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Original Article

Universal cognitive mechanisms explain the cultural success of bloodletting

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ABSTRACT

Bloodletting—the practice of letting blood out to cure a patient—was for centuries one of the main therapies in the west. We lay out three potential explanations for bloodletting's cultural success: that it was efficient, that it was defended by prestigious sources—in particular ancient physicians—, and that cognitive mechanisms made it a particularly attractive practice. To test these explanations, we first review the anthropological data available in eHRAF. These data reveal that bloodletting is practiced by many unrelated cultures worldwide, where it is performed for different indications and in different ways. This suggests that the success of bloodletting cannot only be explained by its medical efficiency or by the prestige of western physicians. Instead, some universal cognitive mechanisms likely make bloodletting an attractive form of therapy. We further test this hypothesis using the technique of transmission chains. Three experiments are conducted in the U.S., a culture that does not practice bloodletting. Studies 1 and 2 reveal that stories involving bloodletting survive longer than some other common therapies, and that the most successful variants in the experiments are also the most successful variants worldwide. Study 3 shows how a story about a mundane event—an accidental cut—can turn into a story about bloodletting. This research demonstrates the potential of combining different methodologies—review of anthropological data, experiments, and modeling—to investigate cultural phenomena.

George Washington died after losing half is blood. This massive blood loss was not due to a battle wound, but to the lancets of physicians (Cheatham, 2008; Morens, 1999). In this Washington was not exceptional: at least from the seventeenth to the mid-nineteenth century, bloodletting—cutting patients to let some blood flow out with a therapeutic aim—was one of the most popular forms of therapy in Europe and North America (Wootton, 2006). Why would people cut themselves—or, more commonly, ask others to cut them—to lose some blood when they are already weakened by disease?

A first explanation is that bloodletting is efficient in preventing or helping to cure some diseases. This is, however, unlikely. Phlebotomy, the modern instantiation of bloodletting, has very few indications (most of them rare diseases, see DePalma, Hayes, & Zacharski (2007). Still, it could be that bloodletting used to be efficient for indications that are now treated by more efficient means. In particular, it has been suggested that bloodletting causes iron deficiency, which can help prevent infections (Denic & Agarwal, 2007; see also Brain, 1986). While this hypothesis suggests that bloodletting might have some positive effects as a prophylactic, it says nothing about its value as a remedy when the infection is already in place. Bloodletting could have placebo effects, but it typically does not fulfill some of the conditions that make a placebo efficient, such as the patient being active (for a list of factors that increase the efficiency of placebo effects, see Trivers, 2011, p. 71).

More importantly, any positive effect bloodletting might have would be mitigated by its costs: bloodletting can endanger the patient's health through blood loss (potentially leading to dehydration and hypovolemia, see Morens, 1999), infection (the concept of aseptic operation was essentially unknown when bloodletting was commonly practiced in the west), or the danger of severing an artery (Brain, 1986). Finally, the reactions to blood loss—which can culminate in vasovagal syncope—tend to be unpleasant—they are for instance considered obstacles to blood donation (Bednall & Bove, 2011).

Another possibility to explain the spread and persistence of cultural practices, and in particular of maladaptive ones, is to use frequency based or model based biases such as the conformity and prestige biases (Boyd & Richerson, 1985; Richerson & Boyd, 2005). The conformity bias increases the likelihood that people adopt the most common behavior in their population (Henrich & Boyd, 1998), while the prestige bias favors the adoption of the most prestigious individuals' behavior (Henrich & Gil-White, 2001). The role of the prestige bias in the case of bloodletting relates to a common explanation: that bloodletting was practiced because it followed from the widely accepted humoral theory of disease (e.g. Arika, 2007; Wootton, 2006). Both bloodletting and the humoral theory had been part of the western cannon since Galen and the Hippocratic writers (Arika, 2007). The prestige of ancient

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Fig. 1. A linear, prestige based history of bloodletting: the Egyptians adopt the practice of bloodletting, they influence the Hippocratic writers, who influence Galen, who influences the next two millennia of western medicine.

Roman and Greek thinkers—and of the physicians who relied on their theories—could therefore explain the success of bloodletting in western medicine (Fig. 1) (for examples of non-adaptive practices spreading through prestige bias, see, e.g., Mesoudi, 2008). Once bloodletting would have become a standard practice, it could be further sustained by the conformity bias.

A third possibility is that bloodletting is psychologically attractive. Cultural practices can spread and endure not because of who practices them, but because of how their content triggers cognitive mechanisms that make them more or less likely to be attended, memorized, and used (concept of guided variation in Boyd & Richerson, 1985; Sperber, 1996). The framework of cultural attraction provides conceptual tools and models linking cognitive mechanisms and cultural phenomena (Claidière & Sperber, 2007; Morin, 2013; Sperber, 1996). Attractors are defined as points or areas in the space of possible configuration towards which transformations tend to converge. They exist because factors of attraction affect the probability that individual variants of a cultural item depart from their models in one direction rather than another. These consistent biases cause the variants of a given item to gravitate towards, and then around the same point. Cultural attraction explains why some representations, practices and artifacts are more prevalent and robustly transmitted than others by looking at the micro-mechanisms involved in their transmission.

