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

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Abstract

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

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Introduction

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

58 **Survival Information Bias**

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

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

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

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

91 **Social Information Bias**

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

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

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

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

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

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

141 and recall five episodes describing a female student completing everyday events. The
142 experimental group were given a social motive for the student, that she was pregnant by her
143 professor, which connected the five episodes into a narrative. The control group were not
144 provided with this motive, leaving the episodes as independent events. The experimental
145 group recalled significantly more of the five episodes than the control group, which suggested
146 that the social nature of the material given to the experimental group exploited a bias for
147 social information in encoding and recall.

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

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

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

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

175 A wide range of social information can be found in urban legends. These legends are
176 frequently built around intense social interaction that could easily be defined as gossip, such
177 as the accidental cybersex between a father and daughter, or actual accidental incest in some
178 instances (Brunvand, 1999). Urban legends can also be attached to real people in a manner
179 that clearly acts as gossip, for instance, the legend of a film star having to have a gerbil (or
180 hamster) removed from their rectum has been said of several real life film stars over the past
181 thirty years (Brunvand, 1986). In these instances the social information contained in the
182 legend would appear to be the sole reason for the legend’s success in transmission. Many
183 urban legends also clearly feature ecological survival information. Food contamination is a
184 common feature, whether it is deliberate, such as in the ‘Razor blade in the apple’ legend
185 (Best & Horiuchi, 1985), or accidental, such as in the ‘Kentucky fried rat’ legend (Fine,
186 1980). These food contamination legends are often localised (Fine, 1980) and as such provide
187 survival information directly relevant to the receivers’ environments. Violence at the hands of
188 other humans is also a common feature and often the perpetrators of this violence are from
189 minorities within a society (Ellis, 1983; Victor, 1990), once again providing information

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

200 **The Present Research**

201 In these studies we used real urban legends, which have been or are actively
202 transmitted between people, as a means to investigate social bias and survival bias. In the first
203 of the three studies, participants rated urban legends on a number of scales related to
204 suggested content biases in order to provide a means of selecting material that could be used
205 in further studies. This material comprised a selection of three types of legends: legends that
206 scored highly for survival-relevant information, legends that scored highly for social
207 information, and legends that scored highly for both kinds of information. Legends which
208 featured both social and survival information were used to examine how a combination of
209 biases affected recall and transmission. In the second study a linear transmission chain design
210 is used to examine the effects of social information, survival information and combining both
211 types of information on the cultural transmission of an urban legend narrative. These
212 experiments aimed to test the hypothesis that legends containing content relevant to survival
213 and social information biases are transmitted with higher fidelity than control material
214 lacking such content. We further hypothesised that legends containing both types of content

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

219 **Study 1**

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

223 **Participants**

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

228 **Materials**

229 Seventeen urban legends were collected from the *Urban Legend Reference Pages*
230 (www.snopes.com); five were thought to contain information relevant to survival (survival
231 type), six were thought to contain information relating to social interaction or relationships
232 between third parties (social type) and six were thought to combine both types of information
233 (combined type). These legends were re-written to approximately match for word length (88-
234 93 words) and number of central propositions (5-6). Control material was also created; this
235 was adapted from a description of the formation of Cheddar Gorge from *Wikipedia*
236 (http://en.wikipedia.org/wiki/Cheddar_gorge), re-written to match the legends in terms of
237 word length and central propositions. Questionnaires were created which contained eight

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

244 **Procedure**

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

249 **Results**

250 Each legend and the control material received 20 ratings on each scale (see
251 supplementary material B for the mean ratings for each legend). Significant variation
252 between legends was found in emotional content (one-way ANOVA, $F_{17, 342} = 2.47$, $p < .01$),
253 plausibility (one-way ANOVA, $F_{17, 342} = 2.09$, $p < .01$), survival information (one-way
254 ANOVA, $F_{17, 342} = 8.20$, $p < .001$), social information (one-way ANOVA, $F_{17, 342} = 21.94$, $p <$
255 $.001$) and gender stereotyped behaviour (one-way ANOVA, $F_{17, 342} = 10.92$, $p < .001$). A *post*
256 *hoc* Ryan-Einot-Gabriel-Welsch multiple F test with $\alpha = .05$ was used to group the legends
257 into homogenous subsets. There were five subsets with similar survival scores, with ten
258 legends in the subset with the highest mean survival score. There were seven subsets with
259 similar social scores, with six legends in the subset with the highest mean score. Only one
260 legend was found which featured in both the highest social subset and the highest survival
261 subset. Legends within a subset were considered not significantly different (see

