DISSERTATION

PRESTIGE: CONCEPT, MEASUREMENT, AND THE TRANSMISSION OF CULTURE

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ABSTRACT

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Cultural transmission influences how we learn, what we learn, and from whom we learn. Factors such as prestige can influence this process, leading to broader evolutionary dynamics that shape cultural diversity. In this dissertation, I describe three studies designed to elucidate the role that prestige and other transmission biases play in determining the course of cultural transmission and cultural evolution.

In the first study, we conduct a systematic review of the academic literature on prestige to determine how the concept of prestige has been defined within different academic traditions, and what potential determinants and consequences of prestige have been proposed. We find that the academic literature on prestige is highly fragmented and inconsistent, and we integrate the diversity of prestige concepts from the literature into a unified framework that represents prestige as an outcome of contributions from all levels of social structure and from individual performance in a social role. We then systematically sample and code the ethnographic literature using the unified framework to determine the variability of prestige concepts across non-Western cultures, and find that different societies show significant differences in how prestige is perceived and operationalized. Using the results of both reviews, we offer an integrative definition of prestige and comment on the utility and implications of the unified prestige framework and definition across disciplines.

In the second study, we develop and validate a common scale to measure individual prestige in Western societies. Drawing from participants in the United States and United Kingdom, we elicit terms related to prestige and evaluate additional terms from the literature. We pare down this pool of terms using attitudinal ratings of speech from a separate group of participants to find which are most closely related to a generalized Western prestige concept and to determine their structure with an exploratory factor analysis framework. Using confirmatory factor analysis and cluster analyses, we obtain a 7-item scale with 3 factors contributing to prestige that we term position, reputation, and information (or “PRI”). Finally, we perform

checks to ensure that the scale exhibits good fit, scale validity, and scale reliability. We provide guidance for using the scale and for extending it to other cultural contexts.

In the third study, we conduct a transmission experiment to compare the effects of prestige bias (a model-based context bias in cultural transmission) against the effects of different content biases represented in a narrative. We use locally calibrated regional accents of English as proxies for prestige, their relative levels of prestige having been established using the PRI scale of individual prestige and an application of the scale to a variety of accents in the United States and United Kingdom. For the content of the narratives, we craft artificial creation stories to resemble real creation stories in their form and in the proportions of each content type suggested in the literature to influence transmission, which were social, survival, emotional, moral, rational, and counterintuitive information. We asked participants to listen to the stories read by a high- or low-prestige speaker, complete a visual memory-based distraction task, and recall the stories to us. Following coding and analysis of the data, we find that prestige does have a significant effect on participants' recall. However, the effect of prestige is small compared to those of social, survival, negative emotional, and biological counterintuitive information. Our results suggest that content biases may play a much more important role in cultural transmission than previously thought, and that the effects of prestige bias are largely limited to information that is free of content biases. As this study is the first to test all of these biases simultaneously, we discuss its implications for our understanding of the complexity of cultural transmission and cultural evolution.

In these three studies, I provide a comprehensive, interdisciplinary account of prestige in which we explore and integrate its diversity of concepts, develop a scale by which prestige can be reliably measured, and report the results of an experimental test of the effects of prestige on cultural transmission relative to content biases. As a whole, this research constitutes a substantial contribution to our collective knowledge of the nature and function of prestige and its variability. This improved understanding of prestige, and in particular the effects of prestige on the process of cultural transmission, has implications for cultural evolution, human dimensions and conservation social science research, and other disciplines across the social sciences.

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Though my name is the sole entry on the authorship line of this document, that attribution represents a terrible falsehood. From start to finish, all of the work described in this dissertation was only possible because of the efforts of numerous other people, and I recognize and express my gratitude for the contributions of all those that have helped me along the way, in no particular order:

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Finally, I thank caffeine, synthwave, and the combined efforts of Gary Gygax and Dave Arneson, without which this dissertation may never have been completed.

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[1] This statement was adapted from the official Land Acknowledgement at CSU, available here: https://president.colostate.edu/speeches-and-writing/land-acknowledgment-at-csu-december-11-2018/

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“It's my estimation that every man ever got a statue made of him was one kind of sumbitch or another.”

— *Malcolm Reynolds,* Firefly

1. INTRODUCTION

1.1 Theoretical Background

Culture is the conceptual fabric that underlays much of the complexity of human behavior. Though the term culture has had many and varied definitions, I choose to define culture here as *"the geographic and temporal patterning of behavioral variation that owes its existence to social learning"* (adapted from Perry 2009, p. 247; Fragaszy and Perry 2008, p. xiii). The core of this definition of culture, and of many others, is the spread of behavior—or, more precisely, the information, values, beliefs, and other traits that affect behavioral variation—through the mechanisms of social learning. Social learning, in turn, is *"any modification of behaviour that is acquired, at least to some extent, by paying attention to the behaviour of another animal or animals"* (Box 1984, p. 213), typically in reference to the behavior of conspecifics or to the products of their behavior (Galef 1988; Heyes 1994). An array of factors are thought to shape the course of social learning (or "cultural transmission," see below), one of the most prominent of which is the relative prestige of the model from whom one chooses to learn (Henrich and Gil-White 2001). Prestige and its role in human cultural learning is the central topic of this dissertation, and will be described in detail later in this introduction and in each chapter. First, however, some background detail on culture, cultural evolution, and the transmission of cultural information is necessary to frame the discussion and clarify these definitions.

1.1.1 A Very Brief History of Culture Theory and Evolutionary Cultural Thought

The concept of culture in the anthropological sense dates to well before the foundation of anthropology as a field, from an agricultural metaphor written by Roman orator Cicero following the loss of his daughter and shortly before the assassination of Julius Caesar and his own subsequent death; that is: "*cultura animi*," or the cultivation of the human soul (Cicero 45BC). From there, the English term "culture" has taken on many varied meanings and its interpretation has been the focus of lasting debate within different schools of American, British, and French anthropology. Kroeber and Kluckhohn (1952) classified the 162 definitions available at the time as "descriptive" (based on content), "normative" (rules, ideals, values, and behavior),

"psychological" (adjustment, learning, or habit), "structural" (organization), or "genetic" (culture as product, ideas, or symbols). One of the most popular and enduring definitions originated from founding cultural anthropologist Edward Tylor: "that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society" (1871, p. 1). Together with Lewis Henry Morgan, Tylor introduced cultural evolutionary thought in anthropology. Their theories were rooted in the popularity of the brand of evolutionary Darwinism of the time, but they, along with some of their peers (such as Francis Galton), took on the mantle of what is today called "social Darwinism," or, more directly, scientific racism. Tylor and Morgan saw cultural evolution as a unilineal process of development from "savagery" to "barbarism" to "civilization," each accompanied by levels of progress in subsistence and technology until reaching the pinnacle of modern civilization which, they argued, was exemplified by the Anglo-American society of their time (Morgan 1877). Though the notion of unilineal cultural evolution has today been replaced by a more integrative and cross-culturally grounded understanding, these biased beliefs continue to influence ideas about the nature of cultural variation and cultural evolution and are reflected in the language used to describe them (e.g. "Stone Age hunter-gatherers," "modernization," and "international development").

The central tenet of the modern interdisciplinary field of cultural evolution is that the cultural material of a society, like the biological material of a species, changes over time in response to evolutionary forces and constitutes a second inheritance system that can be studied using methods originally developed in population genetics, epidemiology, and other related fields (Cavalli-Sforza and Feldman 1981; Boyd and Richerson 1985; Henrich and McElreath 2003; Whiten et al. 2011; Whiten 2017). However, researchers today are also aware of the strengths and limitations of the evolutionary analogy for cultural change (Mesoudi et al. 2004; Mesoudi, Whiten, and Laland 2006; O'Brien et al. 2010). For instance, concepts such as vertical inheritance, competition, selection, and mutation of cultural traits all have close parallels in biological evolution; however, additional challenges are presented by the sometimes-nebulous "units" of cultural transmission and the high frequency with which cultural transmission occurs horizontally and obliquely (see below for definitions of these terms) compared to their rarity in genetic inheritance (Cavalli-Sforza and Feldman 1973, 1981; Atran 2001; Mesoudi 2007; Henrich et al. 2008). Differences between

biological evolution and cultural evolution are important to recognize, not to invalidate cultural evolutionary approaches, but instead to motivate the development of new methods that are more suitable for modeling and analyzing data that result from these cultural processes (Gray et al. 2007; Greenhill et al. 2009; Currie et al. 2010).

The study of cultural evolution today can be broadly split into two scales of differing resolution. First, there is macro-level cultural evolution, which studies large-scale, long-term changes in language, material culture, or other cultural traits often using phylogenetic methods, large within- and cross-cultural databases or assemblages, and historical or environmental data (Mace and Holden 2005; Borgerhoff Mulder et al. 2006; Gray et al. 2010; Mace and Jordan 2011; Kirby et al. 2016; Gray and Watts 2017). Second is micro-level cultural evolution, which studies the fine-grained details of cultural transmission and the questions of when, what, from whom, and how people learn (Cavalli-Sforza and Feldman 1981; Cavalli-Sforza et al. 1982; Hewlett and Cavalli-Sforza 1986; Henrich 2001; Eerkens and Lipo 2005; Mesoudi and Whiten 2008). "When" questions about cultural transmission are addressed by research into social learning strategies, or the conditions under which individuals switch from asocial to social learning (Laland 2004; Rendell et al. 2010, 2011). Choices about "what" and "from whom" people learn appear to be largely structured by internal cognitive biases that direct preferences for certain types of knowledge and cultural models (Boyd and Richerson 1985; Richerson and Boyd 2005; and see later discussion on transmission biases). "How" questions involve the "mode" of transmission, which is made up of its direction (i.e. vertical, from parent to child; horizontal, from peer to peer; or oblique, from non-parental elders to younger generations) and its form (e.g. one-to-one or one-to-many; Cavalli-Sforza and Feldman 1981; Cavalli-Sforza et al. 1982; Hewlett and Cavalli-Sforza 1986; Guglielmino et al. 1995; Hewlett et al. 2002). The specific copying mechanism used (e.g. imitation versus emulation) also has effects on the "how" of transmission and on broader cultural dynamics (Whiten et al. 2009; Csibra and Gergely 2009; Schillinger et al. 2015).

Studies of both micro- and macro-level processes are necessary for a complete theoretical understanding of cultural evolution, as micro-level processes drive the macro-level variation we see within and between cultures. In this dissertation, I focus on micro-level cultural transmission, but also note the implications of our results for understanding macro-scale patterns of cultural diversity.

1.1.2 Mechanisms of Cultural Transmission

Throughout this document, I refer to the central mechanisms by which information is learned as "cultural transmission" in humans and as "social learning" in non-human animals, but historically there is little real distinction between the two terms (Heyes 2017). Cultural transmission is social learning, with the added implication that the information being learned is cultural (as above, geographically and temporally patterned between groups), and thus would generally be synonymous with social learning for humans. Social learning itself is ubiquitous across social animals (Heyes 2012a), including insects (Leadbeater and Chittka 2007a), and has even been shown in some solitary species such as bumblebees (Leadbeater and Chittka 2007b) and tortoises (Wilkinson et al. 2010). However, researchers have typically been much more resistant to ascribe culture to any non-human animals (Tomasello et al. 1993; Boesch and Tomasello 1998; Herrmann et al. 2007; Tennie et al. 2009). Cultural capacities are undeniably most strongly developed in humans, but it is my belief that we should maintain a definition of culture—like the one cited at the beginning of this document—that is maximally inclusive and does not dismiss outright the evolved capabilities of other human animals. As such, my use of the term cultural transmission rather than social learning throughout the body of this dissertation is solely for reasons of conformity with common terminology in the field of cultural evolution, not as an endorsement for human uniqueness.

