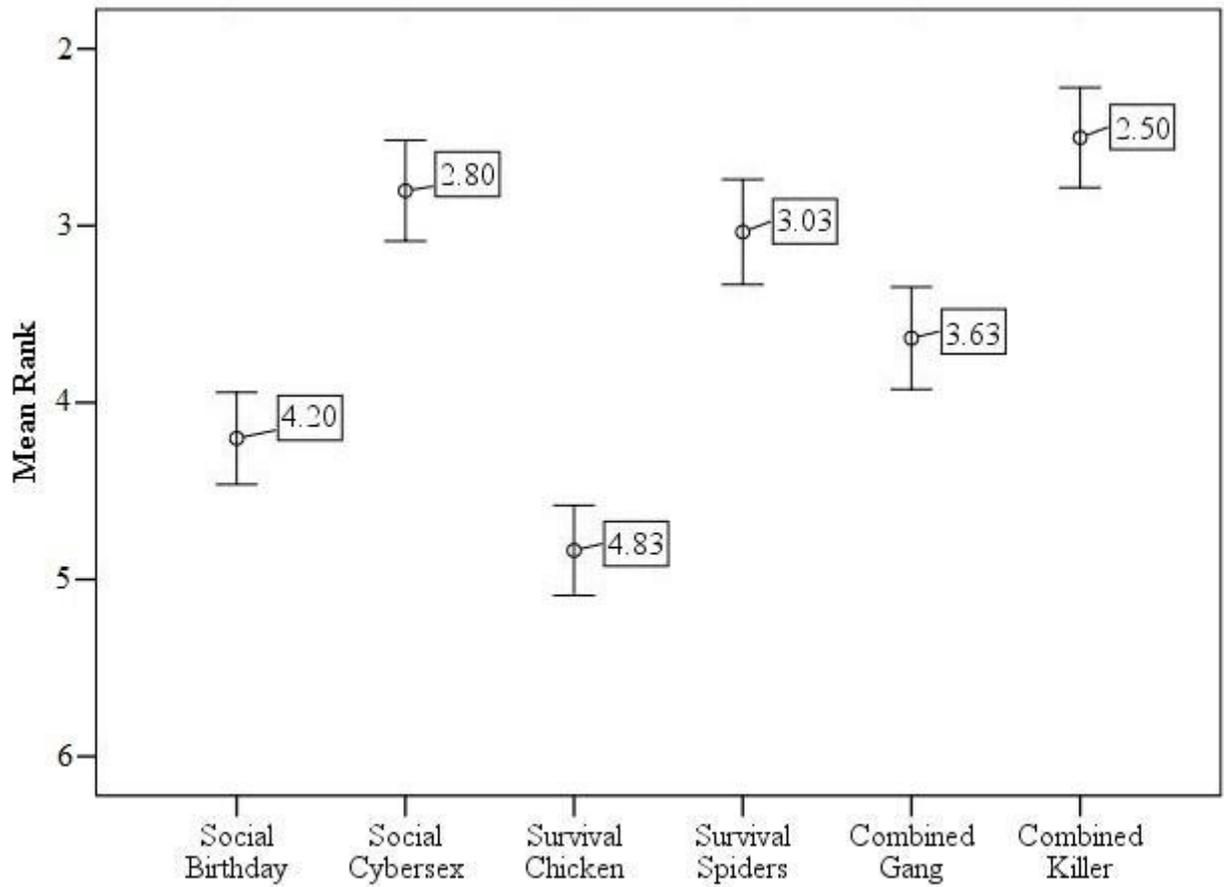


Figure 2. Mean rank of each legend in the choose-to-receive phase of transmission

