



Heriot-Watt University
Research Gateway

Chicken Tumours and a Fishy Revenge

Citation for published version:

Stubbersfield, JM, Tehrani, JJ & Flynn, EG 2017, 'Chicken Tumours and a Fishy Revenge: Evidence for Emotional Content Bias in the Cumulative Recall of Urban Legends', *Journal of Cognition and Culture*, vol. 17, no. 1-2, pp. 12-26. <https://doi.org/10.1163/15685373-12342189>

Digital Object Identifier (DOI):

[10.1163/15685373-12342189](https://doi.org/10.1163/15685373-12342189)

Link:

[Link to publication record in Heriot-Watt Research Portal](#)

Document Version:

Peer reviewed version

Published In:

Journal of Cognition and Culture

Publisher Rights Statement:

© Koninklijke Brill NV, Leiden, 2017

General rights

Copyright for the publications made accessible via Heriot-Watt Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

Heriot-Watt University has made every reasonable effort to ensure that the content in Heriot-Watt Research Portal complies with UK legislation. If you believe that the public display of this file breaches copyright please contact open.access@hw.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

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

3

4 Joseph M. Stubbersfield¹, Jamshid J. Tehrani² and Emma G. Flynn³

5

6 ¹Centre for Social Learning and Cognitive Evolution, School of Biology, St.
7 Andrews University, St. Andrews, U.K. Email: jms29@st-andrews.ac.uk

8 ²Centre for the Coevolution of Biology and Culture, Department of Anthropology,
9 Durham University, Durham, DH1 3LE, U.K.

10 ³Centre for the Coevolution of Biology and Culture, School of
11 Education/Department of Psychology, Durham University, Durham, U.K.

12

13

14

15

16

17

18

19

20 **Abstract**

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

35

36

37

38

39

40

41

42 **Introduction**

43

44 Recently researchers have convincingly argued that the ability to acquire
45 and transmit knowledge through social learning has been a powerful selective
46 force in the evolution of human cognition (Hermann, Call, Hernández-Lloreda,
47 Hare, & Tomasello, 2007; van Schaik & Burkart, 2011; Richerson & Boyd,
48 2005). Reciprocally, it has been suggested that the ways in which information is
49 processed and stored in the brain have a strong influence over the selection and
50 modification of cultural traits that get passed on from person to person (Claidière
51 & Sperber, 2007; Mesoudi & Whiten, 2008; Sperber, 1996). The positive
52 influence of emotional arousal on the encoding and retrieval of memories in
53 individual memory tests is well established (LaBar & Cabeza, 2006) but how this
54 mnemonic advantage may translate to a content bias for emotional content in
55 cultural transmission has received relatively little attention.

56 With regards to the effects of emotion on cultural transmission, previous
57 research has focused on its influence on people's willingness to pass a story on (in
58 Eriksson and Coultas' [2014] three phases of transmission, the stage defined by an
59 individual's willingness to pass cultural information on is the 'choose-to-transmit'
60 phase. The other two phases are 'choose-to-receive', based on an individual's
61 willingness to receive cultural information and 'encode-and-retrieve', based on an
62 individual's ability to encode the information to memory and later retrieve it).
63 Heath, Bell and Sternberg (2001) propose that cultural items such as narratives
64 undergo 'emotional selection', whereby concepts that trigger a stronger emotional
65 response are positively selected for. To test this hypothesis they conducted two

66 studies using urban legends, focusing on the emotion of disgust. In their first
67 study Heath et al. (2001) asked participants to read urban legends and to rate them
68 for emotional, informational and story characteristics such as plot, characters,
69 morals, practical information and plausibility, as well as their willingness to pass
70 the story along to others. It was found that, while informational characteristics
71 such as plausibility, were important in the likelihood of passing on a legend,
72 legends were also more likely to be passed on if they elicited a greater level of
73 disgust. In a second study, when the number and level of disgust evoking motifs
74 in a legend were manipulated, participants preferred, and were more likely to pass
75 on, legends which produced the highest level of disgust despite the fact that these
76 stories were also less plausible and featured higher mean levels of other negative
77 emotions such as anger and sadness. Heath et al. (2001) also found that urban
78 legends which featured a greater number of disgust evoking motifs were more
79 widely distributed on urban legend websites. They argue that urban legends are
80 transmitted and retained in the social environment due to a positive selection for
81 narratives that evoke stronger levels of emotion in general.

