From storytelling to Facebook. Content biases when retelling or sharing a story

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Abstract

Cultural evolution researchers use transmission chain experiments to investigate which content is more likely to survive when transmitted from one individual to another. These experiments resemble oral storytelling, where individuals need to understand, memorise, and reproduce the content. However, prominent contemporary forms of cultural transmission—think an online sharing—only involve the willingness to transmit the content. Here I present two fully preregistered online experiments that explicitly investigated the differences between these two modalities of transmission. The first experiment (N=1080) examined whether negative content, information eliciting disgust, and threat-related information were better transmitted than their neutral counterpart in a traditional transmission chain set-up. The second experiment (N=1200), used the same material, but participants were asked whether they would share or not the content in two conditions: in a large anonymous social network, or with their friends, in their favourite social network. Negative content was both better transmitted in transmission chain experiments and shared more than its neutral counterpart. Threat-related information was successful in transmission chain experiments but not when sharing, and, finally, information eliciting disgust was not advantaged in either. Overall, the results present a composite picture, suggesting that the interactions between the specific content and the medium of transmission are important and, possibly, that content biases are stronger when memorisation and reproduction are involved in the transmission—like in oral transmission—than when they are not—like in online sharing.

Keywords

Cultural transmission; cultural evolution; transmission chain experiments; cultural attraction; content biases; digital media.

Introduction

Evolutionary approaches to culture are used to shed light on contemporary cultural dynamics, such as the evolution of programming languages (Valverde & Solé, 2015), the prevalence of certain narrative techniques in films (Sobchuk & Tinits, 2020), the diffusion of music sampling traditions (Youngblood, 2019), or the cognitive underpinnings of vaccine hesitancy (Miton & Mercier, 2015).

The toolbox of cultural evolution researchers includes transmission chain experiments (Mesoudi & Whiten, 2008). Transmission chains experiments are a laboratory analogous of the broken telephone game: in a typical set-up, a first participant is presented with a piece of information, often a short story, and is asked to repeat the story to a second participant, which, in turn, will repeat it to a third, and so on, until the last member of the chain. In this way, it is possible to track the transformations that the story undergoes, which new details are added and, mostly, which details are lost or survive through the chain.

Transmission chain experiments often highlight the presence of cognitive biases (Stubbersfield et al., 2017) or cognitive factors of attraction (Scott-Phillips et al., 2018): certain types of information, possibly because of general evolved cognitive preferences, are more appealing or memorable and tend to be retained and transmitted with more success than others (Sperber & Hirschfeld, 2004). As an illustration, when presented with a story containing both positive and negative elements, participants tended to remember and transmit preferentially negative elements, suggesting a bias towards negative information (Bebbington et al., 2017).

The same cognitive preferences that influence loss and retention in transmission chain experiments are likely to have an aggregate effect on population-level, real-life, cultural dynamics. The cultural success of a maladaptive practice such as bloodletting, for example, has been linked to its cognitive attractiveness, and transmission chain experiments showed that, when presented with vignette stories with bloodletting or with an alternative therapeutic practice, the bloodletting version tended to be transmitted with more success (Miton et al., 2015). Cognitive biases highlighted in transmission chain experiments have been explored in domains such as urban legends (Stubbersfield et al., 2017) or online misinformation (Acerbi, 2019b). A negative bias may contribute to explain a decrease in positive emotionality in English language song lyrics in the last 50 years (Brand et al., 2019) or in

Anglophone literary fiction in the last two centuries (Morin & Acerbi, 2017).

However, the extension from transmission chain experiments to real-life cultural dynamics is not free from issues. If we zoom into the process of cultural transmission, the usual transmission chain set-up resembles oral transmission, where individuals need to pay attention to the information they are exposed to, understand it, memorise it, and then reproduce it to other individuals with communicative intent. (A difference, with respect to oral transmission, is instead that, in the experiments, individuals generally do not choose whether to transmit a piece of information or not.) This contrasts with many instances of real-life cultural transmission. In the cases of music and literature mentioned above, usually individuals do not need to memorise the content they intend to transmit, and intentional modifications are often constitutive part of the process. Even starker is the contrast with digitally-mediated transmission, a prominent contemporary example. An online sharing does not require memorisation or reproduction and, in fact, not necessarily understanding, but only the willingness to transmit the content (Acerbi, 2019a).