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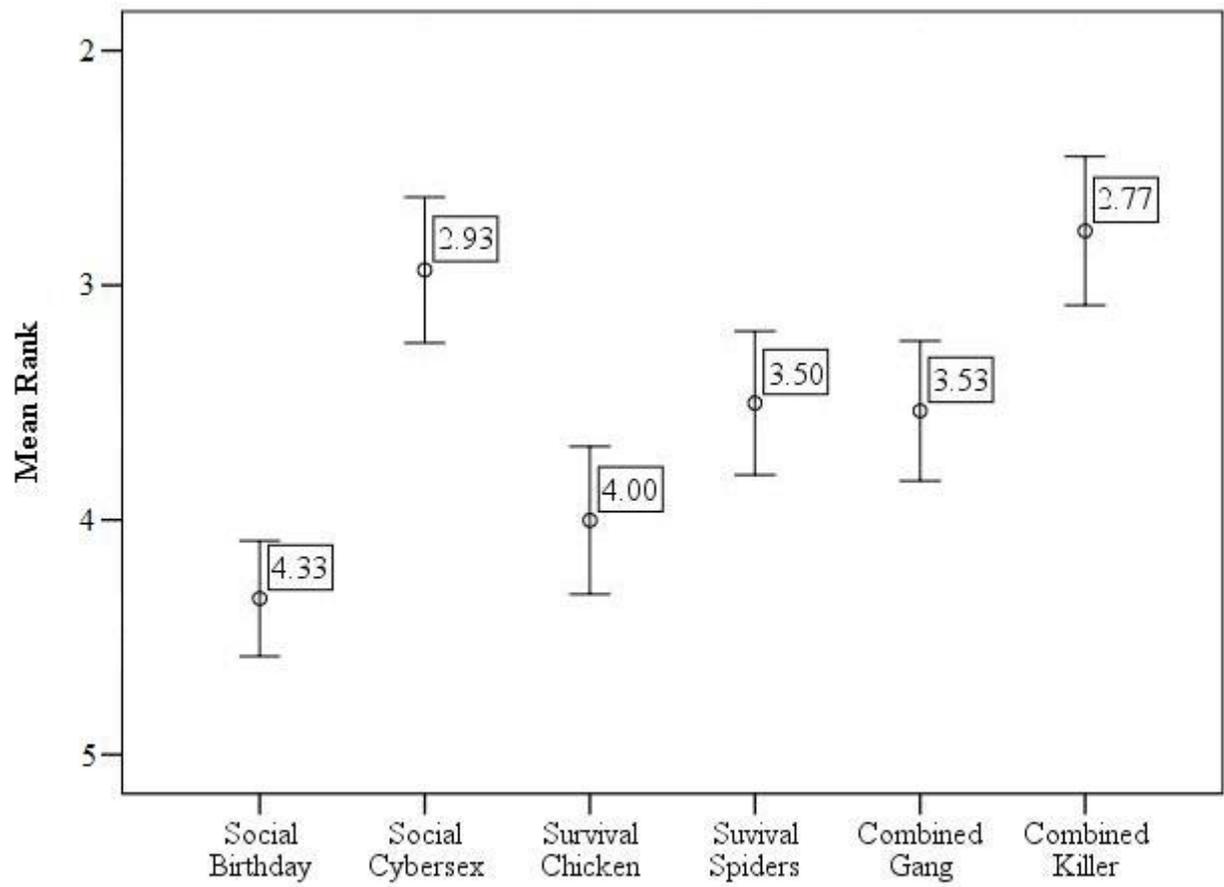


Figure 3. Mean ranks of each legend in the choose-to-transmit phase of transmission

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Supplementary Material

A. Questionnaire used in Study 1.

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)

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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