262 supplementary material C for tables showing the homogenous subsets for each scale).
263 Legends within the high subsets for survival information were considered ‘survival type’
264 legends, those within the high subsets for social information were considered ‘social type’
265 legends and those which featured in high subsets for both social information and survival
266 information were considered ‘combined type’ legends. Significant correlations were found
267 between social information scores and emotional scores ($r_{358} = .17, p < .005$) and between
268 social information score and gender stereotype score ($r_{358} = .48, p < .001$). No other ratings
269 were significantly correlated ($ps > .05$).

270 **Discussion**

271 These results indicate that urban legends vary significantly in their content. Of the
272 potential content biases suggested by previous research (see Mesoudi & Whiten, 2008), there
273 was evidence for all such biases across the legends with significantly high ratings in
274 emotional content, survival information, social information and stereotyped behaviour.
275 Significant correlations were found between social information and emotional content and
276 between social information and gender stereotyped behaviour content, suggesting that these
277 biases may often be found together in urban legends. Equally, gender stereotyped behaviour
278 is unlikely to appear without social information as it implicitly requires some form of human
279 interaction in most cases. Of particular relevance to this study, urban legends can be seen to
280 feature content which would exploit a bias for social information and content which would
281 exploit a bias for survival information. These results further support the argument that urban
282 legends provide a fruitful avenue for research into the effects of content biases on the cultural
283 transmission and evolution of narratives.

284 **Study 2**

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

295 **Participants**

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

301 **Design**

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

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

314 **Material**

315 From the seventeen original legends used in Study 1, two social type legends, two
316 survival type legends and two combined type legends were selected (see Table 1 for an
317 overview and supplementary material D for the full text of the legends used). Outside of the
318 relevant scales, these legends were matched for plausibility, emotional content and gender
319 stereotyped behaviour where possible (see supplementary material E for the mean differences
320 between the legends used in Study 2). The two social type legends appear in the highest
321 social score subset and the lowest survival score subset. The two survival type legends appear
322 in the highest survival score subset and the lowest social score subset. One combined type
323 legend (Combined-Gang) appears in both the highest social score and highest survival score
324 subsets, the other combined type legend (Combined-Killer) appears in the highest survival
325 score subset and the third highest social score subset. No legend other than Combined-Gang
326 appeared in the highest subsets for both social and survival scores so Combined-Killer
327 represents the best choice for a second legend combining social and survival scores.

328 The strong correlation between social information and gender stereotyped content
329 means that one potentially conflicting bias was gender stereotype. Social-Birthday scored
330 significantly higher in gender stereotype than Survival-Chicken and Combined-Gang ($ps <$
331 0.05). Combined-Killer also scored significantly higher than Survival-Chicken ($p < .05$) and
332 the control material was rated significantly lower in gender stereotype than all legends accept

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

338 **[Table 1 about here]**

339 **Procedure**

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

351 **Coding**

352 Following previous studies which used a linear transmission chain design (Bangerter,
353 2000; Kashima, 2000; Mesoudi, et al., 2006; Mesoudi & Whiten, 2004), a propositional
354 analysis (Kintsch, 1974) was performed on each participant's recall. In propositional analysis
355 the text is divided into separate propositions, defined as a predicate (a verb, adjective, or

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

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

370 **Results**

371 To examine whether legend type affected the fidelity of recall, a generalised linear
372 multilevel binomial regression model was used. The analysis was conducted using the lme4
373 software package (Bates, Maechler, Bolker, & Walker, 2008) in R version 3.0.2 (R Core
374 Team, 2013). The initial ‘full model’ had legend type, stereotype level, participant age,
375 participant gender and generation as fixed effects without interaction, assuming a randomised
376 structure of legend type nested within participant, nested within generation. In this full model
377 coefficients for age, gender and stereotype level were not significant. As such a second
378 legend type based model was used with legend type and generation as fixed effects without
379 interaction, assuming a nested randomised structure of legend type within participant, within