It is then a critical question how we can generalise the results of transmission chain experiments to real-life cultural domains, or, more broadly, whether and how the details of the process of cultural transmission influence the content that is more likely to spread. Within cultural evolution research, the experiments described in Eriksson & Coultas (2014) are the first transmission chains that explicitly distinguished three separate phases of transmission: choose-to-receive (do participants want to read a story or not?), encode-and-retrieve (the standard transmission chain procedure) and, finally, choose-to-transmit (do participants want to transmit the story they read or not?). The results showed that the content the experiments were focusing on, that is, content eliciting disgust, was more successful in all three phases. Stubbersfield et al. (2015) compared the performance of social information and survival information in the same three phases of transmission, showing that social information was advantaged over survival information only in the encode-and-retrieve phase, but not in the other two. van Leeuwen et al. (2018) focused on the choose-to-transmit phase, finding limited support both for a negative bias and for an advantage of information eliciting emotions in general. Finally, Stubbersfield et al. (2018) used a modified transmission chain set-up, where participants did not need to recall the story, but were invited to modify it to make it more appealing to the successive readers.

The experiments presented here aimed at comparing explicitly the same material in a standard transmission chain experiment, involving only the encode-and-retrieve phase, with a modality of transmission inspired by online sharing, involving only the choose-to-transmit phase. The experiments investigated three specific content biases that were found successful in previous research: negative content (Bebbington et al., 2017), information eliciting disgust (Eriksson & Coultas, 2014) and threat-related information (Blaine & Boyer, 2018).

The first experiment reproduced an online version of the standard transmission chain setup. For each content bias, I compared the proportion of information successfully transmitted in two chains: one with a version of the story containing the attractive information, and one without. In the second experiment, other participants were instead asked whether they would have shared the same story (either in the attractive or neutral version) in two conditions: with their friends in their favourite social media, or anonymously in a large social media. These two conditions capture the important difference between anonymous and non-anonymous online behaviour (Bernstein et al., 2011). The kind of information shared online, and their tone, are influenced by whether they are shared anonymously or not (Correa et al., 2015). Many reasons can determine this difference, including that anonymous sharing does not affect the reputation of the individuals involved (Boyer, 2018).

The results showed that negative content and threat-related information were, as predicted, favoured in the standard transmission chain setup, but not, surprisingly, information eliciting disgust. Negative information was also favoured when participants were asked to share it (both when sharing with friends and in the anonymous condition), but threat-related information was not. Information eliciting disgust, finally, was not favoured in the sharing experiment, consistently with the transmission chain outcome.

Materials and methods

The analyses of both experiment 1 and experiment 2 are conducted on data pulled together from two repetitions of the same pre-registered experiments. In Supplementary Information I detail the reasons for this choice, and I present separately the results of the originals and the (exact)

replications.

Experiment 1

For the first experiment, 1080 participants from UK were recruited online through *Prolific* (651 females, 420 males, 8 others, 1 prefer not to say, $M_{age} = 36.2, SD = 12.6$). Participants were pre-screened for being more than 18 years old, for reporting English as their first language, and for using a tablet or a computer desktop (not a mobile phone). Each participant was paid 0.48£, or 9.60£/hour for an estimated completion time of 3 minutes.

For each type of content bias (negative, disgust, threat), 120 independent chains of transmission were run, each including three participants. Three iterations are standard in transmission chain experiments and it is considered sufficient to reveal the effect of content biases (see e.g. Stubbersfield et al. (2015)). 60 chains involved the content where the content bias was present, or attractive content, and 60 involved the content where it was not, or neutral content.

Each story was a short text of five or six sentences. Attractive and neutral contents were represented by the same story, with only one detail changed. For content eliciting disgust, for example, the story involved an outbreak of an infectious disease in the fictional Saint Rika hospital in the US, which was the largest in the last 25 years, and of which 500 cases were identified. In the attractive version, it was reported the information that "the likely source of the outbreak is contact with contaminated faeces in the hospital's toilets," while in the neutral was written that the disease could "be transmitted when a person touches another one." For all three stories, both the attractive and neutral variant can be found at: https://osf.io/5yh4u/.

For each chain of transmission, the first participant read the original text and, when ready, they were asked, on a new screen, "to rewrite the story as they were retelling it to a friend." The text generated was then provided to the second participant, and the procedure repeated by passing the text to the third and last participant. The experiment was realised with the software *Qualtrics*.

The text produced by the participants at each step of the chain was analysed by two coders (the author and an independent coder unaware of the experimental procedure and of the predictions) for half of the chains, and by one coder (the author) for the other half. The coding consisted

in determining the presence or absence of basic information from the original story. For content eliciting disgust, for example, were considered (i) the name of the disease, (ii) that the story took place in the US, (iii) in a hospital, (iv) the name of the hospital, (v) that the outbreak was the largest in X (any number of) years, (vi) the correct number of years, (vii) that X (any number of) cases were identified, (viii) the correct number of cases, and (ix) the likely source of the outbreak (or the mean of transmission, for the neutral variant). Between nine and eleven pieces of information were considered for each variant for the three content biases. Complete lists can be found at: https://osf.io/5yh4u/.