65 **B. Table showing Legends' mean scores from Study 1.**

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Legend	Mean Rating (SD)				
	Emotional	Plausibility	Survival	Social	Gender Stereotype
1. Tumour	6.50 (.89)	5.00 (1.95)	4.05 (2.11)	1.90 (1.17)	2.25 (1.65)
2. Noodles	5.30 (1.38)	3.80 (2.12)	4.15 (1.60)	1.70 (.98)	2.45 (1.79)
3. Chicken	5.50 (1.19)	4.25 (1.86)	4.90 (2.00)	2.50 (1.76)	3.00 (1.38)
4. Cybersex	6.00 (1.12)	3.75 (1.94)	2.55 (1.70)	5.85 (1.04)	3.75 (1.71)
5. Farting	5.80 (1.44)	3.50 (2.09)	1.80 (1.24)	5.20 (1.32)	4.55 (1.57)
6. Birthday	5.55 (1.05)	4.40 (1.98)	1.85 (.99)	5.45 (.95)	4.90 (1.41)
7. Gang	5.90 (1.17)	4.85 (1.39)	4.25 (1.70)	4.90 (1.21)	3.25 (1.74)
8. Caller	5.75 (1.37)	3.85 (1.95)	3.95 (1.88)	3.35 (1.66)	3.10 (1.86)
9. Hitcher	5.05 (1.50)	4.60 (1.27)	4.10 (1.74)	3.90 (1.77)	3.30 (1.95)
10. Powder	5.50 (1.32)	4.75 (1.25)	2.10 (1.21)	5.15 (1.53)	3.95 (1.73)
11. Revenge	5.00 (1.45)	4.10 (1.62)	2.30 (1.34)	5.75 (1.12)	5.10 (1.17)
12. Choke	4.80 (1.32)	4.35 (1.81)	1.90 (.97)	3.20 (1.47)	5.30 (1.84)
13. Skin	5.60 (1.39)	5.60 (1.31)	2.80 (1.88)	3.50 (1.32)	2.25 (1.59)
14. Spiders	5.35 (1.35)	3.95 (2.14)	4.05 (1.93)	2.50 (1.61)	4.10 (1.52)
15. Snake	5.65 (1.09)	5.20 (1.80)	4.20 (2.02)	2.25 (.97)	1.9 (.85)
16. Killer	5.50 (.95)	4.15 (1.63)	5.05 (1.96)	3.45 (1.70)	4.65 (1.63)
17. Clown	5.75 (1.21)	5.15 (2.08)	3.40 (2.16)	3.25 (1.86)	2.50 (1.50)
18. Control	4.70 (1.17)	3.75 (2.50)	2.50 (1.70)	1.40 (.82)	1.45 (1.15)

67 **C. Tables showing homogenous subsets and means.**

68 *Emotion score homogenous subsets and means.*

Legend	Homogenous Subsets ($\alpha = .05$)		
	with mean scores		
	1	2	3
18. Control	4.70		
12. Choke	4.80	4.80	
11. Revenge	5.00	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
3. Chicken	5.50	5.50	5.50
10. Powder	5.50	5.50	5.50
16. Killer	5.50	5.50	5.50
6. Birthday	5.55	5.55	5.55
13. Skin	5.60	5.60	5.60
15. Snake	5.65	5.65	5.65
8. Caller	5.75	5.75	5.75
17. Clown	5.75	5.75	5.75
5. Farting	5.80	5.80	5.80
7. Gang	5.90	5.90	5.90
4. Cybersex		6.00	6.00
1. Tumour			6.50

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73 *Plausibility score homogenous subsets and means.*

Legend	Homogenous	
	Subsets ($\alpha = .05$)	
	with mean scores	
	1	2
5. Farting	3.50	
4. Cybersex	3.75	
18. Control	3.75	
2. Noodles	3.80	3.80
8. Caller	3.85	3.85
14. Spiders	3.95	3.95
11. Revenge	4.10	4.10
16. Killer	4.15	4.15
3. Chicken	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

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76 *Survival information score homogenous subsets and means.*

Legend Code	Homogenous Subsets ($\alpha = .05$) with mean				
	scores				
	1	2	3	4	5
5. Farting	1.80				
6. Birthday	1.85				
12. Choke	1.90				
10. Powder	2.10				
11. Revenge	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
2. Noodles				4.15	4.15
15. Snake				4.20	4.20
7. Gang				4.25	4.25
3. Chicken				4.90	4.90
16. Killer					5.05

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80 *Social information score homogenous subsets and means.*