At the micro-level, transmission of information among humans is generally not a copying process and typically results in modifications of the information transmitted. To explain how macro cultural stability may nevertheless occur, cultural attraction stresses the importance of constructive factors in cultural transmission: the psychological mechanisms involved in imitation and in communication are partly preservative and partly constructive (Claidière & Sperber, 2007; Sperber, 1996). Learners use information provided by the teacher to construct their own version of the idea or the practice. If the modifications introduced by the learners were random many representations, practices, or artifacts could not remain sufficiently self-similar in the process of transmission for recognizable cultural items to become prevalent (Claidière & Sperber, 2007, 2010). If some items are culturally successful in these conditions, it is in large part due to psychological and ecological processes that bias the process of transmission in consistent directions (Claidière, Smith, Kirby, & Fagot, 2014). For instance, words can exhibit an extraordinary level of macro stability (Pagel, Atkinson, & Meade, 2007; for another example, see Howe et al., 2001). This stability comes at least in part from the fact that learners tend to bias the evolution of languages in the direction of greater learnability (Kirby, Cornish, & Smith, 2008). This could explain why we observe that the most frequent and most stable words are also the shortest (Pagel, Atkinson, Calude, & Meade, 2013).

In the case of medical treatments, general cognitive biases such as the confirmation bias have been used to explain the spread of inefficient therapies (de Barra, Eriksson, & Strimling, 2014; Hartman, 2009; Tanaka, Kendal, & Laland, 2009). These mechanisms might help explain why a medical practice, once established, persists for longer than warranted by its efficacy. However, these mechanisms cannot explain why a given practice spreads rather than another. In the case of bloodletting, the risks of the practice, and the existence of less risky alternatives, makes the need for other explanations even more acute. A successful explanation of bloodletting has to account not only for the origin, spread, and persistence of a practice but also for the particular form it takes. For instance, blood is known to elicit disgust in contemporary western populations (Tybur, Lieberman, & Griskevicius, 2009), and it has been previously shown that cultural items that elicit disgust—urban legends (Eriksson & Coultas, 2014; Heath, Bell, & Sternberg, 2001) or norms (Nichols, 2002)—tend to be more successful than variants that do not elicit disgust. Many other cognitive mechanisms could help explain why bloodletting became a common practice—in the conclusion, we discuss the potential roles of folk biology, folk physics, and folk psychology, along with more general memory mechanisms.

It is important to note that these three broad explanations are not mutually exclusive, and that they might all play a role in a complete explanation of bloodletting. For instance, some universal cognitive mechanisms might have favored the emergence of bloodletting, and the practice could then have spread and have be sustained by its efficiency (if it has any) and the prestige of its practitioners. Yet the different explanations make different predictions and the more one explanation proves to carry weight, the less necessary the others become. In particular, to the extent that universal cognitive mechanisms are able to account for the success of bloodletting, the standard explanation of bloodletting as chiefly being due to the prestige of some individuals would have to be revised.

The present research tests predictions derived from these explanations. If bloodletting is a historically situated tradition sustained chiefly by prestige and conformity, a practice that happened to be favored for idiosyncratic reasons by a few physicians who proved formidably influential, then one would expect bloodletting to be a common practice only within the sphere of influence of these early western physicians. By contrast, if universal cognitive mechanisms are largely responsible for the success of bloodletting, it should be found in various cultures that have not been influenced by early western physicians. Moreover, if bloodletting is a cultural attractor it should be attractive even in populations that do not practice it. Finally, we should also be able to discern differences in attractiveness between different variants of bloodletting—variants based on localization of the cut, on the status of the practitioner, on the theories invoked, etc.

In order to test these predictions, we use three different methodologies. The first is to analyze an anthropological database in order to gauge the extent of the practice in non-western cultures. If bloodletting is found to be practiced in many different cultures, it might also be possible to discern commonalities in the practice across these cultures. These commonalities could then help to infer the mechanisms that contribute to bloodletting's success. The second method is the use of experimental evidence. To ascertain the presence of mechanisms that make bloodletting intuitive, we rely on an indirect mean: transmission chains. This technique was developed by Bartlett (1932) to study the distortion repeated transmissions introduced in narratives and other representations; it has been found to be useful in the study of psychological mechanisms involved in cultural transmission in humans (e.g. Bangerter, 2000; Barrett & Nyhof, 2001; Kashima, 2000; Mesoudi &