General social learning mechanisms are theorized to have evolved due to the advantages granted over purely "trial-and-error" learning that uses classical or operant conditioning, which is referred to in the literature as individual or asocial learning (Heyes 1994). Specifically, in a social group where everyone learns individually, a lone social learner can avoid the costs associated with individual learning by freely observing and copying the strategies used by others, thereby increasing their own relative fitness and contributing to the eventual spread of social learning through the group (Enquist et al. 2007; Franz and Nunn 2009). In structured populations (meaning, populations made up of stable subgroups), this can lead to the rise or fixation of a majority of social learners, even when there is such a high proportion of social learners that individual learning would have greater fitness (Rendell et al. 2009). Maladaptation can also arise and

persist due to the cultural traits that are learned, because learning from the information available in one's group does not necessarily result in learning the optimal solution to a given problem, particularly if the learned information is outdated in relation to rapidly changing social or environmental conditions, or if a trait is favored for reasons other than its direct fitness benefits (e.g. recreational drug use), or if potentially better variants were lost to random drift-like processes (Feldman et al. 1996; Laland and Williams 1998; Henrich 2004a; Lehmann and Feldman 2009). Social learning is not always optimal; however, we do see that it is ubiquitous in humans and common across many other species, as outlined previously. Therefore, social learning likely provides a fitness benefit relative to individual learning more often than not. Under the argument for "cultural group selection," the increase in fitness need only be true for the group as a whole, if social learning allows the group to outcompete other groups that do not learn socially (Henrich 2004b; Boyd and Richerson 2010; Richerson et al. 2015). For cultural transmission in humans, we additionally find that, if learning is selective—i.e. that there is some cognitive bias that aids learners in finding more highly successful cultural variants—the relative benefits of cultural transmission are enhanced significantly (Boyd and Richerson 1995; Henrich and Boyd 2002; Enquist et al. 2007; Morgan et al. 2012). Much research effort has been devoted to exploring these proposed cognitive biases in the context of cultural transmission, including the effects of prestige.

1.1.3 Content and Context Biases in Cultural Transmission

Formal theory on cultural transmission biases dates back to foundational works in cultural evolution (e.g. Boyd and Richerson 1985). Boyd and Richerson distinguished between three types of transmission biases: "direct," "indirect," and "frequency-dependent" (1985, pp. 134–136). Today, terminology has shifted such that direct biases are referred to as "content-based," indirect are "model-based," and both indirect and frequency-dependent biases fall under a broader category of "context-based" biases (Figure 1.1; Rendell et al. 2011). Though often phrased as "strategies" or "choices" in the literature—in the game theory sense of the words (Taylor and Jonker 1978)—cultural transmission biases are not suggested to be fully

conscious decisions in most cases; rather, they are the result of internal, evolved cognitive processes (Heyes 2016).

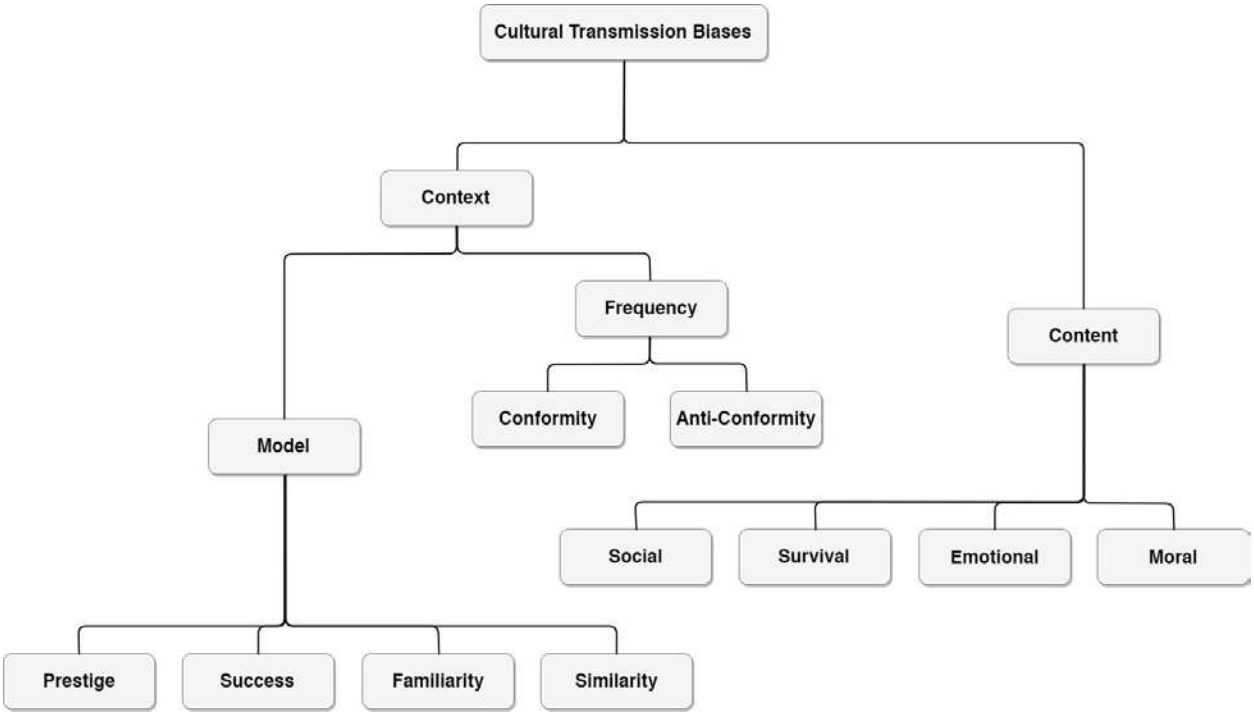


Figure 1.1. Partial taxonomy of cultural transmission biases. Includes context-based and content-based biases proposed by Boyd and Richerson (1985) and others, and draws from those compiled by Rendell et al. (2011).

Content-based transmission biases refer to some inherent quality of the information that aids its transmission, or "judgments about the properties of the variants themselves" (Boyd and Richerson 1985, p. 10). This could relate to the inherent attractiveness of the information in a specific cultural context, or to different types of information that are more salient to human cognition. Some of the content types proposed in the literature are: emotional information that a elicits a strong negative response (Heath et al. 2001; Eriksson and Coultas 2014; Fessler et al. 2014; Stubbersfield et al. 2017), social information that relates to interactions between people or survival information about fitness-relevant aspects of the environment (Mesoudi, Whiten, and Dunbar 2006; Nairne et al. 2007; Otgaar and Smeets 2010; Stubbersfield et al. 2014), and moral information regarding social norms and rules of behavior (Heath et al. 2001; Baumard and Boyer 2013). Content biases, which represent the information independent of the model providing it, have received less attention in the cultural evolution literature, but could potentially have

major effects on transmission processes (Mesoudi and Whiten 2008). Further details on content-based biases are given in Chapter 4 of this document, where we explore the effects of content in an experimental transmission context.

Context-based transmission biases have something to do with either "the observable attributes of the individuals who exhibit the variant" (model-based biases; Richerson and Boyd 2005, p. 69)—with "variant" here referring to alternatives for a particular cultural trait, similar to the relationship between alleles and genes—or the frequency or rarity of the variant in the population (conformity or anti-conformity biases, respectively; Richerson and Boyd 2005, p. 69). Specifically, there are a number of qualities of the cultural model that could influence a learner's choice of from whom to learn or what to learn from that individual. For instance, the prestige (Henrich and Gil-White 2001), success (Mesoudi 2008), or familiarity (Wood et al. 2013) of an individual, or their degree of similarity to the learner (McElreath et al. 2003) could all lead to a preference for that individual as a cultural model. In terms of trait frequency in the overall population, researchers presume that conformity—copying the most frequent variant—has a low cognitive requirement and a relatively high payoff and therefore is likely to be a common strategy in humans and in other animals (Laland et al. 2011). Context-based biases have received a great deal of attention in the literature, particularly conformity bias (Henrich and Boyd 1998, 2001; Kohler et al. 2004; Eriksson et al. 2007; Efferson et al. 2008; Kendal et al. 2009; Morgan et al. 2012; Muthukrishna et al. 2016) and prestige bias (Henrich and Gil-White 2001; Henrich and Boyd 2002; Chudek et al. 2012; Atkisson et al. 2012; Bell 2013; Henrich et al. 2015; Jiménez and Mesoudi 2019).

Under prestige-biased transmission, individuals are theorized to show a preference to learn from "the most highly skilled and competent" cultural models (Cheng and Tracy 2013; but see later discussions on the definitions, determinants, and consequences of prestige). In their original conceptualization of prestige bias and other model-based biases, Boyd and Richerson (1985, pp. 241–279) propose that learners should be expected to use "indicator traits" such as wealth or skill to evaluate the quality of a potential behavioral model in situations where individual learning is costly and where it is difficult to determine the specific traits that led to the model's success. This reliance on prestige as a shortcut for evaluating models,

and the benefits gained, can lead to a runaway process wherein individuals pursue traits that emphasize their prestige at the possible cost of actual reproductive fitness (Bliege Bird and Smith 2005; Ihara 2008).

One model for understanding prestige and evaluating prestige-biased transmission, proposed by Henrich and Gil-White (2001), has addressed the use of prestige as a proxy for quality and the possible context of its evolution. In the 2001 paper and subsequent publications by Henrich and colleagues (Henrich and Boyd 2002; Henrich and McElreath 2003; Henrich 2009; Cheng et al. 2010; Chudek et al. 2012; Cheng et al. 2013; Cheng and Tracy 2013, 2014; Henrich et al. 2015), the authors argue that prestige is an evolved mechanism for attaining status in a social hierarchy, one that is unique to humans. Further, they propose that prestige-based hierarchies are distinct from ones based upon dominance, which are more common in other animals than in humans. Prestige evolved to be a desirable trait, according to Henrich and colleagues, because of the benefits gained through the "deference" granted by competing potential cultural learners, given in exchange for the opportunity to maintain proximity and learn from the prestigious individual. This deference then began to be used as a signal of the most successful individuals in the group, aiding the identification of ideal models for cultural transmission. However, the exact determinants that lead to an individual gaining prestige and the consequences encompassed by the term "deference" are not clearly laid out in this model, and some of the empirical work investigating prestige has not supported the model's predictions (Jiménez and Mesoudi 2019). Nonetheless, the Henrich and Gil-White (2001) model continues to be highly influential in the literature.

In this dissertation, I focus specifically on the term "prestige" due to its importance in the cultural evolution literature and its proposed causal effects in cultural transmission, in which it has a meaning distinct from related terms such as "status" (see Henrich and Gil-White 2001). The relationships between prestige and these other concepts are explored in Chapter 2 and Chapter 3, where we attempt to define and develop measures of prestige. By doing so, we can more clearly distinguish prestige from other related terms and clarify its usage in cultural evolution and in other disciplines.

Prestige-biased cultural transmission has been investigated using a number of different methodological approaches (Jiménez and Mesoudi 2019), using the Henrich and Gil-White (2001) model or more general definitions in the cultural evolution literature, that provide theoretical predictions and

empirical data of its effects on cultural transmission and its expected impacts on cultural macroevolution. However, three key questions remain regarding prestige and its role in cultural learning and cultural change. These three research gaps form the core focus of this dissertation, and I outline each below.

1.2 Research Gaps Addressed by Dissertation

1.2.1 Research Gap #1: Defining Prestige

In human societies, prestige contributes to social stratification and inequality, and therefore is a concept of central importance to many disciplines in the social sciences and beyond (Weber 1922; Trudgill 1972; Wegener 1992; Harbaugh 1998; Smidts et al. 2001). In addition, prestige impacts many other aspects of daily life, from cultural learning (Boyd and Richerson 1985; Henrich and Gil-White 2001) to purchasing behavior (Vigneron and Johnson 1999). However, the precise meaning of prestige is often ambiguous in the academic literature, with multiple coexisting and competing concepts within each discipline. Accompanying this breadth of definitions, many possible determinants and consequences of prestige have been proposed. Further, prior research on prestige has overwhelmingly focused on the perceptions of people in Western societies, without considering ways in which prestige concepts could vary cross-culturally. In Chapter 2, we address these questions in and of the academic literature on prestige, using an integrative and transdisciplinary perspective. First, we conducted a systematic review of the Western academic literature, with a specific focus on how different authors define prestige, and on the proposed determinants and consequences of prestige, and find that the prestige literature is highly fragmented and inconsistent. We then brought together the common elements of the literature, with components from systems theory and social role theory, to construct a unified framework in which we integrate previous ideas on prestige into a more holistic and comprehensive prestige concept. Finally, we conducted a separate systematic review of the ethnographic literature for a diverse set of non-Western societies to explore cross-cultural variation in prestige concepts, and to evaluate the utility of the unified framework for future research. We found that a great deal of cross-cultural variability exists in how societies perceive and operationalize prestige, not only between Western and non-Western societies, but also among non-

Western societies. We conclude by offering an integrative definition of prestige and exploring the implications of this definition and the unified framework of prestige for future research on prestige across disciplines.