380 generation. This type based model showed a significantly better fit than a generation only
381 model ($X^2, 4 = 45.5, p < .001$) and a stereotype level based model ($X^2, 1 = 16.39, p < .001$).
382 The full model did not significantly improve the model fit over the type based model ($X^2, 7 =$
383 $4.69, p > .05$). Comparisons between the models can be seen in supplementary material F and
384 the equation for the type-based model used in the analyses can be seen in supplementary
385 material G. Table 2 shows the results of the type based model.

386 **[Table 2 about here]**

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

391 **[Figure 1 about here]**

392

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

400 **Discussion**

401 **The Cumulative Effects of Recall**

402 The aim of Study 2 was to examine the effects of different informational content on
403 cumulative recall along a transmission chain. Previous research has suggested two potential
404 content biases in cultural transmission: social information bias and survival information bias.
405 This study compared the cumulative recall of urban legends featuring both types of content
406 and a third legend type which combined both. The results show that legends that contained
407 information regarding the interaction between third parties (the social type legends and the
408 combined type legends) were recalled with significantly greater fidelity than the control
409 material and the legends that contained information relevant to survival (survival type
410 legends). This finding is consistent with previous research (Mesoudi et al., 2006) which also
411 found social information to feature an advantage in recall in comparison to equivalent non-
412 social information through a transmission chain. This result provides further evidence to the
413 concept of a content bias for social information in cultural transmission.

414 Survival type legends were not recalled with significantly greater accuracy than
415 legends which featured social information but were recalled with greater accuracy than the
416 control material. This suggests that survival information alone does confer a mnemonic
417 advantage in cumulative recall but not as great an advantage as social information. This
418 supports previous finding by Nairne and colleagues who found that survival processing
419 conferred a mnemonic advantage in individual memory experiments, compared to other
420 forms of mnemonic processing (Nairne, 2010; Nairne & Pandeirada, 2008; Nairne,
421 Thompson & Pandeirada, 2007). The results of Study 2 suggest that this mnemonic
422 advantage granted by survival processing for an individual translates into a cumulative recall
423 advantage across a microculture.

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

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

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

440 That legends high in gender stereotyped behaviour also featured high levels of recall
441 could be considered support for previous research which has suggested a content bias for
442 gender stereotype consistent information in cultural transmission (Bangerter, 2000; Kashima,
443 2000). Although, Lyons and Kashima (2006) found that stereotype consistency bias only
444 emerged in a transmission chain when there was communicative intent rather than just recall
445 as in study 2. As the gender stereotype content in the legends was not the focus of the study
446 the evidence from the results can only be considered inconclusive with regards to true support
447 for gender stereotype bias and the level of social information is likely to be a better
448 explanation of the results. It does suggest, however, that future studies examining gender
449 stereotype or social information bias should consider if both biases are being exploited by the
450 material at once, this is particularly pertinent if the material is ‘gossip’ or involves sexual
451 behaviour.

452 **Transformations**

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

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

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

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

483 **Study 3**

484 While previous research into content biases in cultural transmission has largely relied
485 on the transmission chain paradigm (Mesoudi & Whiten, 2008), in true cultural transmission,
486 selection is not limited by recall ability alone. While memory is important, as an oral
487 narrative must be recalled to be retold, audience feedback and choice as well as the teller's
488 own preferences will affect the transmission of a narrative (Dégh & Vazsonyi, 1975; Lyons
489 & Kashima, 2006; Rubin, 1995; von Sydow, 1948/1965). The choice of the teller can be
490 particularly pertinent as they will not always transmit everything they remember and may
491 refrain from transmitting information if they doubt its truthfulness (Lyons & Kashima, 2003).
492 Tellers are also likely to prefer to transmit information which will keep their audience
493 entertained and/or intrigued (Kashima, Lyons & Clark, 2012). Eriksson and Coultas (2014)
494 argue that research should distinguish between three distinct phases of cultural transmission:
495 'choose-to-receive', 'encode-and-retrieve' and 'choose-to-transmit'. In using the transmission
496 chain paradigm previous content bias research has demonstrated biases in one phase, encode-
497 and-retrieve, but not the other two. Previous research into emotional bias by Heath et al.
498 (2001) demonstrated an advantage for disgusting material in a choose-to-transmit paradigm
499 and Eriksson and Coultas (2014) have expanded this to investigate emotional biases in the
500 two other phases encode-and-retrieve and choose-to-receive. They found an advantage across

