**Believing Chicken Little: Evolutionary Perspectives on Credulity and Danger**

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Introduction

Believing false information provided by others places individuals at risk both of being manipulated by purveyors of false information, and of unwittingly contributing to the manipulation of others through the dissemination of that information. While there are many factors that contribute to whether or not someone believes a given claim, in this chapter I focus on the influence of danger in shaping assessments and transmission of information.

An evolutionary psychological approach to the mind (Buss, 2015) provides a useful metatheory for organizing disparate existing findings and generating novel predictions. To briefly summarize this paradigm, first, evolutionary psychologists conceptualize the

mind as composed of a large number of discrete mechanisms, each of which evolved in response to a specific class of challenges (e.g., obtaining food; avoiding predators; etc.) that confronted ancestral humans.  Second, because evolution by natural selection generally occurs through successive slight modifications of existing traits across generations, these mental mechanisms evolved over periods from hundreds of thousands to millions of years.  As a consequence, recent rapid technological and social changes have produced environments for which humans are poorly adapted, often resulting in a mismatch between the way our minds operate and the information presented to us.

Humans are not particularly fearsome or fleet creatures, yet we dominate the globe.  One key to our species' success is our unique reliance on culture, that is, on socially transmitted information.  To address challenges in their environment, many social animals primarily rely on largely innate behavioural templates combined with trial-and-error learning.  In contrast, every human society is dependent on an enormous repertoire of cultural knowledge.  Hence, throughout life, acquiring information from other people is central to individuals' ability to successfully navigate their physical and social environments.  Reconstructing the pathway whereby our species became so different from other animals, it is plausible that, over hundreds of thousands (if not millions) of years, hominids' growing store of cultural information co-evolved with psychological mechanisms that maximized individuals' capacities to obtain, retain, and employ cultural information: the more extensive the cultural information available at any one time, the greater its adaptive value, and thus the stronger the natural selection pressures for those psychological capacities; the more developed those capacities, the more that individuals who had mastered the existing cultural information could add to it, and improve on it.

Importantly, the evolutionary psychological view of the mind as composed of many discrete mechanisms suggests that there is no single, monolithic "capacity for culture". Rather, because the task of acquiring cultural information is composed of a large number of component goals, each of which entails different demands, we can expect that accessing and using cultural information will be undergirded by many different psychological mechanisms (Fessler, 2006). Here, I focus on those processes that assess the plausibility of information.

Being the product of countless individual contributions, cultural knowledge evolves. One consequence is that culture often solves problems without any of its bearers truly understanding the underlying causal processes (Boyd & Richerson, 2006) (for example, traditional medicines can be effective despite inaccurate ethnomedical theories of disease – [de Montellano, 1975]). Indeed, culture sometimes solves problems without any of its bearers even recognizing the nature of the problems being solved (for example, in regions historically plagued by many diseases, despite the absence of germ theory, traditional cuisines employ spices that possess antimicrobial properties – [Billing & Sherman, 1998]). Another consequence is that cultural solutions to problems are often so complex that only experts understand the relationships between particular practices and particular outcomes; as a result, the rationale behind those practices is opaque to most learners. Taken together, the above considerations indicate that, in any society, to be successful, individuals must avidly learn from those around them, and, critically, they must be credulous, that is, they must accept as true information for which the evidentiary basis, the logical rationale, or both are entirely unclear to the learner (Saler, 2004; Fessler, Pisor, & Navarrete, 2014).