1.2.2 Research Gap #2: Measuring Prestige

A number of scales currently exist that quantify prestige based on occupations (Duncan 1961; Nakao and Treas 1992; Ganzeboom et al. 1992), organizations (Mael and Ashforth 1992; Smidts et al. 2001), brands (Deeter-Schmelz et al. 2000; Vigneron and Johnson 2004), and other assessments (Blaikie 1977; Wegener 1992). However, these existing scales fail to account for the full breadth of potential determinants of prestige or focus only on the prestige of collective social institutions rather than the individual-level perceptions that underpin everyday social interactions. In Chapter 3, we use open, extensible methods to unite diverse theoretical ideas into a common measurement tool for individual prestige. Participants evaluated the perceived prestige of regional variations in accented speech using a pool of candidate scale items generated from free-listing tasks and a review of published scales. Through exploratory and confirmatory factor analyses, we find that our resulting 7-item scale, composed of dimensions we term position, reputation, and information, or "PRI," exhibits good model fit, scale validity, and scale reliability. The PRI scale of individual prestige contributes to the integration of existing lines of theory on the concept of prestige, and the scale's application in Western contexts and extensibility to other cultures serves as a foundation for new theoretical and experimental trajectories across the social and behavioral sciences.

1.2.3 Research Gap #3: Examining Prestige in Cultural Transmission

Context-based cultural transmission biases such as prestige are thought to have been a primary driver in shaping the dynamics of cultural evolution and behavior change (Henrich and Gil-White 2001; Henrich and Boyd 2002; Henrich et al. 2015). However, few empirical studies have measured the importance of prestige relative to other effects such as those of content biases, which are inherent to the information being transmitted (Heath et al. 2001; Atkisson et al. 2012; Morgan et al. 2012; Stubbersfield et al. 2015; Acerbi and

Tehrani 2018). In Chapter 4, we report the findings of an experimental study of cultural transmission designed to compare the simultaneous effects of high- or low-prestige models and the presence of content containing social, survival, emotional, moral, rational, and counterintuitive information. Our results reveal that prestige is a significant factor in determining informational salience and recall, but that several content biases, including social, survival, negative emotional, and biological counterintuitive information, are significantly more influential. Further, we find that prestige is utilized as a conditional bias in determining the transmission of unbiased information when no content cues are available. We demonstrate that no single bias fully explains variation in recall in the transmission of narratives, but that content biases serve a vital and underappreciated role in realistic transmission settings where multiple biases are simultaneously present. This work presents a novel experimental framework that has implications for the experimental study of cultural transmission and for the application of cultural evolutionary theory to real-world problems, as well as emphasizing the value of storytelling as a cross-culturally relevant model for cultural transmission.

1.3 Connections to Human Dimensions of Natural Resources

Research on cultural evolution, and specifically cultural transmission, intersects in many ways with the study of human dimensions of natural resources and conservation social science. Conservation and management are ultimately efforts to solve a problem of human behavior (Schultz 2011); they are "initiated by humans, designed by humans, and intended to modify human behavior" (Mascia et al. 2003). The human dimensions approach represents the application of social science theory to solve management issues, using the best information possible (Manfredo et al. 1995). Therefore, an understanding of human behavior and of how variation in behavior is driven by cultural learning are critical to reaching better outcomes in conservation conflicts (Redpath et al. 2013). I will highlight two ways that cultural transmission research can contribute to human dimensions and conservation social science, specifically through its connections to environmental behavior and communication and the role it plays in shaping diverse knowledge systems.

Human dimensions and conservation social science are highly interdisciplinary endeavors, incorporating perspectives from diverse fields including environmental psychology, human geography, environmental anthropology, and human ecology (Bennett et al. 2017). One branch has focused on the application of theory from social psychology (Fulton et al. 1996; Vaske and Donnelly 1999; Teel et al. 2015; Bennett et al. 2017). In classic models such as the theory of reasoned action (Fishbein and Ajzen 1975) and planned behavior (Ajzen 1985) and the value-attitude-behavior model (Homer and Kahle 1988), knowledge is linked to behavior through the attitudes that one holds. Values serve as the foundation upon which attitudes and beliefs are built, and their degree of homogeneity or heterogeneity within a culture is shaped by cultural transmission (Bisin and Verdier 2000; Schultz 2002). Recent models of behavior are more complex and acknowledge that behavior is driven by a range of additional internal and external factors (Kollmuss and Agyeman 2002), including social norms and economic motives (McKenzie-Mohr 2000), which are also culturally based and transmitted. Cultural evolution thus links easily into human dimensions research by providing context on the learning and spread of concepts like values, attitudes, and norms that are already well-established in human dimensions theory, and can provide a deeper level of understanding on how these concepts affect behavior. A major goal of human dimensions and conservation social science research is to use persuasive communication campaigns and environmental education as mechanisms to drive behavior change (McKenzie-Mohr 2000). However, this literature has not engaged much at all with research on cultural evolution and cultural transmission, representing a major gap that this dissertation can begin to address. A better understanding of cultural evolution and the effects of cognitive transmission biases can inform work to shape more effective and impactful messages that motivate pro-environmental behavior change.

In human dimensions and in social ecological systems research more broadly (Ostrom et al. 2007), there has been a focus on the value of traditional ecological knowledge ("TEK," or Indigenous ecological knowledge, "IEK") in broadening the capacity and representation of solutions to problems based in human-environment interactions (McCarter et al. 2014). Cultural transmission is important to the maintenance of traditional knowledge and, indeed, the common definition of TEK references it directly: "a cumulative body of knowledge, belief and practice, evolving by adaptive processes and handed down through generations by

cultural transmission" (Berkes 2012, p. 7). Preserving the specialized knowledge of a local ecology, the cultural beliefs and practices that have adapted to and coevolved with that ecology, and the means by which they are transmitted and maintained is a critical part of biocultural conservation efforts and crafting management decisions that benefit local stakeholders (McCarter et al. 2014; Gavin et al. 2015). In particular, the pathways of TEK (cultural) transmission are eroding and shifting for many societies across the world due to a number of social and cultural factors, including the impacts of Western-style schooling, which differs markedly from traditional experiential and observational ways of learning (Gómez-Baggethun et al. 2013; Tang and Gavin 2016; Berl and Hewlett 2015). A better understanding of these cultural transmission pathways and future research that integrates a cultural evolutionary approach are vital for preserving TEK by mitigating or adapting to these widespread changes in knowledge systems (McCarter et al. 2014).

Aside from the two primary contributions above, which come from cultural transmission work on humans, we can also consider the impacts of social learning in non-human species. As humans transmit information, so too does the wildlife that natural resources and human dimensions practitioners seek to manage (Whittaker and Knight 1998). As mentioned in earlier theoretical discussions, a number of threatened and endangered animal species learn in a way that many researchers consider cultural, including chimpanzees, orangutans, and orcas (including endangered southern residents: Riesch et al. 2006). Other species that are commonly impacted by management efforts also show evidence of social learning of local ecological information, including North American ungulates (Jesmer et al. 2018) and large carnivores (Macdonald 1983). Management of these species calls for special consideration of factors such as the spread of information within and between groups, including patterns of adaptive and maladaptive behaviors, and the isolation or loss of cultural knowledge (Whitehead et al. 2004; Ryan 2006; Whitehead 2010).

Culture underlies and shapes human behavior, including our behavior towards the environment. Through a better understanding of the process of cultural transmission, and the cognitive biases such as prestige that affect what people learn and from whom they learn it, we can craft more effective, more enduring, and more inclusive solutions to the diversity of issues in conservation and management.

2. A UNIFIED FRAMEWORK OF PRESTIGE: BRIDGING CONCEPTS FROM THEORY, EXPERIMENT, AND CROSS-CULTURAL RESEARCH

2.1 Introduction

Across human history and the breadth of human cultures, the idea of status has served to structure our societies, our behavior, and the courses of our lives. Status indicates one's position in a social hierarchy, and that position affords privileges that lead to material inequalities in access to resources of various kinds, from food to wealth to reproductive opportunities. We are not alone in our reliance on status hierarchies; dominance-based hierarchies are common among other animals, particularly primates (Smith et al. 2016). However, in human societies, social stratification is typically built upon the concept of prestige, rather than dominance (Barkow 1975; Henrich et al. 2015). Research points to the concept of prestige being rare outside of humans (Horner et al. 2010), ingrained early in development (Mascaro and Csibra 2012, 2014; Enright et al. 2017), and present across the range of human cultures (Anderson et al. 2015), even in small-scale societies that have less stratification (von Rueden et al. 2010; von Rueden and Jaeggi 2016; Garfield et al. 2019).

Because prestige forms the foundation of social stratification and structural inequalities in human societies, it has become a concept of central importance to the theory of many disciplines, particularly in the social sciences. In sociology, for instance, prestige has been a foundational part of theory since the time of Weber (1922), where—as "occupational prestige" or as a component of socioeconomic status—prestige is closely associated with an array of social factors and outcomes, including education, income, identity, and physical and mental health (Zhou 2005; Rivas-Drake et al. 2009; Fujishiro et al. 2010). In business and economics, perceptions of "organizational prestige" and "brand prestige" affect identity and morale within companies, negotiations between companies, public reputation and image, and the valuation of products and services (Perrow 1961; Ashforth et al. 2008; Highhouse et al. 2009; Baek et al. 2010). In political science and international relations, "national prestige" is seen as a critical factor in determining the course of diplomacy and the outbreak of warfare between states, and is leveraged in the enforcement of national security and global stability (O'Neill 2006; Kennedy 2010; Wood 2013; Dafoe et al. 2014). Cultural

anthropology, archaeology, and marketing share an interest in the presence, material qualities, and conspicuous display of "prestige goods" in daily life, burial, ritual, and other contexts that provide crucial insights into the differentiation, connectivity, and behavior of present and past societies (Corneo and Jeanne 1997; Plourde 2009; Bentley et al. 2012). Further examples exist across almost every academic field, including the study of prestige in academia itself (Keith and Babchuk 1998; Burris 2004).

Recently, with the development of cultural evolution as an established interdisciplinary field (Henrich and McElreath 2003; Mesoudi, Whiten, and Laland 2006; Brewer et al. 2017), prestige has been a topic of renewed interest in studies of social learning and cultural transmission (Jiménez and Mesoudi 2019). Prestige appears to have the potential to powerfully influence people's choice of from whom they learn different types of information, which in turn shapes the broader dynamics of cultural change (Boyd and Richerson 1985; Henrich and Gil-White 2001; Henrich and Boyd 2002).

However, in this line of research on prestige-biased transmission and in other work across disciplines—including the examples given above—the precise meaning of "prestige" is often left ambiguous (Morin 2016a, pp. 115–119, 2016b) and is operationalized using disparate methods from study to study (Jiménez and Mesoudi 2019), such that it is unclear whether studies from different academic traditions are measuring the same concept (for example, occupational prestige: Blaikie 1977; Guppy and Goyder 1984; Wegener 1992). As a corollary problem, authors have proposed a vast assortment of possible determinants of prestige—from *respect*, *esteem*, or *skill*, to "*an inherent, unique know-how*" (Dubois and Czellar 2002), among many others—as well as many potential consequences and benefits that result from having prestige—such as *deference*, *attention*, and *reproductive fitness*. Moreover, prior research on prestige has predominantly focused on societies that are Western, educated, industrialized, rich, and democratic ("WEIRD": Henrich et al. 2010), without considering ways in which prestige could vary cross-culturally (with a few notable exceptions, see: Reyes-García et al. 2008, 2009; von Rueden et al. 2008, 2010; von Rueden and Jaeggi 2016). If not addressed, this Western bias could lead to deeply flawed generalizations of how prestige operates across diverse human societies, based on conclusions from studying only a small percentage of the world's population (Arnett 2008).

In the present synthesis, we aim to resolve some of these critical questions in and of the literature, using an integrative perspective that cuts across traditional disciplinary lines. First, we conduct a systematic review of the Western academic literature, with a specific focus on how prestige is defined and on proposed determinants and consequences of prestige. We then explore the variation in prestige definitions, determinants, and consequences across fields and bring together common elements to construct a framework by which previous theories can be integrated into a more holistic and comprehensive prestige concept. Finally, we conduct a separate systematic review of the ethnographic literature for a diverse set of non-Western societies to explore cross-cultural variation in prestige concepts, and to evaluate the utility of the unified framework for future research. By doing so, we hope to clarify the state of the literature regarding prestige and establish a cross-disciplinary understanding that can serve as a foundation to further illuminate the function of prestige in human culture and cultural change.

2.2 Literature Review

2.2.1 Methods

2.2.1.1 Eligibility Criteria

We deemed all published, peer-reviewed journal articles, books, or book chapters focused on the concept of prestige from any discipline as eligible for review. Works must have been written primarily in English and have made an attempt to explicitly define or measure prestige in some way. Given our own research interests in the relevance of prestige to cultural evolution, we also included studies that made specific reference to the role of prestige in the cultural evolutionary mechanisms of social learning or cultural transmission.

2.2.1.2 Information Sources

We identified studies through Google Scholar (n = 953) and Web of Science (n = 305). We conducted the first search on July 6th, 2016, and the last on July 8th, 2016.