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

508 **Participants**

509 Thirty participants (24 females) took part. Their ages ranged from 18 to 22 years with
510 a mean age of 19.43 years ($SD = .97$). These were all undergraduate students studying
511 psychology. No participants taking part in Study 3 had taken part in either Study 1 or Study
512 2.

513 **Material**

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

518 **[Table 3 about here]**

519 **Procedure**

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

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

535 **Results**

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

538 **Choose-to-receive Phase**

539 A Friedman test was used to assess variance in rank across individual's 'choice to
540 receive' for all the individual legends. Mean rank varied significantly across the six legends
541 ($\chi^2_5 = 34.23, p < .001$). *Post hoc* analyses with Wilcoxon tests were conducted, with a
542 Bonferroni-Holm correction applied, to examine the differences between legends. This
543 analysis revealed that Combined-Killer (M = 2.5, SD = 1.55) ranked significantly higher than
544 Combined-Gang (M = 3.63, SD = 1.59), Social-Birthday (M = 4.2, SD = 1.42), and Survival-
545 Chicken (M = 4.83, SD = 1.39), $z_s = 370 - 424, ps < .05$. Social-Cybersex (M = 2.8, SD =
546 1.56) ranked significantly higher than Social-Birthday and Survival-Chicken, $z_s = 389, 406.5,$

547 $ps < .05$, and Survival-Spiders ($M = 3.03$, $SD = 1.63$) ranked significantly higher than
548 Survival-Chicken, $z = 394.5$, $p < 0.05$; see Figure 2.

549 **[Figure 2 about here]**

550 A Friedman test was used to assess variance in rank across the *choose-to-receive*
551 *phase* for the legend types. Mean rank varied marginally significantly across legend type (χ^2_2
552 $= 5.67$, $p = .06$). *Post hoc* analyses with Wilcoxon tests were conducted, with a Holm-
553 Bonferroni correction applied, to examine the differences between legend types. The largest
554 difference was found between combined type legends ($M = 3.07$, $SD = 1.28$) and survival
555 type legends ($M = 3.93$, $SD = .93$) but this was not significant ($z = 265$, $p = .069$). All other
556 comparisons were not significant ($zs = 135, 198$, $ps > .05$).

557 **Choose-to-transmit Phase**

558 A Friedman test was used to assess variance in rank across the *choose-to-transmit*
559 *phase* for the individual legends. Mean rank varied significantly across the six legends ($\chi^2_5 =$
560 15.57 , $p < .01$). *Post hoc* analyses with Wilcoxon tests were conducted, with a Bonferroni-
561 Holm correction applied, to examine the differences between legends. This analysis revealed
562 Social-Cybersex ($M = 2.93$, $SD = 1.70$) ranked marginally significantly higher than Social-
563 Birthday ($M = 4.33$, $SD = 1.35$), $z = 371.5$, $p = .06$; see Figure 3. Comparisons between other
564 legends were not significant ($zs = 194.5 - 367$, $ps > .05$).

565 **[Figure 3 about here]**

566 A Friedman test was used to test for variance in rank across the *choose-to-transmit*
567 *phase* for the legend types but no significant variation in mean rank was found ($\chi^2_2 = 5.41$, p
568 $> .05$).