82 Another study by Peters, Kashima and Clark (2009) examined the effect
83 of emotionality on the dissemination of social information. Participants were
84 asked to read anecdotes then complete a questionnaire on how likely they would
85 be to tell this anecdote to an unspecified audience, an audience of friends or an
86 audience of strangers. They found that anecdotes which evoked medium to high
87 levels of emotion were more likely to be passed on than anecdotes which evoked
88 lower levels of emotion. Participants were also significantly more willing to pass

89 on anecdotes which evoked interest, disgust and happiness than sadness, fear and
90 contempt to all three types of audience.

91 Other research suggests that it is the features of emotions rather than
92 individual emotions themselves which enhances transmission. Berger and
93 Milkman (2010) conducted an empirical analysis of 6,956 articles published over
94 three months on the *New York Times* website. When controlling for external
95 drivers of attention (position on the website etc.) and the emotions of surprise and
96 interest, they found that articles which aroused emotions characterised by high
97 arousal, such as anger, anxiety and awe were more likely to be forwarded via
98 email than articles which evoked emotions characterised by low arousal, such as
99 sadness. A survey of *New York Times* readers about their most recently shared
100 article supported this finding (Berger & Milkman, 2010). No relation was found
101 between disgust and how likely an article was to be shared but they suggest that
102 this result is likely to be due to few of the news articles eliciting this emotion.
103 Berger (2011) argues that this increased transmission is driven by the mobilising
104 effect of an excitatory state and found a similar effect even when the arousal was
105 incidental to the material being shared. Other studies have similarly found that
106 increased emotional arousal increases the amount of sharing of information by
107 participants (Christophe & Rimé, 1997; Luminet, Bouts, Delie & Manstead, 2000)
108 but have not looked at the specific emotions involved.

109 Cultural transmission, however, does not just rely on people's willingness
110 to pass a story on; in oral transmission at least, they must also encode and recall it.
111 The cumulative effects of recall will have a particular influence over cultural
112 transmission as only those elements which are preserved will be passed on to the

113 next generation. Eriksson and Coultas (2014) examined the role of cumulative
114 recall in transmission by expanding on Heath et al. (2001). They introduced the
115 concept of three distinct phases of cultural transmission: ‘choose-to-receive’,
116 ‘encode-and-retrieve’ and ‘choose-to-transmit’. In a number of experiments using
117 urban legends, they demonstrated that content evoking a high degree of disgust
118 had a transmission advantage over content evoking a lower degree of disgust in all
119 three phases. However, when looking at individual differences in willingness to
120 pass along stories they found that positively valenced emotions (amusement,
121 surprise) received higher ratings than negatively valenced emotions (anger,
122 sadness, fear, disgust), suggesting that other emotions, particularly positively
123 valenced ones, may be selected for to an even greater degree than disgust, at least
124 in the ‘choose-to-transmit’ phase. While this study did demonstrate an advantage
125 in cumulative recall for content which evoked higher levels of emotion (in their
126 ‘encode-and-retrieve’ phase), like Heath et al (2001) it focused on the emotion of
127 disgust.

128 *The Present Research*

129 As in Heath et al. (2001) and Eriksson and Coultas (2014), real urban
130 legends were used as a means to investigate emotional content biases. The study
131 focused on urban legends because they represent culturally successful narratives
132 from the real world and are also practical for use in experiments because they are
133 relatively short and self-contained. Successful legends often share a number of
134 features, such as a suspenseful or humorous narrative, which contains surprising
135 information or a twist, a warning or moral message that is either explicit or

136 implied, and they are often attributed to a “friend of a friend” (Brunvand, 2000;
137 Fox Tree & Weldon, 2007).