2.2.1.3 Search

Due to the widespread use of the term "prestige" with varied meanings in diverse contexts and the desire to capture works focused narrowly on the concept of prestige itself, we specifically required that the word "prestige" appear in the title of each work. We included additional search terms to restrict the scope to works wherein prestige or its determinants or consequences were explicitly defined or measured, or were related to social learning or cultural transmission, as mentioned above.

Search strings used for Google Scholar took the general form: "intitle:prestige AND ("define prestige" OR "defining prestige" OR "defined prestige" OR "definition of prestige" OR "prestige * defined")". Eleven additional searches used variations on this structure to capture differences in word choice (specifically: describe, characterize/se, measure, and quantify), alternate sentence forms, or specific types of prestige (using a wild card operator between words, e.g. "define * prestige"). One final search, for a total of 13 Google Scholar searches, included terms related to social learning and cultural transmission: "intitle:prestige AND ("social learning" OR "socially learned" OR "cultural learning" OR "culturally learned" OR "social transmission" OR "socially transmitted" OR "cultural transmission" OR "culturally transmitted")".

Web of Science allowed for more flexible construction of searches, including word stemming, and yielded substantially fewer matches, so only two searches were necessary: "TI=prestige AND TS=(defin* OR descri* OR characteri* OR measur* OR quantif*)" and "TI=prestige AND TS=(social OR socially OR cultural OR culturally) AND TS=(learning OR learned OR transmission OR transmitted)".

2.2.1.4 Study Selection

Given the volume of studies returned across all searches (n = 1,258), we pared down the pool of matches using a number of criteria. First, we removed duplicate matches across searches and any works not matching the stated eligibility criteria. This included removing studies that matched the search terms but were unrelated to the topic of the present review (e.g. those related to the sinking of the oil tanker *MV Prestige*). We excluded gray literature, theses and dissertations, conference proceedings, book reviews,

unpublished manuscripts, and studies published in journals that were not peer-reviewed or were known to be predatory[2].

We then made two additional cuts to the full pool of matches. The first, for reasons of manageability, was to remove all full books (retaining book chapters), except for those deemed "influential." The criterion we used to label a work as "influential" was that its citation count be above the third quartile plus 1.5 times the interquartile range (Tukey's (1977) classification of an outlier). For determining influential books, the set of citation counts being compared included all matching books and was not restricted by subject area. In the second cut, we eliminated journal articles that had no citations and were more than 3 years old (published prior to 2014) to remove works that were not actively contributing to the broader discourse.

The above selection methods resulted in a pool of 443 works. As we deemed this too large for full manual review, we elected to take a stratified sample of these studies. To ensure a breadth of representation across disciplines, including those not typically included in theoretical discussions of prestige, we constructed the sample to include a minimum of 25 studies (or as many as were available up to 25) randomly selected from each subject area (based on journal categorization by Scopus). We also randomly selected half of the book chapters (12/25) for inclusion, as well as the 2 "influential" books, defined using the same criterion as above. After this, we selected one study at random from each remaining subject area in sequence until the sample reached a total of 200 works. Lastly, we included any remaining "influential" book chapters, as well as any remaining "influential" journal articles within each subject area. The final sample, thus constructed, consisted of 226 studies.

Relevant studies that did not fulfill all of these criteria or were not selected as part of the sample for full review were still considered in the interpretation and discussion of the results of the review.

[2] This was assessed using Beall's List of Predatory Journals and Publishers (Beall 2016), which was withdrawn in January 2017.

2.2.1.5 Data Items and Collection

From each study in the sample, in addition to standard reference information, we manually collected data on: 1) the study type; 2) the prestige concept being referenced by the study, if any; 2) the text, concept, and cited source of any definitions given for prestige; 3) the text of any prestige determinants suggested by the author(s); 4) the text of any prestige consequences suggested by the author(s); and 5) whether the study took an explicitly evolutionary perspective on prestige.

The study type variable classifies each study by the methods used, split broadly into empirical, theoretical, review, commentary, or applied works, with nested levels of finer distinctions within these types. The concept variables refer to traditional prestige concepts that are regularly referred to as topics of academic study, for example: occupational prestige, brand prestige, linguistic prestige, and prestige-biased transmission (Appendix 2, Table A2.1).

The two variables for prestige determinants and consequences were used to differentiate the stated or implied causal placement of terms related to prestige, as either contributing to the accumulation of prestige or resulting from the accumulation of prestige. These terms were drawn from the studies by searching within a 1- to 2-paragraph vicinity of any appearance of the word prestige (or its derivatives, e.g. "prestigious"), as well as related tables, sidebars, and any other relevant sections of the text, and were recorded as written (with extraneous "stop words" removed). These terms were included if they were mentioned by the author in any context as being associated with high prestige (rather than low), regardless of whether a causal relationship was supported by evidence. Each term was noted only once for each category per study, in order of first mention. A note was made for any sources or terms that referred exclusively to men, to women, and/or to individuals in a non-Western culture, to enable finer analyses of these terms and exclude non-Western examples from characterizations of prestige in "Western" society.

Lastly, an evolutionary perspective was evidenced by the use of population-level thinking and references to evolutionary concepts such as selection, fitness, and transmission. We noted this to track sources that were relevant to discussions to prestige-biased transmission in cultural evolution, an active theme in our research (Berl et al. [in prep.]; Samarasinghe et al. [in prep.]; Berl [this document]).

We retrieved article-level citation counts from Google Scholar using the Publish or Perish software (Harzing 2016). We retrieved journal-level metrics, rankings, countries of publication, and subject areas from Scimago and Scopus and manually matched them with studies in the sample. We also retrieved citation counts for books and book chapters, and assigned subject areas based on their catalogue data.

2.2.1.6 Risk of Bias

Efforts were made to reduce bias in the sample by allowing published works from any academic field and by constructing a stratified subsample to ensure all fields were represented. However, sources of potential bias still exist. Citation count was used as a screening mechanism to focus on literature that is representative of the current discourse, but citation count is not necessarily an indicator of quality. Similarly, restrictions on English-language and peer-reviewed works are exclusive by nature and may lead to uneven representation of ideas. This risk may also be spread unevenly across fields, as some disciplines—for instance, computer science or natural resource management—are more likely than others to present results in formats such as conference proceedings or gray literature rather than in peer-reviewed academic publications. The publication process itself also introduces a level of bias that we are unable to account for in our sample.

Perspectives on prestige likely change over time, so transitions could have occurred over the span of time represented by the range of publication dates in the sample. The aggregation of results from across studies means that the "Western prestige concept" examined here should only be regarded as a general representation of views over that time period.

2.2.1.7 Analyses

We tabulated the number of studies in each subject area and calculated the proportion of studies using each prestige concept. Using the citation data for prestige definitions collected during the review, we constructed a bibliometric network by representing citations as directed edges from the citing study to the cited study. We then visualized this network and calculated the descriptive statistics that apply for a network with disconnected components.

Using the full list of unique terms or phrases used to describe determinants and consequences of prestige, we constructed a list of synonyms by which terms with common meaning could be grouped. Generally, this procedure consisted of replacing multi-word phrases with a single-word synonym and converting words to the form of an adjective, when used as a description, or a noun, when referring to a domain of knowledge or expertise (e.g. "influence" to "influential" and "experience serving military" to "military"). We took into account the intention and connotations used for these terms in the original texts in determining these groupings. Following this procedure, we reduced the list of unique terms to 459. Using the levels of social stratification or stages in role processes assigned to each prestige determinant and consequence (see Results and Discussion), we then tabulated the proportion of terms that fell within each level or stage, which terms were most or least common, and tested how the distributions of terms within levels and stages differed between the determinants and consequences of prestige.

2.2.2 Results and Discussion

In terms of general statistics, the literature review sample exhibited a wide spread of attributes and perspectives. The year of publication for the studies in the sample ranged from 1938 to 2016 (*Median* = 2005, Q_1 = 1985, Q_3 = 2012). Citation counts ranged from 0 (for 19 studies) to 1,953 (for 1 study; M = 99, SD = 245). The majority of the sample consisted of empirical studies (n = 114; 76.5%), and theoretical papers (n = 27; 18.1%), with the remaining 5.4% split between reviews and commentary articles. There were no applied studies in the sample.

In examining the connections between studies in the form of prestige definitions and concepts, we find that the literature discussing prestige is highly fragmented and inconsistent. A network diagram of the studies in the sample and their connections to the sources of the definitions that they cite shows a disconnected network (**Figure 2.1**), with 34 isolated components delineating particular schools of thought within different disciplines. Of the definitions represented, Henrich and Gil-White (2001) is the most-cited, with 18 incoming connections ("indegree"), and it has 36 other studies connected within its component, making it the largest in the network. In turn, aside from dictionary entries, Henrich and Gil-White (2001)

only cited one other definition (Miller and Dollard 1941), and does not seem to have had a major influence on other isolated disciplinary prestige concepts aside from prestige bias and particularly evolutionarily-minded studies in prestige goods and historical sociolinguistics. General definitions were most common in the network overall (n = 59), with occupational prestige the most common non-general concept (n = 40). Additionally, though the search and eligibility criteria were designed to locate studies that explicitly defined or measured prestige, 98 of the 226 studies examined (43.4%), while focused on the concept of prestige, failed to define it themselves or cite another work that defined prestige.

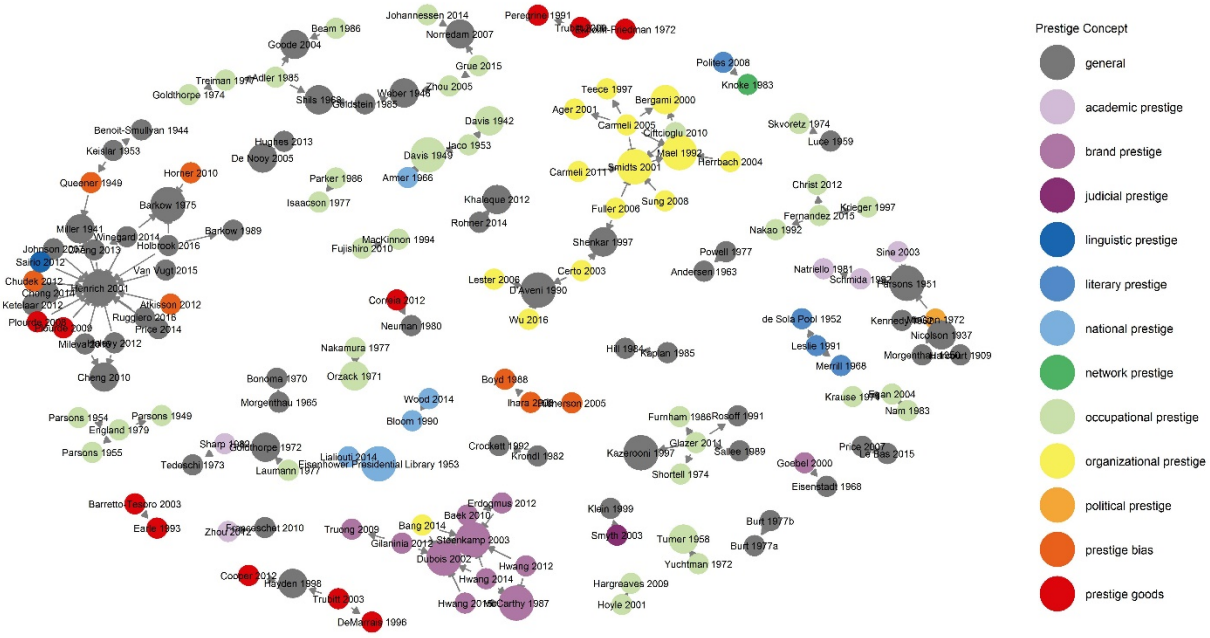


Figure 2.1. Network diagram of prestige definitions citations. Connections are depicted as arrows (edges) from the citing paper to the cited paper (nodes), each represented by first author and year. The colors of nodes indicate the prestige concept referenced in the citing paper or cited definition. The relative size of nodes depicts their number of citations (indegree).

We see from these analyses that there is very little cross-disciplinary conversation on prestige, in terms of theory or experiment. Academic networks are highly isolated and cultivate their own prestige concepts with minimal cross-pollination of ideas, even within particular fields of study. Likewise, it is clear that there is no single universal definition of prestige, but a broad collection of definitions (over 150, not including minor variations) that vary broadly in focus and scope. When prestige is defined at all, the

definitions cited tend to be tied to influential studies focused on specific prestige concepts that have been passed down within traditions of research. The few studies that have taken a general, cross-disciplinary perspective on prestige (e.g. Henrich and Gil-White 2001) have been the most successful at making connections and are among the most highly cited studies in the sample, but have thus far not served to unify the disparate lines of prestige research. The results as a whole demonstrate that the study of prestige is not a cohesive body of knowledge and lacks a unified framework.