569 **Discussion**

570 The aim of Study 3 was to examine how social information bias and survival
571 information bias operate on two distinct phases of transmission, the *choose-to-receive phase*
572 and the *choose-to-transmit phase*. Previous research has demonstrated these biases in the
573 *encode-and-retrieve phase*, but has not investigated their effect outside of that single phase.
574 The experiment also examined the effect of combining both social and survival information
575 on transmission across these phases. The results demonstrate no particular preference for
576 either survival or social information at the *choose-to-receive phase* with both being equally
577 preferred as legend types. Legends which combined both showed a slight advantage but this
578 was not significant. Further research should investigate how different combinations of biases
579 operate at this phase of transmission. In the choose-to-transmit phase, no advantage for any
580 legend type was found, suggesting that people are equally willing to pass on legends that
581 contain social information, survival information and combine the two. A possible limitation
582 of the approach used in this study is that the results were based on self-reported data. While
583 self-report may be a plausible means to measure the choose-to-receive phase to it may be less
584 appropriate in the choose-to-transmit phase as participants may not have an accurate
585 perception of which stories they would actually transmit in a real life situation, however, it
586 would be practically challenging to replicate the transmission of urban legends in an
587 experimental setting while remaining ecologically valid.

588 **General Discussion**

589 The aim of these studies was to examine the effects of social information bias,
590 survival information bias and combining both biases on the cultural transmission of urban
591 legends across three distinct phases of transmission: the *choose-to-receive phase*, the *encode-*
592 *and-retrieve phase* and the *choose-to-transmit phase*. Taken together the results for Studies 2
593 and 3 demonstrate the importance of examining transmission in all of these different phases
594 when seeking to demonstrate a content bias in cultural transmission. Previous research by

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

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

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

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

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

645 the 'real world' and provides an explanation for the large number of legends which feature
646 some form of social information (Stubbersfield, Tehrani & Flynn, 2014).

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

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792 Table 1

793 *Legends used in Study 2 with their respective legend types and codes (see supplementary*
794 *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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801 Table 2.

802 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		

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

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816 Table 3.

817 *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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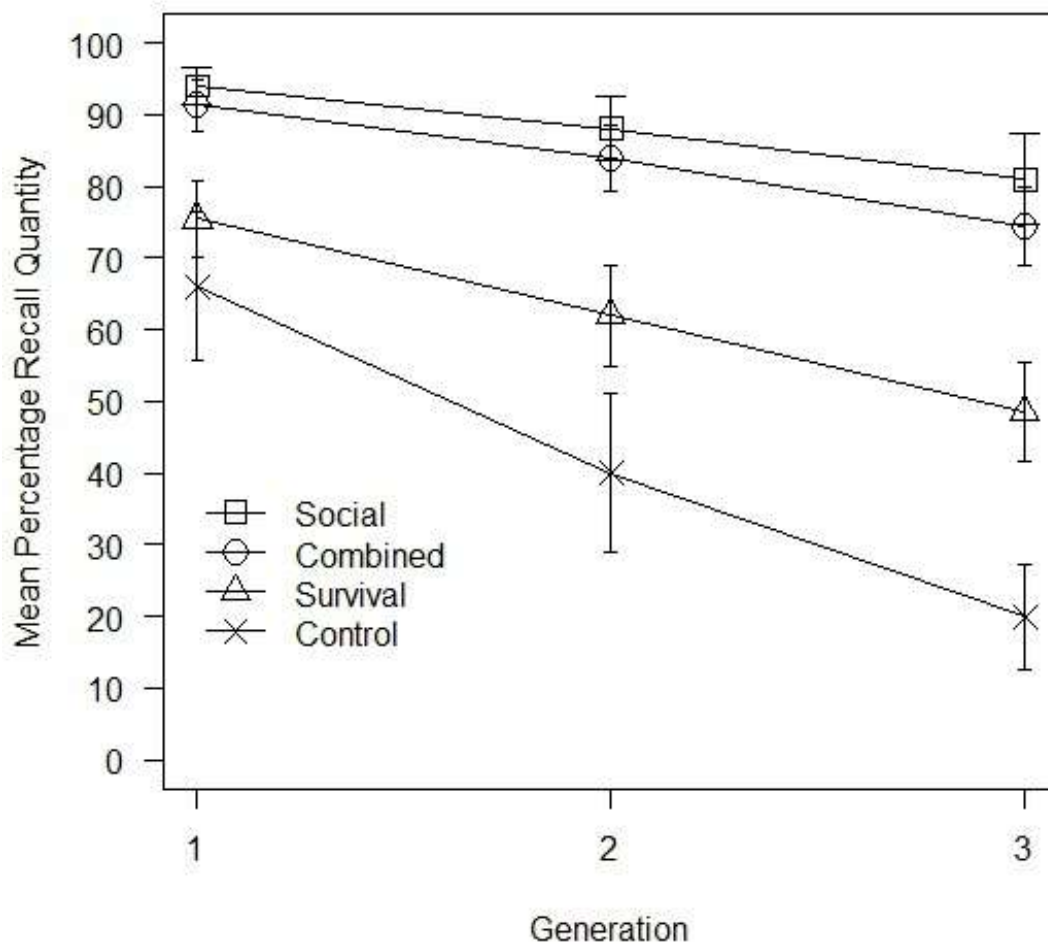