138 In contrast to the studies by Heath et al. (2001) and Eriksson and Coultas
139 (2014), emotional content bias is investigated as a general phenomenon, rather
140 than focusing on the single emotion of disgust, and the effects of emotion level on
141 cumulative recall (the ‘encode-and-retrieve’ phase of transmission) are examined
142 rather than either just the ‘choose-to-transmit’ phase or all three phases of
143 transmission. Cumulative recall was chosen for examination as this can produce
144 different results from individual recall, for example studies examining stereotype
145 consistency bias have found that stereotype inconsistent (SI) information is
146 recalled better than stereotype consistency (SC) bias at the individual level
147 (Dijksterhuis and van Knippenberg, 1995; Macrae, Hewstone, & Griffiths,
148 1993) but in cumulative recall stereotype consistent information is recalled better
149 (Allport & Postman, 1947; Bangerter, 2000). Kashima (2000) found that, when
150 remembering plot-relevant details, participants in earlier positions in a
151 transmission chain recalled SI information better than SC information, however,
152 SC information was retained better than SI information towards the end of the
153 chain.

154 A transmission chain design is used, in which some form of information is
155 passed from one participant to another in a linear ‘chain’ (as per the children’s
156 game ‘Chinese Whispers’/‘Broken Telephone’). Transmission chain experiments
157 are uniquely effective in uncovering content biases in transmission (Mesoudi et al,
158 2006) and have been used successfully to investigate cognitive content biases,
159 such as minimally counter-intuitive (MCI) bias (Barrett & Nyhof, 2001), a

160 hierarchical bias (Mesoudi & Whiten, 2004), a stereotype consistency bias
161 (Kashima, 2000) and a social information bias (Mesoudi, Whiten & Dunbar,
162 2006) as well as multiple biases occurring together (Stubbersfield, Tehrani &
163 Flynn, 2015). In order to select appropriate material, seventeen urban legends
164 were selected from the *Urban Legends Reference Pages* (www.snopes.com). The
165 extent to which the legends evoked emotion was then rated by participants on a 7-
166 point scale. Four legends were selected, two which scored high for evoking
167 emotion and two which scored low. These legends evoked a range of emotions
168 including disgust and amusement. This experiment aimed to test the hypothesis
169 that emotional content bias is a general phenomenon and that legends that evoke
170 higher levels of emotion will be recalled with higher fidelity along a transmission
171 chain than legends that evoke lower levels of emotion, regardless of the emotion
172 evoked. Individual recall-based experiments have shown a recall advantage for
173 content which evokes high emotion across both positive and negative valences
174 (LaBar & Cabeza, 2006) while transmission-based experiments have found
175 differences between positive and negative valence in certain circumstances
176 (Eriksson & Coultas, 2014; Peters et al., 2009) so here the effect of valence of
177 cumulative recall is also examined.

178

179 **Methods**

180 *Participants*

181 One-hundred and twenty participants (94 females) took part. Their ages
182 ranged from 16 to 52 years with a mean age of 20.36 years (SD = 6.34). The

183 majority (92%) were undergraduate students studying psychology, education or
184 recruited through opportunity sampling. Others were prospective students and
185 parents attending a Psychology Department Open Day; all participants under the
186 age of 18 took part with their parents' consent.

187 *Design*

188 A linear transmission chain design was used. Each individual legend was
189 transmitted along ten chains of three participants or 'generations', totalling forty
190 chains for all four legends. Three generations was judged to be an optimum chain
191 length, capable of capturing long-term cumulative effects of cultural transmission
192 but short enough to be practical in terms of participant recruitment and has been
193 used successfully in previous research (Barrett & Nyhof, 2001; Nielsen,
194 Cucchiaro & Mohamedally, 2012; Stubbersfield et al., 2015). The first participant
195 in each chain received a selection of legends which were counterbalanced so no
196 legend appeared in the same position more than another legend. The next
197 participant was presented with the material that had been recalled by the previous
198 participant and so on, along the chain.