Empty texts or texts clearly not related to the task (e.g. participants writing "I could not read the story") were excluded, and participants were replaced. For each of the three content biases, the output, consisting in the proportion of information transmitted at each step of the chain, was analysed using generalised linear mixed models, with the position in the chain and content (attractive/neutral) as fixed effects, and each chain ID and repetition (original/replication) as random effect. The analysis was performed with the software R, using the lme4 package (Bates et al., 2015). The prediction was that, for each content bias, the attractive content would be transmitted better than its neutral counterpart.

Experiment 2

The second experiment involved 1200 participants from UK, recruited online through *Prolific*, 600 participants for condition 1 (414 females, 184 males, 1 others, 1 prefer not to say, $M_{age} = 35.82, SD = 11.4$), and 600 participants for condition 2 (415 females, 180 males, 3 others, 2 prefer not to say, $M_{age} = 34.58, SD = 11.4$). Participants were pre-screened for being more than 18 years old and for reporting English as their first language (the usage of a mobile phone was allowed in this case, as participants did not have to produce written text). Each participant was paid 0.73£, or 8.76£/hour for an estimated completion time of 5 minutes.

Experiment 2 used exactly the same material used as seeds for the transmission chains of experiment 1. In this case, however, the three texts, one for each content bias, were presented to each participant, in random order. For each content bias, again randomly, either the attractive or the neutral version was presented. In condition 1 ("anonymous"), for each text, participants were asked if they would

share the story "anonymously, in a large social network, such as Reddit." In condition 2 ("sharing with friends"), the participant was asked if they would share the story "with your friends in your favourite social media." The experiment was also realised with the software *Qualtrics*.

The output for each content bias, consisting of the decision of sharing or not, was analysed using generalised linear mixed models (binomial) with content (attractive/neutral) as fixed effect and order of presentation and repetition (original/replication) as random effect. As for experiment 1, the analysis was performed with the software R, using the lme4 package (Bates et al., 2015). In this case, there was no specific prediction, but the research question was whether in each condition (anonymous/sharing with friends), and for each content bias, the attractive content was shared more than the neutral content.

Ethics approval for the study was granted by the College of Health, Medicine and Life Sciences Research Ethics Committee of Brunel University London (ref: 24117-MHR-Sep/2020-27910-2). The two experiments were fully preregistered at https://osf.io/wf7pd. All data and code to reproduce the analysis and the figures presented here can be found at https://osf.io/5yh4u/.

Results

Overall, for experiment 1, inter-coder agreement was high (94% probability of agreement, Cohen's $\kappa = 0.879$). As expected, the proportion of content retained and transmitted decreased in all transmission chains (see Figure 1). The attractive content was better transmitted than the neutral content, confirming the predictions, for negative information ($\beta = 0.126, SE = 0.027, t(58) = 4.765, p =< 0.001$) and threat-related information ($\beta = 0.098, SE = 0.024, t(58) = 4.093, p < 0.001$), but there was no difference for information eliciting disgust ($\beta = 0.040, SE = 0.030, t(58) = 1.329, p = 0.189$).

In experiment 2,the attractive content was shared more than the neutral counterpart for only one content-bias, i.e. negative content, both in the anonymous ($\beta = 0.644, SE = 0.191, z(296) = 3.377, p < 0.001$) and in the "sharing with friends" condition ($\beta = 0.607, SE = 0.236, z(296) = 2.575, p = 0.010$).

The difference was also significant for information eliciting disgust in the anonymous condition, but in the unexpected direction, with neutral content shared more than attractive content ($\beta =$