Although credulity is vital to success in any society, nevertheless, it comes at a cost. At the least, individuals who are overly credulous will acquire many incorrect beliefs, and these can shape their behaviour in a variety of unproductive ways (Saler, 2004; Boyd & Richerson, 2006). Worse still, excessive credulity invites exploitation by malicious actors who knowingly provide false information (Saler, 2004; Kurzban, 2007). Accordingly, for any given individual in any given environment, there will be an optimal level of credulity, below which the individual fails to take advantage of amassed cultural wisdom, and above which the individual suffers burdensome false beliefs and/or outright exploitation. Importantly, this trade-off point depends in part on the type of information at issue. For information concerning hazards, failing to believe true information will often result in costly encounters with danger, whereas erroneously believing false information will often result in the adoption of precautions that, while potentially entailing costs, will frequently harm the individual less than would encounters with the (purported) danger. No equivalent asymmetry characterizes information concerning benefits. As a consequence, we can expect natural selection to have shaped the human mind so as to make people more credulous of information concerning hazards than of information concerning benefits, i.e., to exhibit *negatively-biased credulity* (Fessler et al., 2014; Fessler, Pisor, & Holbrook, 2017).

Negatively-biased credulity builds on *negativity bias*, the overarching tendency, evident across a wide variety of species, for information concerning threats or losses to have greater attentional salience, evoke stronger emotional responses, be more memorable, and motivate action more strongly than information concerning opportunities or gains. Negativity bias too is explicable in evolutionary-functionalist terms, as dangers

will often be more imminent than opportunities; will often preclude opportunities; and will often have a greater effect on biological fitness than opportunities (Rozin & Royzman, 2001; Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001).


<u>Evidence of negatively-biased credulity and informational negativity bias</u>

Consonant with an overarching propensity for negativity bias, the public's perception of impending economic circumstances is influenced more by negative reports than by positive ones (Soroka, 2006; Nguyen & Claus, 2013; Garz, 2012), and, in turn, news that consumer sentiment is falling has a bigger effect on the stock market than does news that consumer sentiment is rising (Akhtar, Faff, Oliver, & Subrahmanyam, 2011; Akhtar, Faff, Oliver, & Subrahmanyam, 2012). Likewise, in keeping with the specific tendency for negatively-biased credulity, people believe claims that commercial products are dangerous more than they believe accounts indicating that those products are safe (Siegrist, Cousin, & Frei, 2008; Siegrist & Cvetkovich, 2001; Slovic, 1993; White, Pahl, Buehner, & Haye, 2003a).

The processes underlying the above patterns have been explored experimentally. First, addressing the relationship between overarching negativity bias and credulity, in a number studies, using information regarding a variety of subjects, Hilbig (2009; Hilbig, 2012a; Hilbig, 2012b) demonstrated that Germans believe information more when it is framed in a negative rather than positive manner.

Paralleling Hilbig's technique of exploring the determinants of believability by altering the framing of information without changing its substantive content, Fessler, Pisor, and Navarrete (2014) examined negatively-biased credulity by presenting

American subjects with sets composed of one of two paired statements, phrased so as to emphasize either the danger presented by a situation, or the benefit that the situation entails (e.g., "*Although proponents consider German shepherds loyal and intelligent pets, a recent study in the U.S. notes that this breed is responsible for 11% of dog attacks*," "*Despite their fierce appearance, German shepherds are considered loyal and intelligent pets. A recent study in the U.S. notes that other breeds of dog are responsible for 89% of dog attacks*"). Per predictions, participants judged statements more likely to be true when they focused on hazards than when they focused on benefits.

While effective, framing manipulations such as those employed by Hilbig and Fessler et al. suffer the problem that manipulating a negative statement so as to create a positive one can lead to descriptions of benefits that consist primarily of the avoidance of hazards, thereby failing to cleanly disambiguate the two types of information. In part to address this, Fessler, Pisor, and Holbrook (2017) created statements that were thematically paired in each of eight domains, with one statement describing a hazard and one describing a unrelated benefit (e.g., "*Kale contains thallium, a toxic heavy metal, that the plant absorbs from soil*," "*Eating carrots results in significantly improved vision*"). In studies with American participants, they found additional evidence of negatively-biased credulity. Most recently, in multiple studies employing variants of the above techniques and somewhat differing content, Samore (2017) again documented negatively-biased credulity in American participants.