199 *Material*

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

205

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

207 *A woman underwent an operation to remove an ovarian cyst but just a*
208 *few months later she relapsed and was rushed to her gynaecologist. The*
209 *gynaecologist asked her if she often ate chicken wings, when she said yes*
210 *he explained that, today, chickens are injected with steroids to accelerate*
211 *growth. These steroids can have a terrifying effect on the body and are*
212 *most dangerous in the presence of female hormones. Exposure to these*
213 *steroids can lead to women being more prone to the growth of cysts in her*
214 *womb.*

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

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

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

224 *A woman went into a takeaway and ordered a chicken burger but*
225 *asked for it without mayonnaise. After leaving the restaurant she bit into*
226 *the burger and discovered that there was mayonnaise in it after all, but*
227 *she finished the burger anyway. Later that evening, she checked herself*
228 *into the local hospital after falling violently ill with food poisoning. Her*

229 *stomach was pumped and the doctors discovered that the chicken in her*
230 *burger had contained a tumour and that the sauce wasn't mayonnaise, it*
231 *was pus from the tumour.*

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

234 *A man was having dinner with his girlfriend's parents when he was*
235 *suddenly gripped by terrible flatulence. He excused himself from the table*
236 *and went in search of a toilet, however, he couldn't find one in time so*
237 *instead he farted through an open window out of the parent's earshot.*
238 *Much relieved, he returned to the table and continued the meal. Later, he*
239 *asked his girlfriend how the night had gone, expecting a good response,*
240 *however, she replied "it was going fine until you farted through the*
241 *servicing hatch!"*

242 Table 1 gives further detail about the legends used, such as their valence
243 and the emotions they were said to evoke by participants. The legend selection
244 was informed by questionnaire ratings from 106 participants on scales relevant to
245 potential content biases such emotion, plausibility, survival information, social
246 information and gender stereotyped behaviour. The ratings from this questionnaire
247 allow for comparisons to be made between the legends in terms of content which
248 may influence their recall and transmission. The high emotion legends were rated
249 as evoking higher levels of emotion than the low emotion legends. Of the
250 seventeen legends originally rated, Tumour-HN received the highest rating for

251 emotion and Dinner-HP was ranked 4th, Cyst-LN was ranked 12th and Fish-LP
252 was ranked 16th.

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

263 [Table 1 about here]

264 *Procedure*

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

272 *Coding*

273 Following previous studies which used a linear transmission chain design
274 (Bangerter, 2000; Kashima, 2000; Mesoudi, et al., 2006; Mesoudi & Whiten,
275 2004; Stubbersfield et al, 2015), a propositional analysis (Kintsch, 1974) was
276 performed on each participant's recall. This involves dividing the text into
277 separate propositions. Only propositions central to the narrative were coded so as
278 to avoid legends with more background details appearing to have poorer recall, as
279 previous research has demonstrated that information relevant to the plot of a
280 narrative is better recalled than background details (Kashima, 1997). This
281 propositional analysis was used to calculate the percentage of original central
282 propositions correctly recalled. Percentages were used instead of total number as
283 the original texts varied between five and six central propositions. No significant
284 difference in the percentage of central propositions recalled was found between
285 legends with five central propositions and legends with six.

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

290 **Results**

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

296 28.62, $p < .001$) and higher in generation 2 than generation 3 ($F_{1, 36} = 11.38, p <$
297 .005).

298 There was also a significant main effect of legend on the percentage of
299 propositions recalled ($F_{3, 36} = 22.87, p < .001$). A Games-Howell *post hoc* test
300 revealed that Tumour-HN and Dinner-HP both had significantly higher recall than
301 Fish-LP and Cyst-LN ($ps \leq .001$). No other significant results were found. Figure
302 1 shows the pattern of recall for each legend along the chains for each generation.

303 [Figure 1 about here]

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

313 As some of the legends were not matched across potentially confounding
314 content biases it is important to test for any effects this content may have had on
315 recall. No significant correlations were found between the percentage of central
316 propositions recalled and the social information score ($M = 3.84, SD = 1.67$) or
317 the stereotype score ($M = 3.73, SD = 1.15$), both tests $p > .05$. However, a
318 significant negative correlation was found between the percentage of central

319 propositions recalled and the survival information score ($r = -.35$, $n = 120$, $p <$
320 $.01$). In order to test how much effect the survival information score had on the
321 percentage of central propositions recalled, a multiple regression was run to
322 predict percentage of central propositions recalled from emotion level and
323 survival information score. The regression model significantly predicted recall
324 ($F_{2, 117} = 68.87$, $p < .01$, $R^2 = .54$, adjusted $R^2 = .53$). Emotion level received the
325 strongest weight in the model, explaining 41.6% of the unique variance compared
326 to the survival information score which only predicted 2.79% of the unique
327 variance. No significant age or gender effects were found.