Figure 1. The mean percentage of original propositions recalled over the three generations by legend type.

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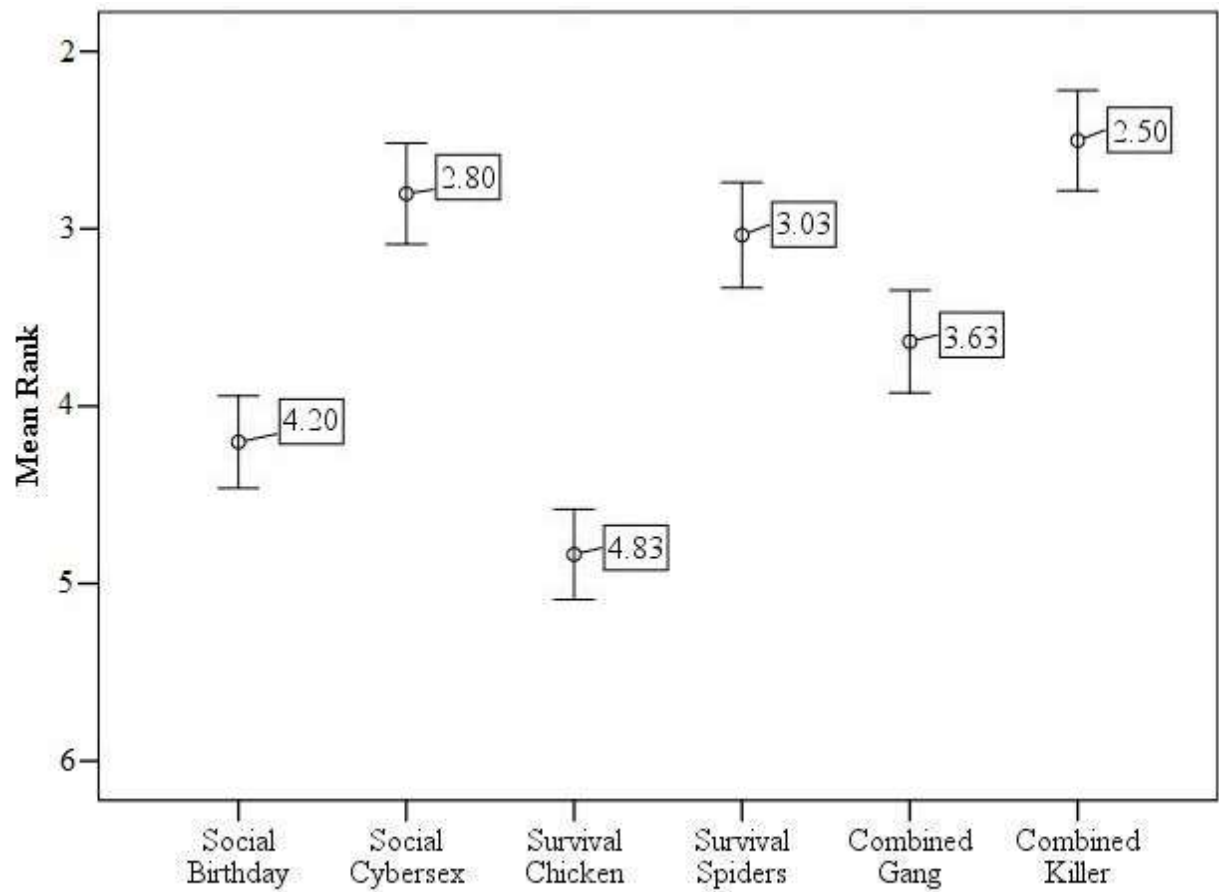