Across the literature sample, we collected a total of 2,780 proposed determinants of prestige (1,970 unique) and 1,179 proposed consequences (903 unique). Following synonym replacement (as described in the Methods), this was reduced to 425 unique determinants and 211 unique consequences. For these terms, we calculated an accumulation curve (Appendix 2, Figure A2.1) using the exact sample-based rarefaction method (Chiarucci et al. 2008) that shows that the number of unique terms (after grouping by synonyms) approached saturation from this sample. This indicates that enlarging the sample size beyond the 226 studies included would not contribute much additional information as the majority of unique terms were acquired within the first 100 studies, regardless of the order in which they were sampled.

The most commonly implicated determinants of prestige were *skilled* and *educated* (n = 50 each), followed by *status* (n = 39), *reputable* and *knowledgeable* (n = 38 each), *powerful*, *occupation*, *income*, *important*, and *gender* (n = 36 each), *wealthy* and *respected* (n = 34 each), *valued* (n = 33), *quality* (n = 32), and *influential* and *academic* (n = 27 each). For proposed consequences of prestige, the most frequent in the sample were *influential* (n = 42), *deference* (n = 38), *status* (n = 35), *signaling* (n = 32), *attractive* (n = 31), *powerful* (n = 26), *social learning* (n = 20), *respected* (n = 19), *self-esteem* and *admired* (n = 18 each), *wealthy* (n = 16), *satisfaction* and (reproductive) *fitness* (n = 15 each), *employment* (n = 14) and *imitation* (n = 13). Based on our descriptive examination of these proposed determinants and consequences, we saw there was a need for a more fine-grained qualitative analysis but, at this stage, lacked a framework to do so.

From the initial results obtained over the course of conducting this review, it became clear to us that different fields seem not to be talking about different *types* of prestige, but of different *elements* of prestige. There is occupational prestige, and national prestige, and linguistic prestige, but, in reality, individuals are not perceived by one another as exemplars of only their occupation, their nation, or their

language (or any other trait implicated in this review, such as ethnicity, age, or gender). Rather, in the words of philosopher Lewis R. Gordon, "we (human beings) don't 'see' race, gender, class, or sexual orientation walking around; we exemplify, coextensively, all of these, all the time, in different ways" (2018, pp. 30–31). The suite of traits that contribute to or result from prestige are embodied in multifaceted individual people that inherit or attain these qualities and the prestige (or lack thereof) associated with them from their parents, their ethnolinguistic affiliations, their institutional memberships, and the full array of other cultural constructs, as well as their own behavior. All levels of a stratified social system contribute to individual prestige, and the prestige associated with these identities are in turn shaped by people.

These realizations led us to construct a relatively simple framework that represents the idea of prestige as a holistic system with contributions from all levels of social structure: from external environmental conditions, to cultural, institutional, collective, relational, individual, and symbolic factors (**Figure 2.2**). Individuals are the foundation of this model in that individual people acquire and use prestige and have belongings (both material and immaterial) that may confer prestige, while also themselves belonging to larger social structures. The overall structure reflected in the framework was defined based on ideas of the development of structure from social behavior and relationships (Hinde 1976) and from applications of systems theory to social structure (Parsons and Smelser 1956; Bronfenbrenner 1979; Holling 2001; Ostrom 2005, 2007), and should be recognizable in general form and function to a researchers across fields. To maximize the applicability of our model across the social sciences, we derived our definitions of each level of stratification (**Table 2.1**) from standard reference materials (Calhoun 2002; Outhwaite 2003).

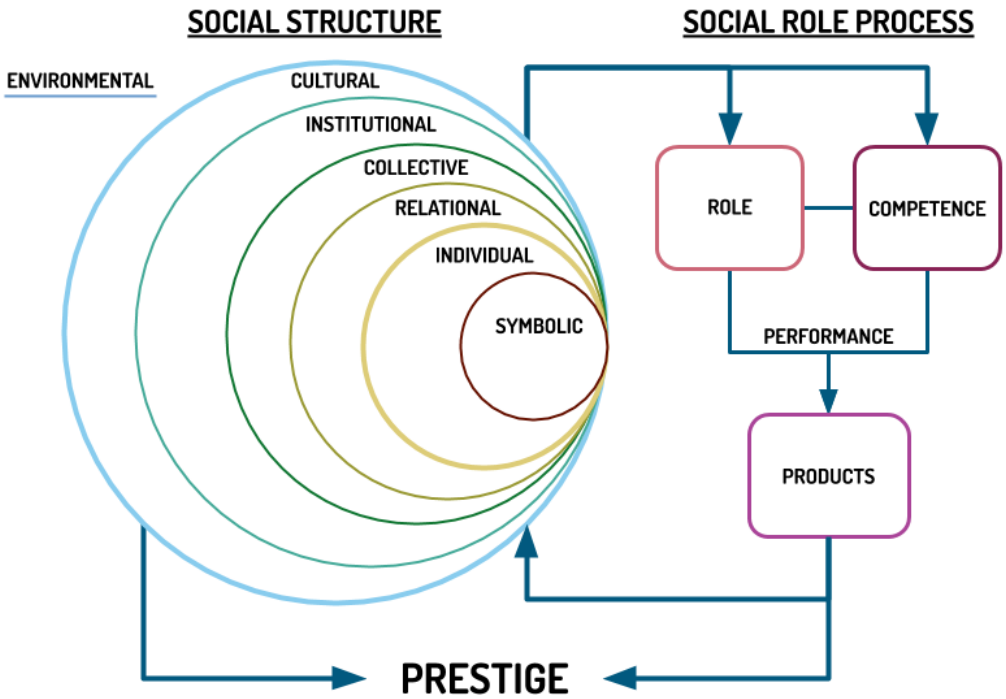


Figure 2.2. Unified framework of prestige. Depicts social structure as a stratified multilevel system that, in combination with the outcomes of social role processes, determines perceptions of individual prestige. See **Table 2.1** for the definitions used for each term.

Table 2.1. Glossary of terms used to describe levels of social structure and stages in social role processes. Levels and stages were used in building the framework of prestige and in categorizing the determinants and consequences of prestige.

Level of Social Structure	Definition
Environmental	conditions or features of physical, chemical, or ecological systems that are relatively unchanged by culture
Cultural	value judgments related to systems of learned and inherited knowledge, meaning, and significance that shape individual perceptions and behavior; here, excluding those that are specific to one social group or evaluations of individuals
Institutional	established societal structures, systems, practices, or organizations that are not limited to members of one social group
Collective	shared identities, histories, experiences, or qualities of more than two individuals that define them as members of a bounded, exclusive group
Relational	coordinated behavior, connections, or patterns of interaction between pairs of individuals that influence each other; relationships
Individual	characteristics, traits, thoughts, knowledges, skills, or behaviors of a single being, or labels assigned to a single being as sociocultural constructs or evaluations, excluding those that identify group membership
Symbolic	material or immaterial symbols or possessions, or the display of these as signals of meaning
Stage in Social Role Process	**Definition**
Role	determinants, expectations, tasks, special rights, or responsibilities of an individual's position or identity in society
Competence	knowledge and behavior displayed by an individual in fulfillment of their role
Products	social outcomes, judgments, sanctions, or material or immaterial rewards that result from an individual's role fulfillment

However, we found that representing prestige solely in the context of social structure did not fully describe prestige; but rather gave the impression that prestige is a static property determined only by one's social position, instead of a characteristic that experiences ongoing dynamic revision while also being influenced by individual action. We therefore integrated the concept of role performance (Biddle and Thomas 1966)—the fulfillment of the responsibilities and expectations of an individual's position or identity in society—into our framework (**Figure 2.2**; **Table 2.1**). Across the social sciences, the development of foundational ideas of social status has gone hand-in-hand with our understanding of roles and role theory (Mead 1934; Moreno 1934; Linton 1936; Merton 1949; Parsons 1977). Therefore, an examination of

prestige would be incomplete without considering the potential contributions of role performance processes, and integrating them into our framework encourages us and others to test these ideas. Role performance provides one well-studied mechanism by which individual traits can lead to prestige benefits (Goode 1960; Turner 1978); however, other such mechanisms may exist and could be further explored in future applications and extensions of this framework.

When categorized by their level of social stratification, the proportions of terms in each level were similar across determinants and consequences (**Figure 2.3A**), but with some significant differences (X^2 [7, N = 3238] = 172.963, $p << 0.001$), the most notable of which being larger proportions of collective, institutional, and cultural determinants relative to consequences and larger proportions of relational and status consequences relative to determinants. In addition, beneath the apparent similarities, the particular terms used within each level contrast sharply between those used to describe determinants and those for consequences (Appendix 2, Table A2.2A). For example, individual traits are most important in determining prestige and individuals also benefit the most from gaining prestige, but the most frequent individual-level determinant is that a person is *skilled* while the most frequent individual-level consequence is that a person becomes more *attractive*. Some terms, such as an individual being *respected,* are present in high frequencies in both lists, indicating that they contribute to prestige and are also enhanced by having prestige. A number of terms in the sample exhibit this circular nature.

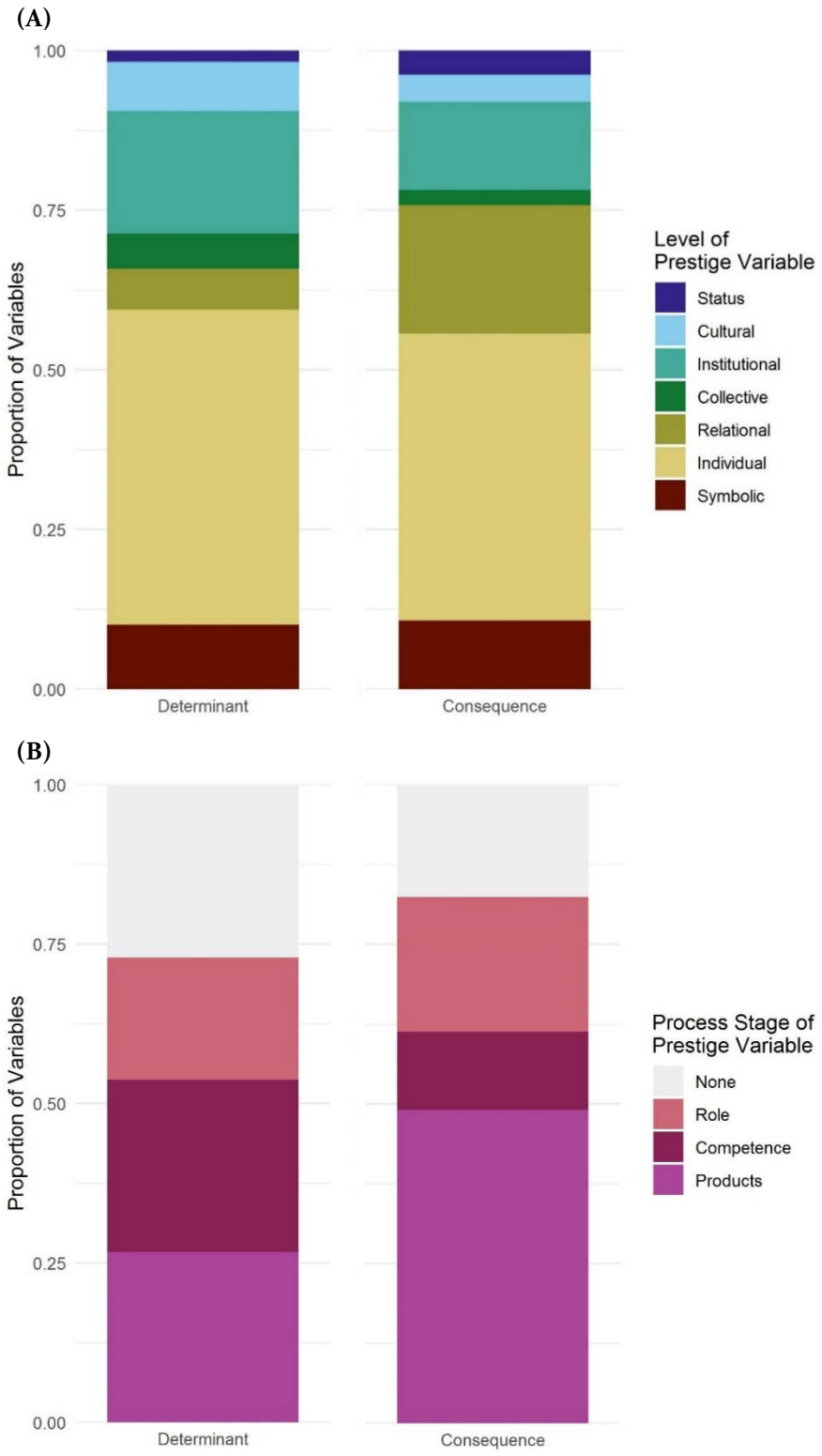


Figure 2.3. Proportions of determinants and consequences of prestige within each level of social stratification (A) and stage in role processes (B). All terms were assigned a level; only applicable terms were assigned a stage.