328 **Discussion**

329 The results of this study show that the urban legends which evoked higher
330 levels of emotion in general were recalled with greater accuracy across a linear
331 transmission chain than urban legends which evoked lower levels of emotion.
332 This is consistent with previous research, which has demonstrated a cognitive bias
333 for content which evokes higher levels of emotion (Berger & Milkman, 2010;
334 Christophe & Rimé, 1997; Luminet, Bouts, Delie & Manstead, 2000).
335 Importantly, however the emotional valence of an urban legend, positive or
336 negative, was found to have no significant effect on cumulative recall. This is
337 consistent with individual recall experiments where emotional arousal was found
338 to enhance encoding and retrieval across both positive and negative valence
339 (LaBar & Cabeza, 2006). Previous studies have found that participants were more
340 willing to pass on stories which were positively valenced than negatively
341 valenced, with the possible exception of when it is negatively valenced due to
342 disgusting content (Eriksson & Coultas, 2014; Peters et al., 2009). The

343 transmission chain design presented here revealed that positive valence lends no
344 advantage in the encode-and-retrieve phase of transmission, perhaps explaining
345 why negatively valenced legends are so pervasive in the cultural environment.
346 Future research should examine the differing levels of arousal of specific
347 emotions in cultural transmission. If negatively valenced content is more likely to
348 arouse strong emotions it could have an advantage at the encode-and-retrieve
349 phase of transmission. Future research should also focus on the effects of positive
350 or negative valence in the chose-to-receive phase and focus on examining the
351 consumption of negatively valenced material.

352 Much of the existing research into emotional content bias in cultural
353 transmission has focused on disgust (e.g. Eriksson & Coutlas, 2014; Heath et al.,
354 2001; Nichols, 2002). For example, Nichols (2002) found that 16th century
355 etiquette norms which prohibited disgust evoking actions were more likely to
356 survive in the social environment than other etiquette norms. Similarly, Heath et
357 al. (2001) found that participants preferred, and were more likely to pass on,
358 legends which produced the highest level of disgust even though these stories
359 were also less plausible and featured higher mean levels of other negative
360 emotions such as anger and sadness. Heath et al. (2001) also found that urban
361 legends which featured a greater number of disgust evoking motifs were more
362 widely distributed on urban legend websites. Disgust does make an interesting
363 case study when examining the role of emotional content in the cultural
364 transmission of narrative, largely because of the question: why would people
365 choose to receive or transmit content which is negatively valenced? However,
366 disgust is somewhat uniquely affective as an emotion. It arouses powerful

367 behavioural responses and impacts on human society through our individual moral
368 choices and public policy on issues such as health, justice, social exclusion and
369 warfare (Curtis, 2011). This may make the findings of Nichols (2002) and Heath
370 et al. (2001) more difficult to generalise to an overall bias for emotional content
371 rather than a specific effect of disgust evoking content as it would be reasonable
372 to expect disgust to be uniquely effective in cultural transmission compared to
373 other emotions.

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

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

393 Following previous research into emotional bias in cultural transmission
394 (Eriksson & Coultas, 2014; Heath et al, 2001) but unlike previous research
395 examining other biases in cultural transmission that has used original material (i.e.
396 Mesoudi et al., 2006) this study used real urban legends. There are a number of
397 benefits to using ‘real world’ material in such an experiment but this can come at
398 the cost of full control over the features of the material. In this experiment efforts
399 were made to control for any confounding variables in terms of content. As
400 mentioned in the results section, survival information was found to be negatively
401 correlated with recall. This contradicts previous research which has found an
402 advantage for survival related information in recall (e.g. Nairne 2010; Nairne &
403 Pandeirada, 2008; Stubbersfield et al, 2015). It is unclear why that would be the
404 case here. The results of the regression show that the degree to which the legends
405 were rated as containing survival information explained far less of the variance in
406 the percentage of propositions recalled than the emotion level, suggesting that it is
407 correct to attribute the variation in recall to the different levels of emotion.