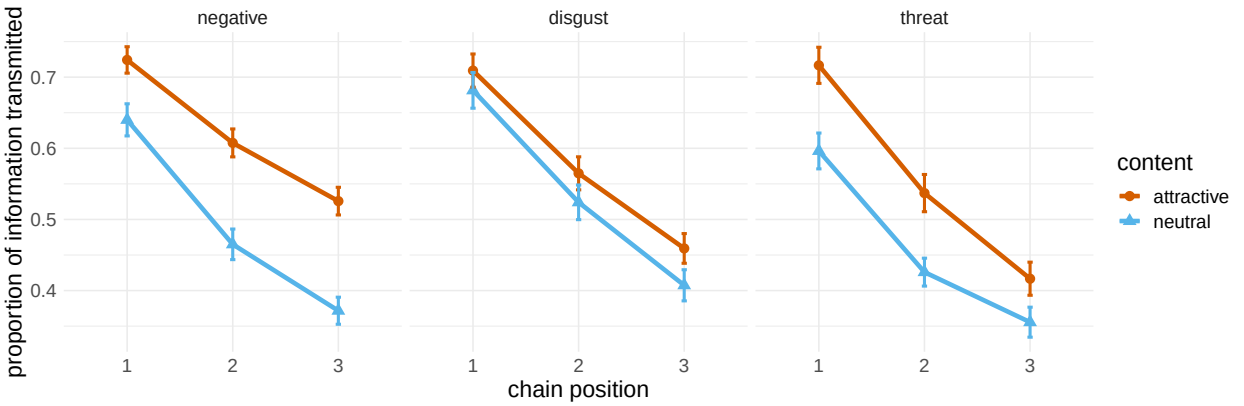

Figure 1: Proportion of information transmitted for the three content biases in the transmission chain set-up of Experiment 1. Points indicate the means, and error bars indicate standard errors.

$-0.370, SE = 0.185, z(296) = -1.994, p = 0.046$), while no significant difference was found in the "sharing with friends" condition ($\beta = -0.061, SE = 0.208, z(296) = -0.294, p = 0.769$).

Finally, no effect was found for threat-related information either in the anonymous ($\beta = 0.231, SE = 0.186, z(296) = 1.247, p = 0.213$) or "sharing with friends" condition ($\beta = 0.165, SE = 0.209, z(296) = 0.792, p = 0.428$).

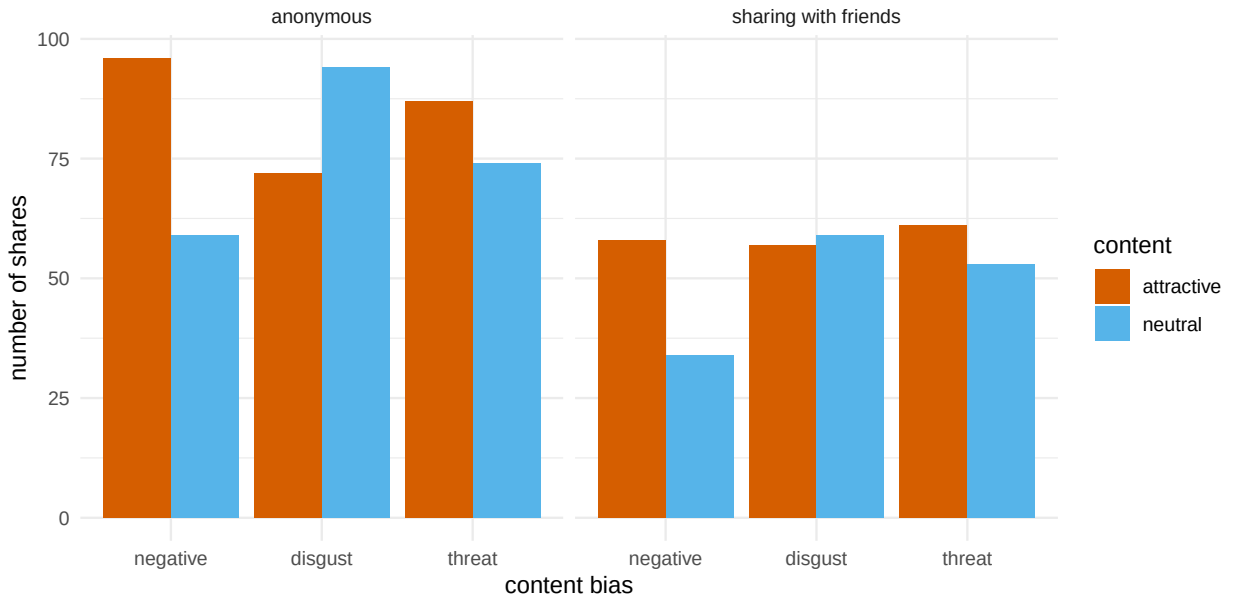

Figure 2: Number of shares for the two conditions of Experiment 2, for the three content biases.

Discussion

As mentioned, the results provided a somewhat composite picture. Comparing the outcomes of experiment 1 (resembling oral transmission) and experiment 2 (resembling online sharing), they were consistent for negative information and disgust-eliciting information, with the former being advantaged, and the latter not, in both experiments. Threat-related information, instead, was advantaged in transmission chain experiments, but not in the sharing condition.