Individual differences in negatively-biased credulity

Although negatively-biased credulity is thought to be a species-typical trait of human cognition, nevertheless, individual variation in this trait is plainly evident. A collection of related features underlie such variation. First, the costs and benefits of negatively-biased credulity importantly hinge on the probability that a previously unfamiliar hazard described in a given message does, in fact, exist. One factor shaping individuals' estimations of this probability is the frequency of other hazards. This is because hazards often co-occur. For example, if an ecosystem harbors one species of, say, dangerous predator, or lethal mushroom, it often harbors others as well (Andheria, Karanth, & Kumar, 2007; Cai, Cui, & Yang, 2016); likewise, a neighborhood blighted by petty crime will frequently suffer from a variety of more serious crimes as well (Perkins, Wandersman, Rich, & Taylor, 1993). Accordingly, individuals living in dangerous environments will often benefit from enhanced negatively-biased credulity, as the presence of multiple known hazards increases the probability that a message purportedly describing a previously unknown hazard is accurate.

Second, because, independent of issues of danger, people evaluate the plausibility of new information against the backdrop of their existing knowledge such that messages that are consistent with prior understanding are viewed as more plausible than those that are inconsistent with previous knowledge (White, Pahl, Buehner, & Haye, 2003b). This offers another pathway whereby beliefs regarding the frequency of hazards should influence assessments of statements purporting to describe previously unknown hazards – whether the individual's environment is objectively dangerous or not, those who *believe* their environment to be dangerous should find new information about hazards more congruent with their prior knowledge, and thus more plausible.

Third, due to differences in physical and social resources, people differ in their ability to weather encounters with hazards. As a result, the threat posed by a given source of danger will often vary across individuals, with corresponding consequences for the utility of negatively-biased credulity. Lastly, driven by variation in personality (Zuckerman & Kuhlman, 2000) that may in part be evolutionarily maintained through frequency-dependent selection (Dall, Houston, & McNamara, 2004) and may in part result from differing adaptive developmental trajectories (Wang, Kruger, & Wilke, 2009), people differ in their willingness to take risks with their safety; correspondingly, features of personality correlate with the extent to which the world is perceived as dangerous (Dallago, Mirisola, & Roccato, 2012), and, together, these features likely drive enhanced negatively-biased credulity.

To summarize the above, people can be expected to vary in their perceptions of the frequency of hazards in their environment and their willingness to confront them, and this variation should influence the propensity for negatively-biased credulity. Paralleling this prediction, as both a trait and a state, anxiety is associated with the tendency to acquire and transmit rumors (Anthony, 1992; Bangerter & Heath, 2004; Pezzo & Beckstead, 2006; Rosnow, 1980; Rosnow, Esposito, & Gibney, 1988; Walker & Beckerle, 1987). More specifically, concern about threats enhances susceptibility to rumors about imminent hazards (Greenhill & Oppenheim, 2017). Against this backdrop, directly testing the aforementioned prediction, Fessler, Pisor, and Navarrete (2014) found that the degree to which participants evinced negatively-biased credulity correlated with their responses on a three-item survey assessing generalized belief in a dangerous world (e.g., "*The world is a dangerous place,*" etc.).

In keeping with the personality differences described above, people differ in the extent to which they evince negativity bias in general, and threat reactivity in particular. This variation correlates with differences in political orientation, as political conservatives exhibit more overarching negativity bias, and more attention and reactivity toward threats, than do political liberals (Hibbing, Smith, & Alford, 2014; Lilienfeld & Latzman, 2014; Ahn et al., 2014; Mills, Smith, Hibbing, & Dodd, 2014; Mills et al., 2016; but see Knoll, O'Daniel, & Cusato, 2015). Correspondingly, and critical for the present purposes, conservatives tend to see the world as more dangerous than do liberals (Federico, Hunt, & Ergun, 2009). These patterns can be understood as follows: to the extent that conservatism (or, more precisely, social conservatism) focuses on the maintenance of existing cultural practices, social structures, and institutions, it constitutes a strategy of maintaining and reinforcing systems that have effectively organized social relations to date. Conversely, to the extent that (social) liberalism embraces cultural pluralism and innovation, the reshaping of social structures, and the revamping of institutions, it constitutes a strategy of experimentation rather than maintenance. Existing practices have, by definition, passed the test of time, including weathering any dangers that confronted society and its members in the past. Experimentation necessarily entails the risk of failure, and both the likelihood of failure and the costs of failure escalate as the level of danger confronting a group increases. Accordingly, conservatism will generally be the better strategy in a dangerous world, while liberalism will be more effective in a safe world.