408 The results suggest that in general terms, material which evokes greater
409 levels of emotion will be more successful in cultural transmission due to an
410 advantage in cumulative recall. It is expected that, for an urban legend to be
411 successful over other urban legends in the social environment it must evoke a
412 greater degree of emotion. This is supported by a content analysis of 254 urban
413 legends, which found emotional content bias to be one of the most frequently
414 coded biases, being found in the majority of legends, with all of the emotions

415 coded being characterised by high arousal (Stubbersfield, Tehrani & Flynn, under
416 review). Emotional content is clearly a highly effective bias in the cultural
417 transmission of urban legends.

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

430

431

432

433

434

435

436 **References**

437

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

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

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

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

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

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

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

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

- 457 Fox Tree, J.E., & Weldon, M.S. (2007). Retelling urban legends. *The American*
458 *Journal of Psychology*, 120, 459-476.
- 459 Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats:
460 Emotional selection operating in three phases of cultural transmission of
461 urban legends. *Journal of Cognition and Culture*, 14, 1-26.
- 462 Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: The
463 case of urban legends. *Journal of Personality and Social Psychology*, 81,
464 1028-1041.
- 465 Herrmann, E., Call, J., Hernández-Lloreda, M. V., Hare, B., & Tomasello, M.
466 (2007). Humans have evolved specialized skills of social cognition: the
467 cultural intelligence hypothesis. *Science*, 317, 1360-1366.
- 468 Kashima, Y. (1997). Culture, narrative, and human motivation. In D. Munro, J.F.
469 Schumaker, & S.C. Carr (Eds.). *Motivation and Culture* (pp. 16-30). New
470 York: Routledge.
- 471 Kashima, Y. (2000). Maintaining cultural stereotypes in the serial reproduction of
472 narratives. *Personality and Social Psychology Bulletin*, 26, 594-604.
- 473 Kintsch, W. (1974). *The Representation of Meaning in Memory*. Oxford:
474 Erlbaum.
- 475 LaBar, K.S., & Cabeza, R. (2006). Cognitive neuroscience of emotional memory.
476 *Nature Reviews Neuroscience*, 7, 54-64.

- 477 Luminet, O., Bouts, P., Delie, F., Manstead, A. S. R., & Rimé, B. (2000). Social
478 sharing of emotion following exposure to a negatively valenced situation.
479 *Cognition & Emotion*, 14, 661–688.
- 480 Mesoudi, A., & Whiten, A. (2004). The hierarchical transformations of event
481 knowledge in human cultural transmission. *Journal of Cognition and*
482 *Culture*, 4, 1-24.
- 483 Mesoudi, A., & Whiten, A. (2008). The multiple roles of cultural transmission
484 experiments in understanding human cultural evolution. *Philosophical*
485 *Transactions of the Royal Society B*, 363, 3489-3501.
- 486 Mesoudi, A., Whiten, A., & Dunbar, R.I.M. (2006). A bias for social information
487 in human cultural transmission. *British Journal of Psychology*, 97, 405-
488 423.
- 489 Nairne, J.S. (2010). Adaptive memory: Evolutionary constraints on remembering.
490 *Psychology of Learning and Motivation*, 53, 1-32.
- 491 Nairne, J.S., & Pandeirada, J.N.S. (2008). Adaptive memory: Is survival
492 processing special? *Journal of Memory and Language*, 59, 377-385.
- 493 Nichols, S. (2002). On the genealogy of norms: a case for the role of emotion in
494 cultural evolution. *Philosophy of Science*, 69, 234-255.
- 495 Nielsen, M., Cucchiaro, J., & Mohamedally, J. (2012). When the transmission of
496 culture is child's play. *PLoS One*, 7, e34066.

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

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

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

504 Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (2015). Serial killers, spiders and
505 cybersex: Social and survival information in the transmission of urban
506 legends. *British Journal of Psychology*, 106, 288-307.

507 Stubbersfield, J.M., Tehrani, J.J., & Flynn, E.G. (under review). Santa crucified
508 and death by lollypop: culture, cognition and the epidemiology of urban
509 legends. *Journal of the Royal Anthropological Institute*.