Similar patterns to the level of social structure are seen for each term's stage in the role performance process (**Table 2.1**; **Figure 2.3B**), but there is a clearer distinction between the proportions at each stage (X^2 [3, N = 2447] = 147.750, $p << 0.001$), with competence being more of a contributor to prestige than a result, and with the products of the process being primarily consequences rather than determinants. Those products of successful role performance that also contribute to prestige, such as an individual being *reputable* and *important* and earning a high *income*, make good intuitive sense in that position, as do the competence-based consequences of prestige, represented primarily by the *signaling* value of success (Appendix 2, Table A2.2B). Likewise, there is logic to the terms present on both lists (e.g. *status*, *powerful*, and *authority*) as circular traits that influence and are influenced by prestige, as seen in the previous analysis on stratification level. Overall these results indicate the validity of this pathway to prestige and its explanatory utility as an addition to a multilevel framework based on social stratification.

The results of using our framework to categorize and analyze the determinants and consequences of prestige provides insights into how prestige is represented in the academic literature on Western societies. According to their frequency in the literature, individual-level traits are indeed most important in determining prestige—at least, in the perception of Western researchers—and individuals gain the largest proportion of the benefits. A substantial proportion of the benefits of prestige are in the relational sphere, with influence (as *influential*) and *deference* being the most frequent consequences noted in the literature across all levels of both social stratification and role performance. Collective benefits were less frequent than any other level of consequence (aside from environmental, which had no terms), and the institutional benefits seen (such as *powerful* and *employment*) also seemed to primarily aid the individual. In short, prestige in the generalized "Western society" represented by the academic literature is highly individualistic, and contributions to individual prestige from collective and institutional factors are usually cashed in for individual-level benefits.

Given the emphasis in the literature on prestige in Western societies and the relative paucity of cross-cultural research across many disciplines (Boyacigiller and Adler 1991; Myers and Tan 2002; Arnett 2008; Henrich et al. 2010; Kirmayer 2012; Nielsen et al. 2017), it is difficult to know from this review alone whether these trends are reflective of broader human social patterns. We therefore undertook a systematic

review of the ethnographic literature to gain a cross-cultural understanding of prestige, its determinants, and its consequences.

2.3 Ethnographic Review

2.3.1 Methods

2.3.1.1 Eligibility Criteria

Ethnographic sources that explicitly mentioned the word prestige or its derivatives were eligible for review. For this study, we restricted our sample of societies to only those that appeared in all three of: the Ethnographic Atlas ("EA"; Murdock 1967; Gray 1999), the Standard Cross-Cultural Sample ("SCCS"; Murdock and White 1969), and the Probability Sample File ("PSF"; a stratified random sample from eHRAF World Cultures, below). We did this to reduce the breadth of the world's cultures to a manageable and reasonably representative sample, to enable comparisons with other data available for the societies in these three collections, as well as to provide flexibility for any future expansion of the sample.

2.3.1.2 Information Sources

We used the eHRAF World Cultures database ("eHRAF"; Human Relations Area Files n.d.) to identify ethnographic sources for the 32 societies that met the eligibility criteria (see Appendix 1).

2.3.1.3 Search

While the subject areas from the Outline of Cultural Materials ("OCM"; Murdock 1961) were coded at the paragraph level for sources in eHRAF, the most applicable code, "Status, role, and prestige" (OCM 554), did not include every mention of the word "prestige" and, in an initial screen, missed some instances that would be relevant for this study. Therefore, we instead searched across all subject areas using the stemmed keyword "prestig*" to capture all instances in which any form of the word "prestige" was used.

2.3.1.4 Study Selection

We obtained all matching sources from eHRAF, consisting of 2,377 paragraphs across 363 documents. We then reduced this sample by excluding sources that were not noted as full or partial matches to the EA or SCCS and had coverage dates greater than 10 years distant from the focal dates of the EA and SCCS. We did this to ensure the sources were representative of these societies at the time and place foci at which they were studied, which were generally the earliest and most complete descriptions available. The final sample consisted of 1,477 paragraphs across 187 documents by 128 sets of authors. This sample covered 30 societies, since 2 societies (the Andamanese ["Andamans"] and the Chukchi ["Chukchee"]) had no sources matching the criteria. Not all of the paragraphs that did match the criteria provided relevant information (see Results and Discussion).

2.3.1.5 Data Items and Collection

For consistency and comparability between data sets, we collected data from the ethnographic review in as similar a fashion to that of the literature review as possible. We randomized the order of societies prior to data collection to avoid any systematic bias that could have been introduced by sequentially sampling related societies. Aside from reference information on each document and paragraph, including OCM subject tags, we noted all terms used to refer to a determinant or consequence of high prestige, as in the literature review. We noted each unique term only once for each category per paragraph, in order of first mention. Afterwards, we grouped terms by synonyms in a manner identical to that of the literature review, using the literature review's list of synonyms as a starting point and adding additional synonyms as needed for new concepts. We also noted terms that referred exclusively to males or females. We did not collect terms from any sections of matching documents that dealt with postcolonial practices or changes that occurred due to colonialism or modern westernization.

2.3.1.6 Risk of Bias

The sources of potential bias in a sample as diverse as this one are numerous. Firstly, the earliest sources used were published in the late 1800's to early 1900's and the latest in the 1990's. Many sources, particularly the earliest ones, were written by foreign, white anthropologists with distinctly colonial viewpoints. For example, titles included *The sexual life of savages in northwestern Melanesia* (Malinowski 1929) and *Primitive Polynesian economy* (Firth 1939) and many passages from these and other works were written in a similarly pejorative tone. As in the literature review, perspectives on prestige are likely to change over time. Since many of the ethnographic sources are now several decades old and sections dealing with postcolonial practices were excluded, the prestige concepts depicted for each society represent traditional practices specific to a specific historical time and place and should not be generalized beyond that context, or to these societies in modern times.

Some potential bias has been introduced by the perspectives of ethnographers: book-length sources mentioned prestige by name only once or twice, while others had over 50 instances, so the degree of interest and word choice by the ethnographer is not necessarily indicative of its importance within the society. Nor is the accuracy of the ethnographer's information guaranteed to be accurate. All ethnographic sources, no matter how objective the observer endeavors to be, will have some degree of bias in their description of cultural values and practices that are not their own. However, in sampling as many different authors and documents as were available for each society, individual differences between ethnographers were minimized to the extent possible for this study. Other studies have previously shown that eHRAF and the EA, SCCS, and PSF collections are relatively robust to various other types of bias (Gray 1996; Ember and Ember 2009; Bahrami-Rad et al. [in prep.]).

2.3.1.7 Analyses

Using the levels of social stratification and stages in the role process developed from the synthesis of the literature review, we similarly assigned each term from the ethnographies a social stratification level and, as applicable, a role process stage. We were then able to tabulate the proportion of terms that fell within each

level for each society, which terms were most or least common, and test how the distributions of terms within levels differed between the determinants and consequences of prestige and between different societies. In addition, we perform a cluster analysis (using chi-square distances of the counts in each level or stage and a k-medoids clustering algorithm) to visualize any clusters of similar societies in terms of their determinants and consequences of prestige.

2.3.2 Results and Discussion

Following data collection, of the 30 societies selected for ethnographic review, we deemed 15 to have sufficient relevant material and detail to be used for analyses based on paragraph count and content. Though this led to a much smaller sample than intended in terms of the number of societies covered, it ensured that the data set within each society was larger, more richly detailed, and more likely to yield meaningful results (*M* number of paragraphs = 64, *SD* = 27). The retained societies covered 6 language families (and 1 isolate) across a range of latitudes, regions, and biomes (**Figure 2.4**).

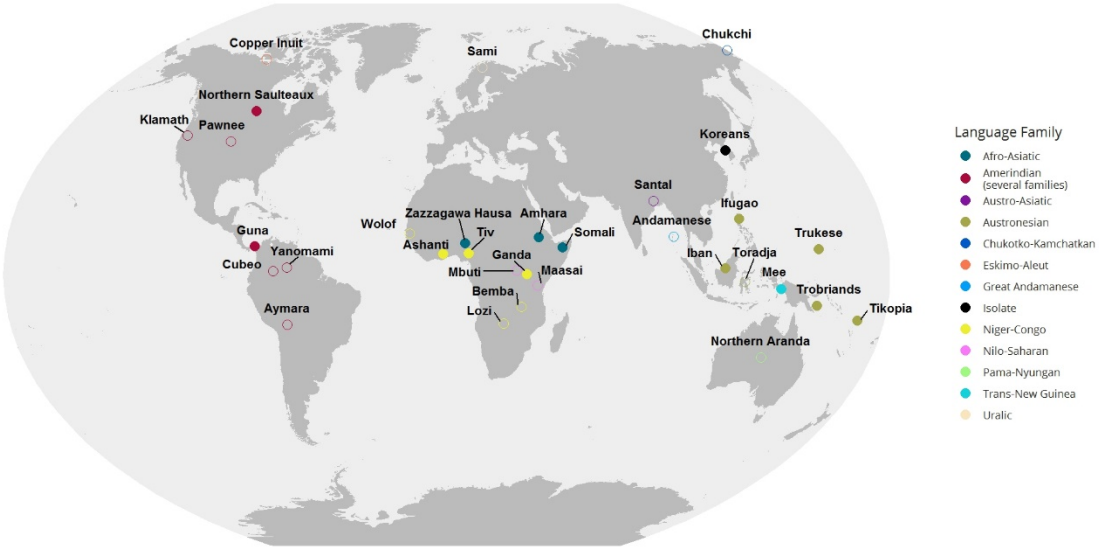


Figure 2.4. Societies examined in the systematic ethnographic review. Geographic points for each society (from latitude and longitude in the Standard Cross-Cultural Sample) are colored by language family; societies retained for full analysis are shown as filled points, while excluded societies are shown as outlines only.

On average, each of the 15 societies had relevant ethnographic information from 8 different documents (*Median*; $Q_1 = 7$, $Q_3 = 12.5$) by 6 different sets of authors (*Median*; $Q_1 = 3$, $Q_3 = 8$). This alleviates to some degree the concern of bias due to the perspective of any one ethnographer. Sources on the same society generally shared consistent sets of terms related to prestige, but occasionally placed different degrees of emphasis on certain terms depending on their perspectives and research foci.

We collected a total of 1,482 prestige determinants (1,041 unique) and 293 proposed consequences (216 unique) from the selected ethnographic sources. Following synonym replacement, the number of unique terms or phrases was reduced to 192 determinants and 85 consequences.

Societies showed significant differences in the proportions of prestige determinants in each level of social stratification (**Figure 2.5A**; Fisher's exact test, $p < 0.001$) and of prestige consequences by level (**Figure 2.5B**; Fisher's exact test, $p < 0.001$). This finding remained true whether the results of the literature review were included (as "Western": **Figure 2.5A**) or not, indicating that there are differences between non-Western societies, not only between "Western" societies and non-Western societies. Tests of independence adjusted for multiple comparisons revealed a number of pairwise differences between societies (Appendix 2, Table A2.3), and proportions from the Western literature are generally different from those drawn from ethnographies of other societies. However, in contrast to the shared ancestry represented by shared language family, societies that speak languages within the same family were not necessarily more similar to each other in these proportions than they were to societies in other families; for example, Austronesian speakers shared a high degree of similarity with one another, while Afro-Asiatic speakers had very little. An examination of the most frequent terms within each level of stratification complements the proportions by showing which traits are most influential in determining prestige for each society (Appendix 2, Table A2.4A). For instance, though they differed in proportions, the three Afro-Asiatic societies in the sample all place high importance on the institutional value of religion as a route toward gaining prestige, along with material and immaterial possessions of various kinds.

Results from categorizing terms as prestige consequences in the ethnographic data were less clear than those from prestige determinants, as there were much fewer terms given (272 consequences spread across 15 societies, compared to 1,381 determinants). Hence, we present results for these variables but

choose not to speculate on any apparent trends. Later, the results of cluster analyses on the consequences of prestige by level of social structure display the tentative nature of these data.