Figure 2. Mean rank of each legend in the choose-to-receive phase of transmission

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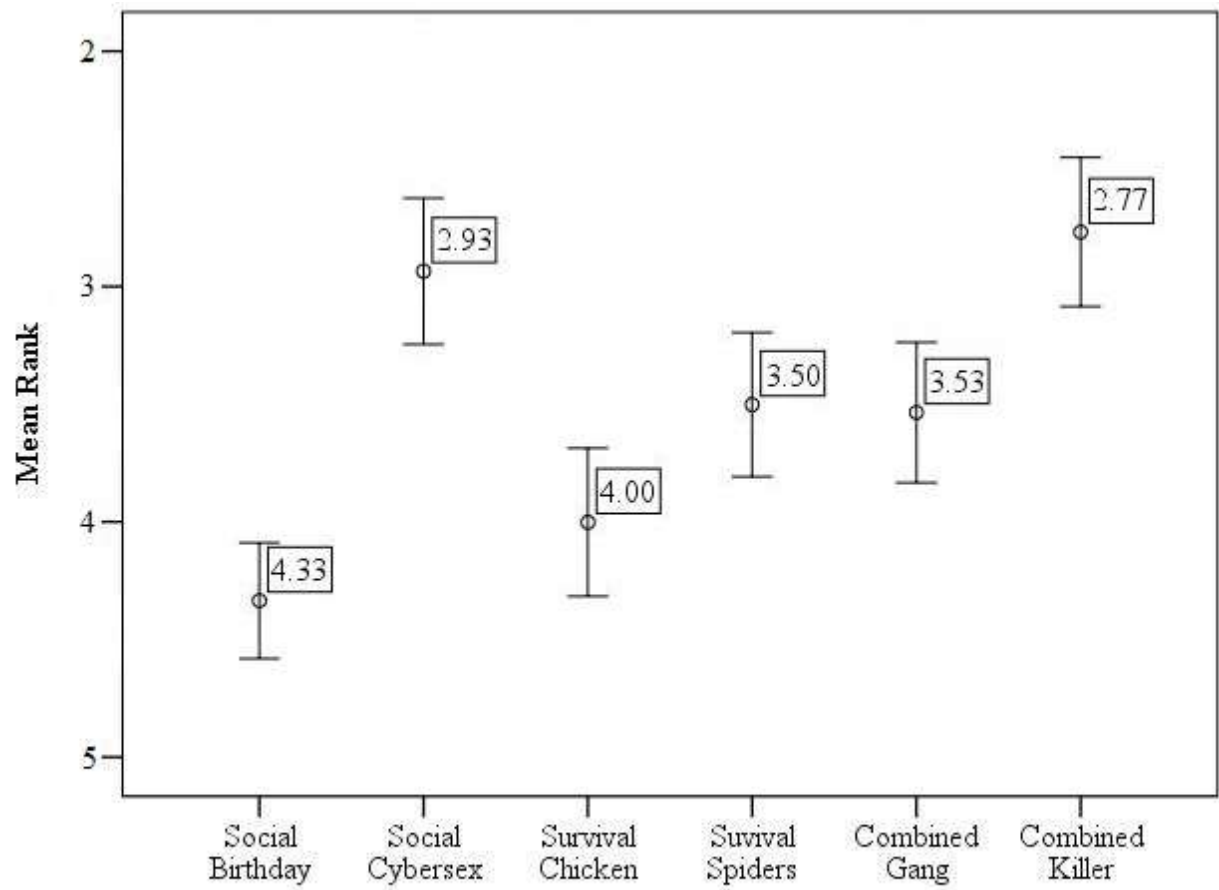


Figure 3. Mean ranks of each legend in the choose-to-transmit phase of transmission