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

513

514

515

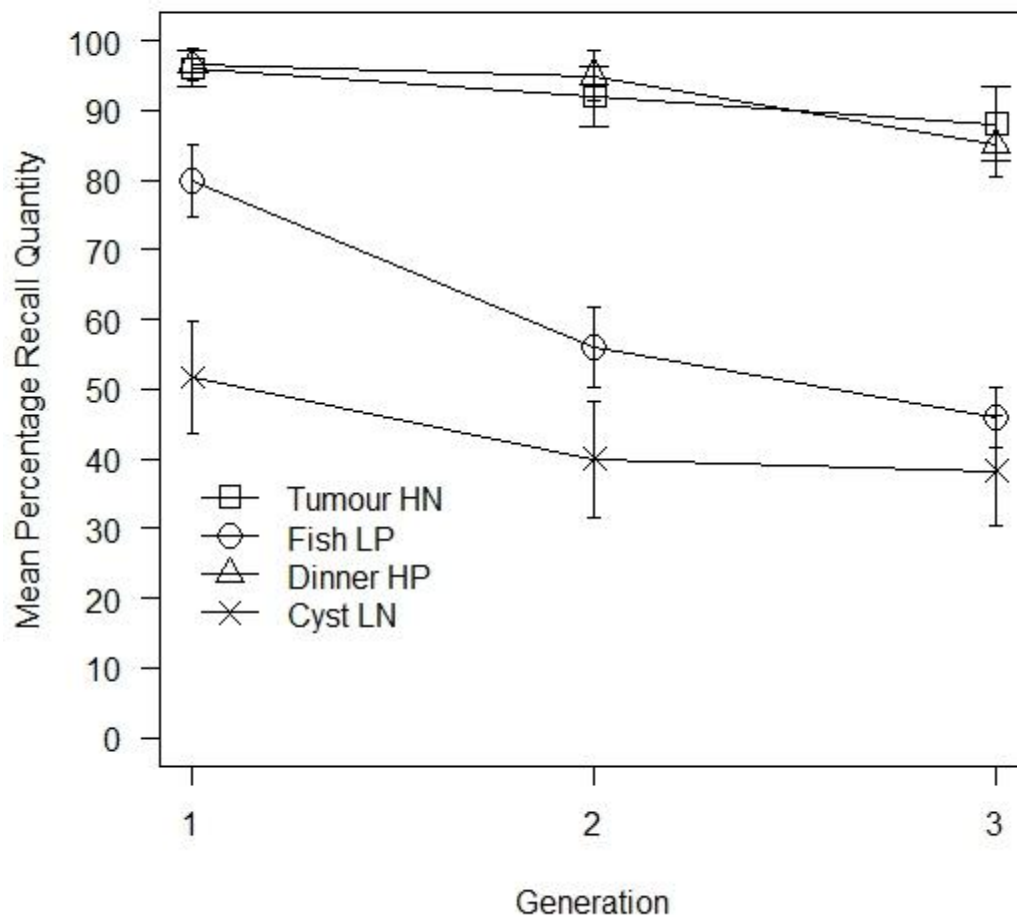
516

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

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

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

522



523

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

529

530

531 **Supplementary Material**

532

533 *Table showing the mean differences between the legends used in Chapter 4 (column –*

534 *row).*

	Cyst-LN (2)	Dinner-HP (3)	Fish-LP (4)
Tumour-HN	E 1.00	E .70	E 1.50
(1)	P .75	P 1.50	P .90
	G -.75	G -2.30*	G -2.85*
	S -.60	S -3.30*	S -3.85*
	V -.85	V 2.25*	V 1.75*
2		E -.30	E .50
		P .75	P .15
		G -1.55*	G -2.10*
		S -2.70*	S -3.25*
		V 3.10*	V 2.60*
3			E .80
			P -.60
			G -.55
			S -.55
			V -.50

535 * Indicates legends are found in different subsets ($p \leq .05$)

536 Key:

537 E = Emotion score

S = Social information score

538 P = Plausibility score

V = Survival information score

539 G = Gender stereotype score

540