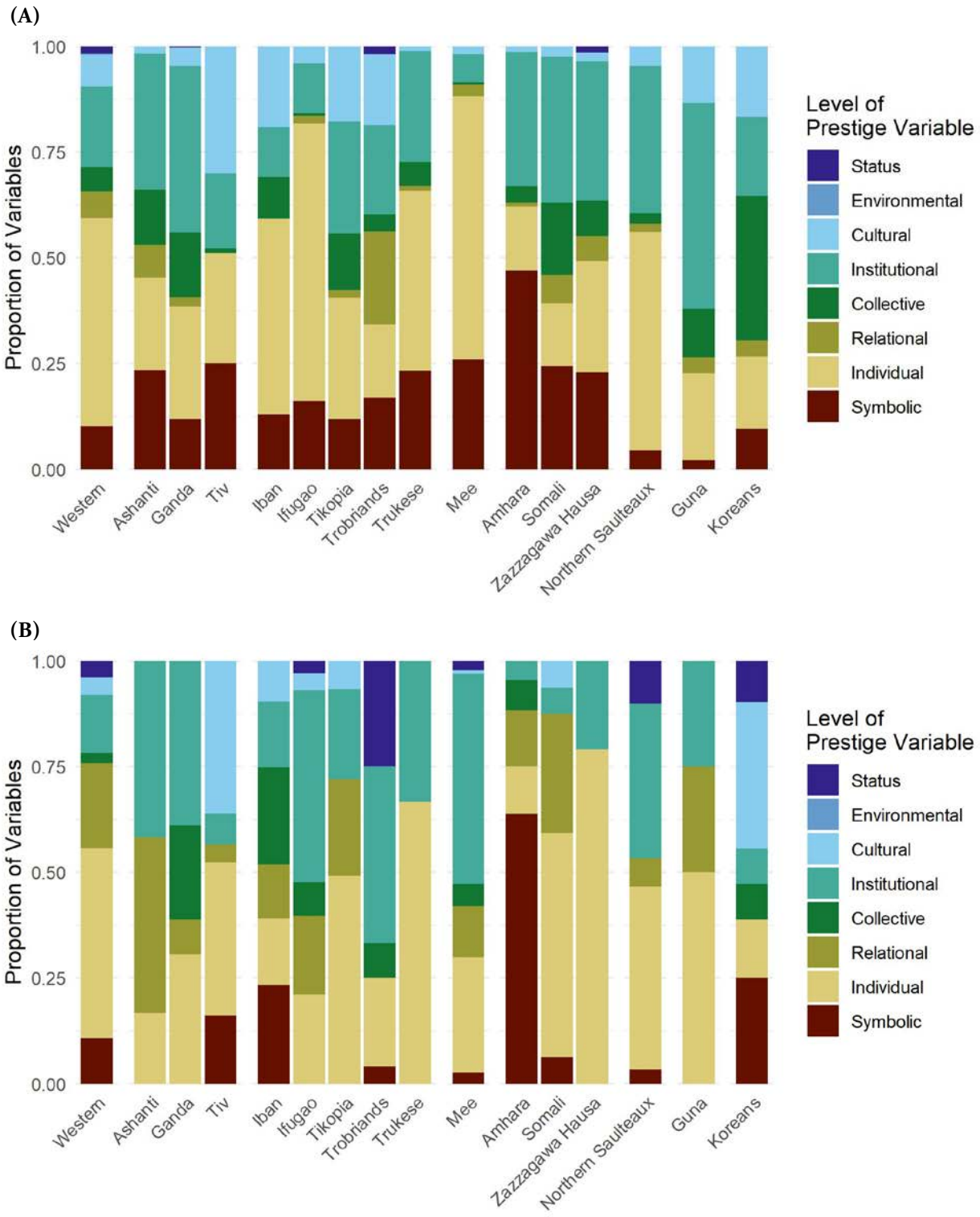


Figure 2.5. Determinants (A) and consequences (B) of prestige from Western sources and ethnographic sources on non-Western societies, classified by level of social structure. Data from "Western" sources are from the literature review of the present study. Societies are grouped by language family (see **Figure 2.4**) and are, in order: Indo-European (in this instance, given literature in English only), Niger-Congo, Austronesian, Trans-New Guinea, Afro-Asiatic, Algic, Chibchan, and language isolates.

Patterns in the proportions of terms at each stage in the role performance process were similar to those seen in social stratification for both determinants (**Figure 2.6A**) and consequences (**Figure 2.6B**). Significant differences between societies were found in the proportions of determinants (Fisher's exact test, $p < 0.001$) and consequences (Fisher's exact test, $p < 0.001$) at each stage, and groupings from pairwise comparisons showed similar trends to those found from the proportions by social stratification level (Appendix 2, Table A2.3). As with social structure, the most frequent terms in each stage of the role process provide additional insight into how prestige is gained within each society (Appendix 2, Table A2.4B). Positions of leadership, along with those having to do with religion and ceremonial or cultural practices, are common across the sample, and nearly all gain in prestige from having obtained wealth as a result of successful role performance. As with the level of social structure, there were too few terms for the consequences of prestige in each society (85 terms across 15 societies) to conduct a meaningful analysis.

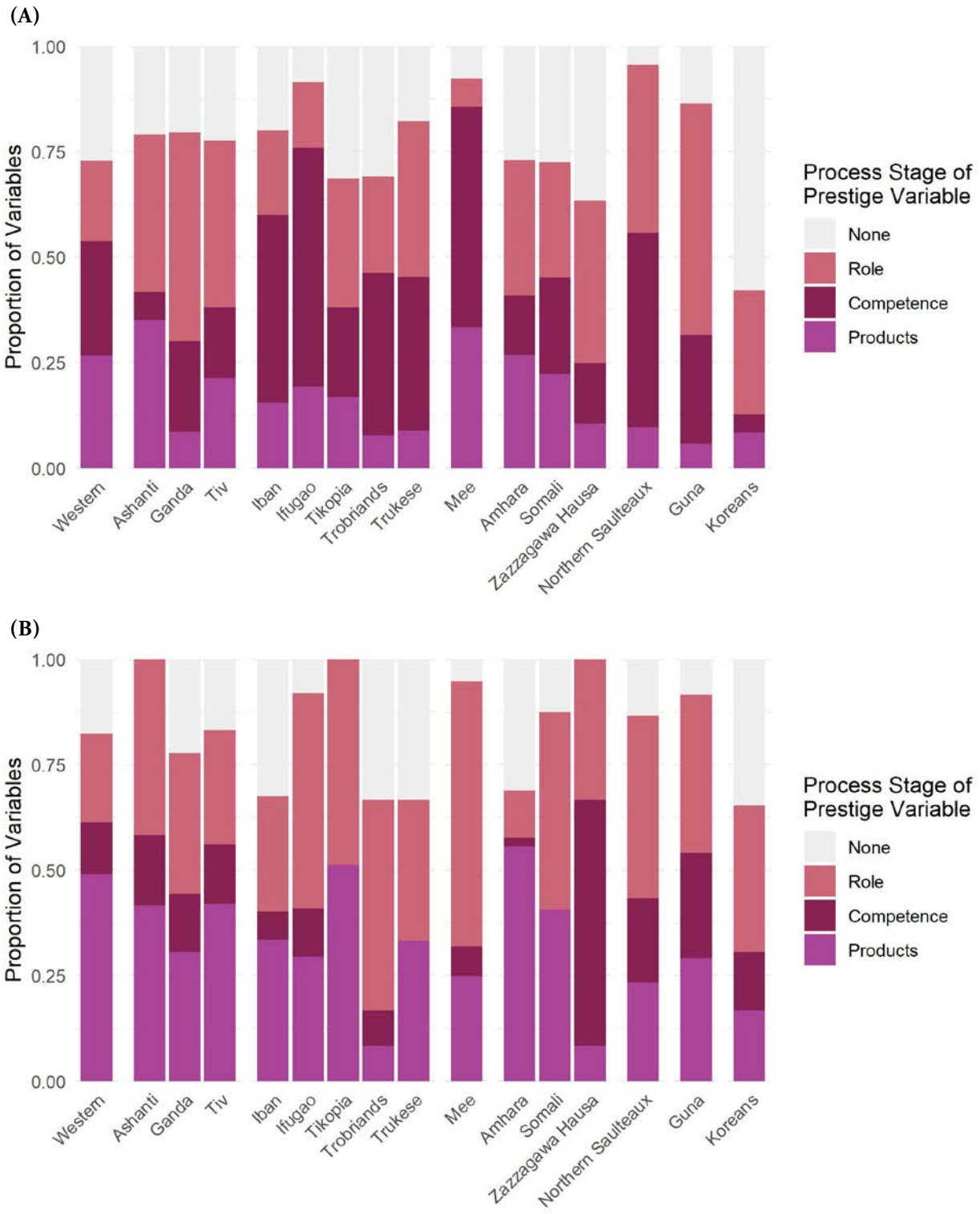


Figure 2.6. Determinants (A) and consequences (B) of prestige from Western sources and ethnographic sources on non-Western societies, classified by stage in social role processes. Data from "Western" sources are from the literature review of the present study. Societies are grouped by language family (see **Figure 2.4**) and are, in order: Indo-European (in this instance, given literature in English only), Niger-Congo, Austronesian, Trans-New Guinea, Afro-Asiatic, Algic, Chibchan, and language isolates.

Cluster analyses reveal that the non-Western societies generally divide into two clusters in terms of the proportions of prestige determinants in each level of social structure, consequences in each level, determinants in each stage of role processes, and consequences in each stage (**Figure 2.7A-D**). The proportions of variance explained by the first two clustering components displayed for each of these four sources of data are 69.4%, 62.6%, 80.8%, and 83.3%, respectively. Our results suggest that the Ifugao, Mee, and Northern Saulteaux are consistently distinct from other non-Western societies in their perceptions of the determinants of prestige, and that these clusters are relatively well-supported, but that clustering by prestige consequences yields less reliable results (at least when categorized by level of social structure). This inconsistency is explained by the small sample sizes mentioned previously; the consequences by stage of role process had fewer categories and therefore gave more reliable clustering results.

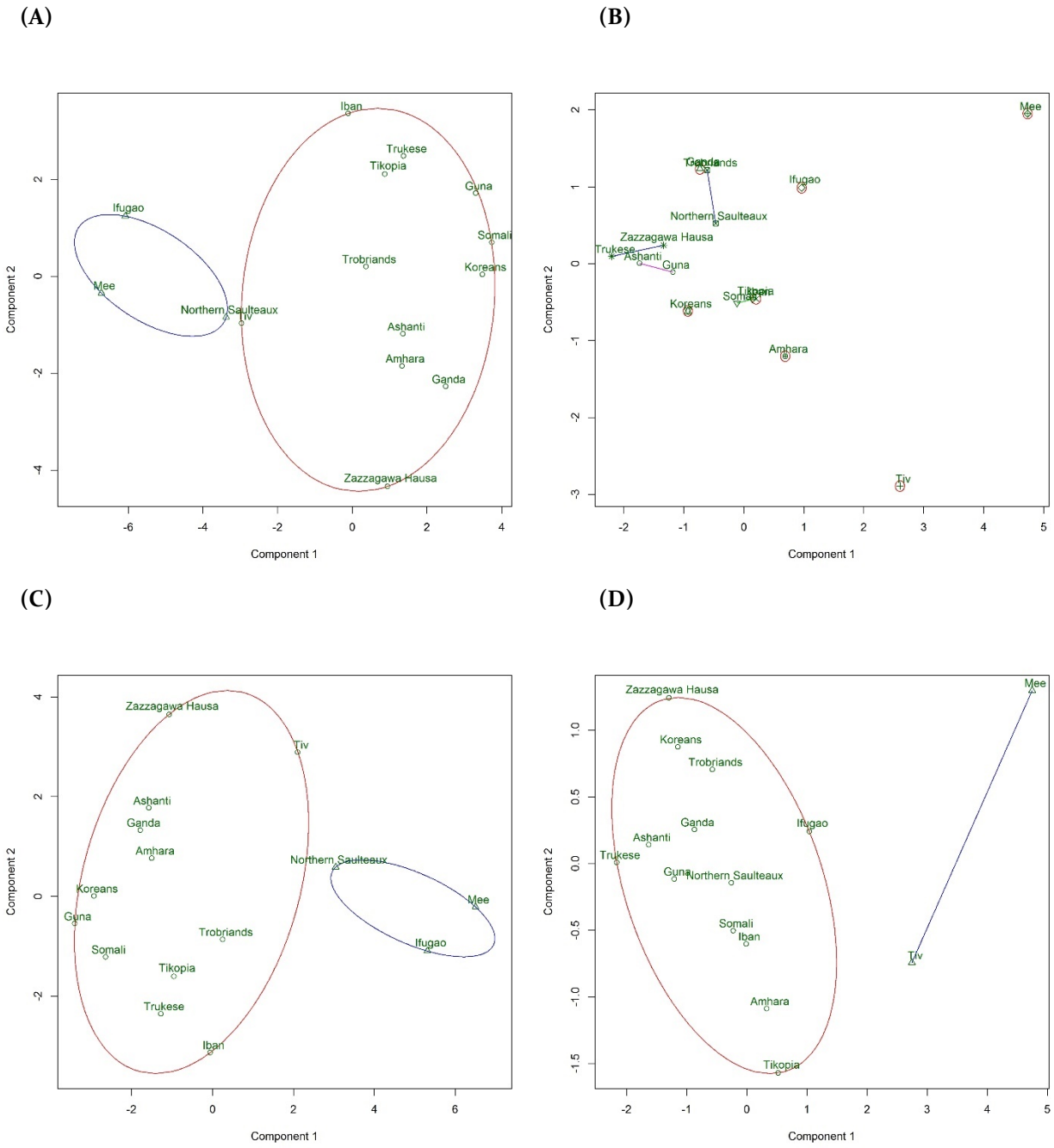


Figure 2.7. Clustering of non-Western societies according to determinants of prestige by level of social structure (A), consequences by level of social structure (B), determinants by stage in social role processes (C), and consequences by stage in social role processes (D). Optimal clusters are indicated by ellipses around groups of points, which show warmer colors with increasing density.