Legend	Homogenous Subsets ($\alpha = .05$) with mean scores						
	1	2	3	4	5	6	7
18. Control	1.40						
2. Noodles	1.70						
1. Tumour	1.90	1.90					
15. Snake	2.25	2.25	2.25				
3. Chicken	2.50	2.50	2.50	2.50			
14. Spiders	2.50	2.50	2.50	2.50	2.50		
12. Choke		3.20	3.20	3.20	3.20		
17. Clown			3.25	3.25	3.25		
8. Caller			3.35	3.35	3.35		
16. Killer			3.45	3.45	3.45		
13. Skin				3.50	3.50		
9. Hitcher					3.90	3.90	
7. Gang						4.90	4.90
10. Powder						5.15	5.15
5. Farting							5.20
6. Birthday							5.45
11. Revenge							5.75
4. Cybersex							5.85

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85 *Gender stereotype behaviour score homogenous subsets and means.*

Legend	Homogenous Subsets ($\alpha = .05$) 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. Chicken	3.00	3.00	3.00	3.00	3.00					
8. Caller	3.10	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	3.30		
4. Cybersex			3.75	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	3.95
14. Spiders					4.10	4.10	4.10	4.10	4.10	4.10
5. Farting						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. Revenge									5.10	5.10
12. Choke										5.30

87 **D. Full text of urban legends used in Studies 2 and 3.**

88 Central propositions are indicated with square brackets and numbered.

89 *Survival-Chicken*

90 [A woman underwent an operation to remove an ovarian cyst]¹ but just a few months [later
91 she relapsed]² and was rushed to her gynaecologist. The [gynaecologist asked her if she often
92 ate chicken wings]³, when she said yes he explained that, today, [chickens are injected with
93 steroids to accelerate growth]⁴. These steroids can have a terrifying effect on the body]⁵ and
94 are most dangerous in the presence of female hormones. Exposure to these [steroids can lead
95 to women being more prone to the growth of cysts in her womb]⁶.

96 *Survival-Spiders*

97 When beehive hair styles were in fashion it was almost [a competition to see which girl could
98 get her hair the highest]¹. There was one girl who got her hair so high, and put so much hair
99 spray on it, that she never took it down, combed it or washed it]². One day [she suddenly fell
100 ill and died]³. They found out that a [deadly spider had nested in her hair and laid eggs]⁴.
101 When [the eggs hatched the baby spiders bit into her scalp and poisoned her.]⁵

102 *Social-Birthday*

103 The [boss of a small company took his attractive secretary out for a long lunch on his
104 birthday]¹ and they enjoyed some drinks together. Afterwards, the [secretary invited the boss
105 up to her apartment]² for a few more drinks and which he readily agreed to. At her apartment
106 [she left the room to 'slip into something more comfortable']³. When she [returned a few
107 minutes later with a birthday cake, surrounded by the man's friends, family, and his wife]⁴,
108 they [found the surprised man waiting in nothing but his socks!]⁵

109 *Social-Cybersex*

110 A [student broke up with her boyfriend after they started university]¹. Feeling lonely, [she
111 started to use internet dating and met a new guy online]² who she began to share flirtatious
112 messages with before [eventually winding up having fully fledged cybersex]³. After months
113 of an online relationship [they eventually decided to meet]⁴ and arranged to spend the
114 weekend together. She waited for him in the hotel room and when her dream man came in
115 through the door, [she was horrified to discover it had been her dad all along!]⁵

116 *Combined-Gang*

117 A [little boy was out shopping with his mum]¹ and [needed the toilet, so she let him use the
118 gents']² toilet on his own rather than going into the ladies' with her. When [he didn't come
119 back]³, his mum began to get worried and [asked a passing policeman to check in the toilet
120 for her son]⁴. The [policeman found the little boy almost immediately, lying in a pool of
121 blood]⁵ in one of the cubicles. Apparently, the [poor boy had been attacked as part of a gang
122 initiation]⁶.