Given the functional associations between i) perceptions of the world as dangerous and the value of enhanced negatively-biased credulity, and ii) social conservatism and perceptions of the world as dangerous, it follows that social conservatives should exhibit

greater negatively-biased credulity than social liberals.  Fessler, Pisor, and Holbrook (2017) tested this prediction by employing the paired-statements measure of negatively-biased credulity described earlier in conjunction with a variety of existing measures of political orientation.  In two studies of Americans, the authors found that, per predictions, social conservatism was positively correlated with negatively-biased credulity.  Likewise consonant with predictions, fiscal political orientation (which concerns competing philosophies regarding the relationship between government spending and economic growth) was unrelated to negatively-biased credulity.  Military conservatism, the tendency to endorse the use of force to resolve international conflicts and maintain domestic order (practices that are of greater utility in a more dangerous world), was associated with negatively-biased credulity, albeit less so than social conservatism.  In forthcoming work, Samore, Fessler, and Holbrook (In preparation) replicated the relationship between social conservatism and negatively-biased credulity, studying Americans approximately six and twelve months after the 2016 U.S. presidential election that reversed the political fortunes of conservatives and liberals.  Contrary to competing explanations proffered by some, the core relationship between political orientation and negatively-biased credulity was not altered by this change in the power structure, supporting the thesis that it derives not from exogenous political dynamics, but from elementary psychological differences underlying political orientation.

Parallel hazard biases in information selection and transmission

The same functionalist logic that explains negatively-biased credulity also governs the selection and transmission of information.  Specifically, when given a choice as to

what information to pursue, people target information concerning hazards over other types of messages, a pattern consonant with the fact that hazards are often more imminent than opportunities; preclude opportunities; and thus have a greater effect on individual welfare than do opportunities (Blaine & Boyer, 2018; Eriksson & Coultas, 2014; Eng, 2008).  Likewise, paralleling the perceived greater value of information concerning hazards, participants assess individuals who provide information about hazards as being more competent than those who provide other information (Boyer & Parren, 2015). Lastly, given that i) people are most likely to transmit to others information that they themselves believe (Pezzo & Beckstead, 2006); ii) people are presumably most likely to transmit to others information that they themselves would wish to obtain; iii) people likely understand that transmitting information to others can be an avenue for enhancing one's own prestige; and iv) arousal is one factor shaping individuals' willingness to transmit information (Berger, 2011), and negative events are usually more arousing than positive ones (Baumeister et al., 2001; Rozin & Royzman, 2001), it follows that a pattern paralleling negatively-biased credulity should exist in information transmission, i.e., people should be more likely to faithfully pass on to others messages concerning hazards than messages concerning benefits.  This prediction is supported by a growing body of experimental evidence (Altshteyn, 2014; Bebbington, MacLeod, Ellison, & Fay, 2017; Blaine & Boyer, 2018; see also Eriksson & Coultas, 2014; Heath, Bell, & Sternberg, 2001; Peters, Kashima, & Clark, 2009; but see Eriksson, Coultas, & De Barra, 2016; Stubbersfield, Tehrani, & Flynn, 2015).


Hazard biases and the content of culture

Because culture exists primarily as information acquired, stored, and transmitted by individuals, cultural patterns observable at a large scale can reflect widespread features of the mind (Boyer, 2000; Conway & Schaller, 2007; Norenzayan & Atran, 2004; Sperber, 1996; Sperber, 2006). Biases to pursue information about hazards; believe information about hazards; elevate the stature of those who provide information about hazards; and transmit to others information about hazards should, aggregated over time and numerous information transmission events, create an imbalance wherein information about hazards is more common than information about benefits. This asymmetry should be especially evident in domains where accuracy is difficult or impossible to discern.