The clearest result is the advantage of negative information both in standard transmission chains and in the sharing experiments. This is in agreement with previous research that found a bias toward negative sentiments in recall in transmission chain experiments (Bebbington et al., 2017), or in acceptance of information (Fessler et al., 2014). A negativity bias is consistent with a broad evolutionary logic that would advantage negative information in salience and memorability (Baumeister et al., 2001), and it has been suggested that could influence as well the diffusion of information online (Acerbi, 2019b; Bellovary et al., 2021; Melumad et al., 2021; Schöne et al., 2021). On the other side, the present experiments compared a negative narrative with a neutral one, without considering explicitly a positive condition. Other transmission chain experiments found indeed an advantage for emotional content in general (Stubbersfield et al., 2017) and, as above, emotional content, independently from the direction (positive or negative) has been found favouring online diffusion of content (Berger & Milkman, 2012; Brady et al., 2017).

Surprisingly, content eliciting disgust was not transmitted or shared differently from its neutral counterpart. In fact, in the anonymous sharing condition of experiment 2, the attractive content was transmitted *less* than the corresponding neutral content. These results are at odds with evolutionary reasoning about the salience of stimuli eliciting disgust (Curtis et al., 2004), and with transmission chain experiments that found that narratives with disgusting elements were better remembered and transmitted (Eriksson & Coultas, 2014). This result suggests that fine-grained details of the transmission process may be important for the resulting cultural dynamic. For example, we may be attracted by particular content, and perhaps remember it better, but we may not be willing to share it (an obvious example is sex-related information (Berriche & Altay, 2020)). Similarly, subtle cues in the experimental procedure may favour or not the repetition of sensitive material, like the

disgust-eliciting details, such as the perception of anonymity, whether participants think that their text will be passed to others, and so on.

Threat-related content was the only content bias for which a difference between the transmission chain experiments and the sharing experiments (in both conditions) was found, with the attractive content being advantaged in the transmission chains but not in the sharing scenario.

The overall contrast between transmitting and sharing, with respect to content biases, is not straightforward. A possible suggestion, worth exploring in future studies, is that the effect of content biases is stronger when retelling a story than when sharing it. The attractive content was favoured in two cases out of three in the transmission chain experiments (negative and threat-related content) and two out of six possible combinations bias/condition in the sharing experiments (negative content on both anonymous and sharing conditions). This difference is clearer when considering the repetitions of the experiments (original and replication) separately (see Supplementary Information). In this case, attractive content was advantaged four times out of six in the transmission chain experiments and only in two out of twelve possible cases in the sharing experiments. This difference would be consistent with the idea that cognitive factors related to memorisation and reproduction influence the content biases, so that they would be stronger when the medium of transmission requires these phases. More counterintuitively, it would suggest that online sharing may be *less* content-biased than oral transmission.

Regarding the difference between anonymous and non-anonymous sharing, the effect of the attractive content was not evident. In the case of negative content, the only one in which attractive content was favoured, it was favoured in both conditions. The main difference was that sharing was, in general, less common in the "sharing with friends" than in the "anonymous sharing" condition. In the former, the total sharing was around two-third of the latter (322 versus 482). It is also interesting to notice that the total amount of sharing was less than expected, as the total possible occasions to share were 1,800 for each condition, so that participants shared less than 20% and 30% of the times, respectively.

Some of these results may be explained by the limitations of the current study. First, participants were not actually sharing content in social media (and, as a consequence, they were also not

anonymous or not), but they were simply asked *if* they would share that content. Even though self-reported sharing intentions has been shown to be relatively good indicators of real online sharing behaviour (Mosleh et al., 2020), subtle differences could change the outcomes presented here. Second, small sharing advantages for a type of content could be amplified in real social media by actual sharing. Individuals would then encounter more of the attractive versions, while here they were presented at the same rate. A possible extension that addresses these shortcomings may be represented by digital field experiments, such as having a bot posting attractive/neutral material (of various contents) in real social media, and see how the posts are shared.

More generally, these experiments point to the importance of keeping into account the details of the transmission process when considering which traits will be favoured by cultural evolution. If content-biases such as the ones studied here can make a cultural trait appealing and memorable, the decision of transmitting it can be detached from these qualities. The types of news that people tend to read most are in general different from the types of news they share most (Bright, 2016). Sharing can be motivated by various interests, including managing one's reputation (Altay et al., 2020) and signalling group membership (Osmundsen et al., 2021), that are not necessarily aligned with the intrinsic attractiveness of a piece of information. Ultimately, cultural evolution has mostly focused on consumers of cultural traits as a determinant of cultural success—what they want to copy, from whom—while less attention has been given to the motivation of the transmitters or producers (André et al., 2020). This may be a fruitful avenue for future studies.

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