123 *Combined-Killer*

124 One night a [woman heard a baby crying outside her door]¹. [She rang the police because it
125 was late and she thought it was weird]². The police told her "whatever you do, do NOT open
126 the door."³ The [woman said that she was worried that the baby would crawl into the street
127 and get run over]⁴ but the police then told her that [a serial killer has a baby's cry recorded
128 and has been using it to coax women out of their homes so he can kill them]⁵.

129 *Control Material*

130 [Cheddar Gorge is a rock formation formed by melt water floods at the end of the last Ice
131 Age]¹. The [limestone rock was blocked with ice which prevented water from flowing

132 through it]², so [melting water was forced to flow over the surface, carving out the gorge]³.
133 During warmer periods the [ice melted and water flowed underground through the limestone,
134 creating the caves and leaving the gorge dry]⁴. Today [much of the gorge has no river until an
135 underground river emerges in the lower part from a cave.]⁵

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151 **E. Table showing the mean differences between the legends used in Chapter 5 (column –**
 152 **row).**

	Cybersex	Birthday	Gang	Spiders	Killer	Control	
	Social	Social	Combined	Survival	Combined		
Cyst	E -.50	E -.05	E -.40	E .15	E .00	E .80	Key: E = Emotion P = Plausibility G = Gender stereotype S = Social info V = Survival info
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*	

153 * Indicates legends are found is different subsets ($p \leq .05$)

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156 **F. Tables showing comparisons between the models used in the analysis of Study 2.**

157 *Model comparison with predictor coefficients*

Model	AIC	Predictor	Coefficient	SE	Z
Full	201.54	(Intercept)	1.13	1.49	0.76
		Age	-0.04	0.02	-1.54
		Gender=Male	-0.45	0.54	-0.84
		Stereotype=Low	-1.38	1.21	-1.14
		Stereotype=Medium	-1.2	0.96	-1.25
		Type=Social	2.95	0.98	3.01**
		Type=Survival	2.03	0.63	3.21**
		Type=Combined	3.55	0.9	3.94***
		Generation=1	1.17	0.36	3.29***
Generation=2	1	0.3	3.36***		
Generation Only	229.72	(Intercept)	1.24	0.18	7.01***
		Generation=1	0.81	0.28	2.9**
		Generation=2	0.71	0.23	3.13**
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***

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

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160 *Model comparison with goodness-of-fit tests*

Model	Df	AIC	BIC	Log Likelihood	Test	X ²
1. Full	16	201.54	255.09	-84.77		
2. Type	9	192.22	222.35	-87.11	1 vs. 2	4.69
3. Generation Only	5	229.72	246.46	-109.86	3 vs. 2	45.5***
4. Stereotype	8	206.61	233.39	-95.31	4 vs. 2	16.39***

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

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166 **G. Full equation for the model used for analyses in Study 2**

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$$Y_{tig} \sim \text{Binomial}(1, \pi_{tig}),$$

$$\text{logit}(\pi_{tig}) = \beta_0 + \beta_1 \text{Control}_{tig} + \beta_2 \text{Social}_{tig} + \beta_3 \text{Survival}_{tig} + \beta_4 \text{Combined}_{tig} \\ + \beta_5 \text{Gen1}_g + \beta_6 \text{Gen2}_g + \beta_7 \text{Gen3}_g + U_g P_{ig} + e_{tig},$$

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$$U_g \sim N(0, \sigma_U^2),$$

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$$P_{ig} \sim N(0, \sigma_P^2),$$

$$e_{tig} \sim N(0, \sigma_e^2)$$

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Where Y_{tig} denotes the observed percentage of central propositions recalled for legend type t , by participant i , in generation g and π_{tig} denotes the proportion of central propositions recalled for legend type t , by participant i , in generation g . The fixed intercept for the mean of all responses is denoted by β_0 . The fixed intercepts of each material type (control, social, survival and combined type) are denoted by β_1 to β_4 and β_5 to β_7 denotes the fixed intercepts of each transmission generation (1, 2 and 3). The random effect of participant at the level of generation is denoted by $U_g P_{ig}$ and e_{tig} denotes individual level errors.