Consonant with the above prediction, rumors describing negative events spread faster and wider than those reporting positive events, even when they are of equal importance (Walker & Blaine, 1991). Likewise, news reports that elicit high-arousal emotions are more likely to spread rapidly on the Internet, and anxiety is a central determinant in this regard (Berger & Milkman, 2012). Rumors or false reports can solidify into urban legends, that is, untrue accounts of events that a) purportedly happened in the present or recent past, in settings familiar to the audience, b) are intended to be both believable and believed, c) circulate widely in a social environment, and d) are believed to be true or likely to be true by a substantial number of people (Tangherlini, 1990; Brunvand, 2001; Fessler et al., 2014). Fessler et al. (2014) evaluated a large sample of urban legends circulating on the Internet, finding that, in keeping with the above prediction, information concerning hazards was approximately three times more common than information concerning benefits (see also Heath et al., 2001).

Although urban legends are believed and transmitted by many individuals, they likely achieve less complete population penetration than do supernatural beliefs, another domain in which the accuracy of information cannot be assessed by prospective adherents.  Fessler et al. (2014) also assessed a large sample of supernatural beliefs, collected from a representative collection of accounts of the world's cultures.  Per predictions, hazard information was a component of such beliefs approximately 1.5 times as often as was benefit information.

Conclusion

In sum, the human mind coevolved with, and is intimately dependent upon, cultural information.  Because the utility and functional logic of cultural information is often opaque to learners, humans have evolved to be credulous, that is, we have an innate propensity to believe what others tell us about the world.  However, because excessive credulity is costly, the mind contains mechanisms that adjust credulity in light of expected costs and benefits.  If information concerns hazards, erroneous incredulity will often be more costly than erroneous credulity, hence people can be expected to exhibit negatively-biased credulity, a greater propensity to believe information about hazards relative to information about benefits.  A growing corpus of findings directly and indirectly supports this thesis.  Although negatively-biased credulity is predicted to be a species-typical characteristic, individuals are expected to differ in the extremity of this bias as a function of individual differences in sensitivity to threats, and differing perceptions of the level of danger in the world.  Evidence increasingly supports this contention as well, including the translational application of this idea to the political realm where, consonant with differences in threat

reactivity and dangerous-world beliefs, social conservatives have been shown to exhibit greater negatively-biased credulity than social liberals. Paralleling negative bias in credulity, and following a similar functionalist logic, people also exhibit a greater propensity to pursue information about hazards; to view as competent those who provide such information; and to transmit such information themselves. Aggregated across multiple individuals, the result is that cultures tend to accumulate false information about hazards, as evident in assessments of rumors, urban legends, and supernatural beliefs.

One implication of the above portrait is that it may be possible for positive feedback loops to arise wherein negatively-biased credulity leads to greater circulation of information about hazards, causing an increase – mediated by credulity – in perceptions of the dangerousness of the world, leading in turn to greater negatively-biased credulity, and so on. Moreover, modern information technology may substantially elevated the risk that such reality-distorting feedback loops will occur. This is because i) mass communication channels and social media allow for the dissemination of information on unprecedented scales and at unprecedented speed; ii) events are witnessed onscreen as though they occurred in the immediate vicinity even if they are, in fact, distant; iii) whether motivated by profit or politics, media organizations seek to leverage negativity bias to gain viewers, broadcasting threat information at high rates; iv) social media provides conduits for information transmission from individuals who, by virtue of their familiarity, are likely to be trusted more; and v) online communities allow for self-selected segregation of like-minded individuals to a degree that is often impossible in everyday life. These features are united by a common thread, namely that the human mind, which evolved over millions of years for face-to-face information transmission, is unprepared for

the cyber-environment of the twenty-first century.  Around the world, we are currently witnessing both the political polarization and the distortion of perceptions of reality that can result.

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