Much has been made of the need to move beyond the WEIRD research paradigm in modern social science research, and our findings demonstrate that cultural variability exists in how prestige is defined and operationalized in real societies. The societies in this ethnographic review differ substantially from Western perceptions of prestige. In particular, compared to the Western literature sample, many of the non-Western societies show a much higher contribution from traits such as perceived generosity (as *generous*), religiosity (*religious* as an individual-level trait, and institutional *religion*), and leadership (as *leader*) toward prestige. In many of these societies—particularly the Amhara, Koreans, Trobriands, and Ashanti—less emphasis is placed on individual-level prestige contributions and outcomes, with comparably higher frequencies of social factors in the relational, collective, institutional, and cultural levels.

However, we also stress that it would be inappropriate to generalize across non-Western societies regarding their conceptions of prestige, because our results show substantial variation between societies—as we might expect, given the diversity of cultural histories and values in our sample. We find that some societies—the Tikopia, Trobriands, Trukese, and Northern Saulteaux—have broad similarities to the proportions of terms in the Western sample, while other non-Western societies are more similar to one another. In our cluster analyses, the Ifugao, Mee, and Northern Saulteaux formed a cluster apart from other non-Western societies. The reasons behind these surface-level similarities between societies in how prestige is conceptualized are unclear without finer analyses and, indeed, the diversity within our sample is likely understated, as these analyses were based only on the proportions of each level or stage and do not incorporate the additional layer of nuance given by the specific terms within them. We also must note that these analyses are not phylogenetically controlled, and so must remain inconclusive on whether similarities can be attributed primarily to shared history, to similarity in environments, or to cultural diffusion. This is a question that remains open to potentially highly impactful future research. It is clear, however, that there is a great deal of cross-cultural variation in prestige, even within our relatively small sample.

Prestige as a general concept was present across all of the cultures we sampled, including those with insufficient data for full analysis; there were no societies that do not recognize prestige or for whom prestige is unimportant. Rather, our results demonstrate substantial differences in the degree to which different traits are valued for their contributions to prestige, and in the personal and societal consequences

of prestige. This illustrates the importance—in studies of prestige and other inherently cultural concepts—of sampling cross-cultural ethnography in a systematic way, rather than picking out instances that support a particular hypothesis or generalizing cultural traits or values across regions, language families, or modes of subsistence (e.g. sweeping statements about hunter-gatherers across time or space). Most importantly, it shows the necessity of a unifying framework of prestige that can adequately represent this variation. Isolated prestige concepts such as occupational prestige or national prestige are clearly insufficient to describe the nuances of prestige in the cultures we sampled.

Over the course of the ethnographic review, we found that the framework developed for our literature review was highly suitable for accurate classification, analysis, and synthesis of perceptions of prestige cross-culturally. Additional terms were added as needed for concepts that did not appear in the literature review—such as *midwifery*, *magic*, and *trapping*—but we did not encounter any circumstances where the framework could not adequately represent the context of the terms used. We do acknowledge that there are limitations to this ethnographic review, largely due to its tightly defined scale and scope. This study is a general overview of how prestige is represented in these societies within the available ethnographic literature, and is not a substitute for a targeted study of prestige in any one society in particular. Our results paint a broad picture of cross-cultural diversity in prestige concepts, and form the basis for studying the cultural nuances of prestige with increased resolution in future research.

2.4 Conclusions

Our broad syntheses of the academic literature, spanning a diversity of fields with over 150 unique definitions of prestige, as well as the perspectives of a sample of non-Western cultures across the world and the creation of a new framework to represent the components of prestige, returns us to the primary question asked by this study, which is: What is prestige? Our distillation of the results of both studies leads us to recommend the following definition: **prestige is a positive *attitude* that reflects a collective assessment of relative *inequalities* within a *social structure*.**

We arrived at this definition by bringing together its three core elements—attitudes, inequalities, and social structures—that allow it to encompass the diversity of ideas across all of the academic fields and world cultures we examined, while maintaining precise delineations between prestige and related concepts. One of the primary distinctions that needs to be made is that between prestige and status, and we do so by emphasizing that prestige is an *attitude*, as in the tradition of social psychology (Goldthorpe and Hope 1972, pp. 19–20). Prestige is not status, but reflects explicit and implicit thoughts, beliefs, and values about status. Status, in its original definition, is "a position in a particular pattern" (or "with relation to the total society") that is constituted of "a collection of rights and duties" (Linton 1936, p. 113). Thus, status is a relative position and the differential privileges and benefits associated with that position (*inequalities*) within a *social structure*, and prestige is the attitudinal perception of that status by others. Our definition is flexible on the particular structure being referenced and the inequalities that it carries because, as Linton first noted (1936, p. 113), an individual has "many statuses" and likewise can have different perceived levels of prestige in different social spaces and contexts. This may explain some of the confusion around whether prestige is domain-specific or domain-general (Henrich and Gil-White 2001; Chudek et al. 2012), in that these perceptions may be variable across individuals and cultures, as well as being context-dependent. Along with the multiple statuses of an individual, in daily life and across varying fields, abstract entities such as corporations, brands, and nations are regarded as having status, with rights and duties that are somewhat different from those expected of individual people, and their prestige is evaluated on those bases. Regardless of the entity it applies to, prestige, as an attitude, is held in the minds of individual people.

Similar to this distinction between prestige and status, prestige is not behavior, though, as an attitude, it influences behavior. Some behavior can be "prestige-seeking" (Vigneron and Johnson 1999; Ihara 2008), but the behavior itself is not equivalent to prestige; rather, it is an attempt to improve one's own status and prestige perceptions. As is the case with any other attitude, prestige attitudes are formed and influenced by social learning. This is a significant point when we consider the implications for cultural transmission, as theory suggests that learners preferentially attend to and copy high-prestige models (Boyd and Richerson 1985; Henrich and Gil-White 2001; Henrich and Boyd 2002). Thus, prestige is learned but also affects learning, and prestige is acquired through the copying of behavior but also influences behavior.

This feedback echoes the circular nature of many of the prestige determinants and consequences found in these studies.

Why do people pursue prestige? What is gained? As we have seen with other aspects of prestige, the answers to these questions vary significantly across cultures. Some researchers have suggested that prestige leads to increased reproductive success (Smith 2004; von Rueden et al. 2010; Price and van Vugt 2014), but others dispute this claim (Hill 1984) or have found mixed or nuanced results (Perusse 1993; Ihara 2008; Smith et al. 2016; von Rueden and Jaeggi 2016). We find that the most persistent consequence of prestige across cultures is as a route to power (and various means of exercising and displaying power, such as wealth, influence, leadership, and authority). The status associated with a position means little if the perceived prestige of that position does not afford access to some measure of control over others or over resources. Thus, it makes sense for individuals to pursue positions, traits, behaviors, and affiliations that grant power (in whatever form is appropriate in the context of their culture) to improve their own circumstances or the circumstances of their family, lineage, institution, and so on, whether these consequences are ultimately fitness-enhancing or not. In turn, the cultural benefits of prestige lead to the motivation for those in positions of prestige and power to maintain and enhance the systems that brought them to that state.

One example of the structural consequences of this reification of prestige systems is the depiction in our sample of prestige as a quality largely exclusive to men. In the studies and ethnographies we examined, the question considered was often not whether women have high or low prestige, but whether the concept of prestige can be applied to women at all. Only roughly 3% of the literature sample and 2% of the ethnographic sample specifically mentioned determinants or consequences of prestige for women; the vast majority of the remainder either referred explicitly to men and used male pronouns, talked about cultural positions, roles, or traits that could only apply to men, or passively assumed that the occupants of high-prestige positions were men. Very few sources used gender-neutral or inclusive language to state that the traits listed could also apply to women (and non-binary genders were never mentioned, even in the ethnographic literature). In cases where the prestige of women was addressed, the determinants by which they are evaluated and the consequences of obtaining prestige are distinct from those for men and often

revolve around attractiveness, marriage, and childbearing (Kaplan 1985; McLaren and Godley 2009; Price and van Vugt 2014). Studies in the Western literature have found that women tend to be rated much lower in a prestige hierarchy (Touhey 1974; Bose and Rossi 1983; Powell and Jacobs 1984), or do not obtain comparable benefits from prestige (England 1979), or occupy a hierarchy entirely separate from that of men (Wegener 1992). These results extend to other demographic categories such as race but, within the bounds of our review, race and ethnicity were often mentioned explicitly as factors that affected prestige, while views on sex and gender were more implicitly embedded in the texts themselves. We posit that this pervasive bias in the literature is reflective of historical top-down social pressures to reinforce systems and qualities that preferentially grant prestige and power to men, and the perspectives of authors from cultures that have annealed these biases within institutions and practices.

There are limitations to describing prestige concepts at the societal level, both from the Western literature and ethnographic depictions of societies, in that it may obscure differing perspectives on a general social prestige hierarchy. An individual's perspective on prestige depends upon their position in the hierarchy (Alexander Jr 1972; Wegener 1992) and a variety of other demographic factors, so a degree of variation from the normative view is expected. An individual may hold more than one of these views simultaneously, given that one person can belong to a number of groups and have multiple identities. Additionally, as an individual can have "many statuses" (Linton 1936), they may also have "many prestiges" in different spaces and contexts. These questions are finer in scope than the general perspectives examined in these reviews, and present opportunities for future research using the integrative framework established here.

In summary, the implications of a better understanding of prestige stretch across all disciplines concerned with human society and culture. Prestige has a multitude of effects on the lives and success of individuals and cascades through social strata to have impacts on collective social groups, institutions, and cultures, which then feed back to shape individual perceptions of prestige. To have a truly integrative understanding of human sociality, stratification, and inequality, we must have a common ground to stand upon, which can be provided by an integrative concept of prestige that ensures different researchers can measure, study, and communicate about the same ideas. Many questions remain regarding how prestige is

operationalized in day-to-day life, to what degree the relative importance of different prestige determinants and consequences vary across cultures, and under which circumstances prestige can influence the transmission and evolution of culture. We regard this synthesis of the academic and ethnographic literatures, as well as the unified framework and generalized definition of prestige that we have produced as a result, to be a foundation for future research, in the hope that these studies will inspire a thriving cross-disciplinary discourse on the concept of prestige and its outcomes on the many and varied social lives of our species.

3. THE POSITION-REPUTATION-INFORMATION (PRI) SCALE OF INDIVIDUAL PRESTIGE

3.1 Introduction

Prestige is a key concept for many disciplines in the social and behavioral sciences, including psychology (Asch 1948), sociology (Wegener 1992), anthropology (Barkow 1975), and economics (Harbaugh 1998). Through its influence on the cultural transmission of knowledge and the dynamics that shape cultural diversity, prestige has been implicated as a crucial component in the evolution of our highly social species (Boyd and Richerson 1985; Henrich 2001; Henrich and Boyd 2002; Richerson and Boyd 2005). These cultural evolutionary dynamics ultimately arise from social interactions between individuals at the microevolutionary level. Therefore, we can consider the individual as the unit that acquires, holds, and benefits from prestige in day-to-day life. Despite the theoretical and practical importance of the prestige concept, it is surprising that no satisfactory tool currently exists for measuring individual prestige.

A scale of individual prestige that is theoretically and practically meaningful must have validity (e.g. it measures what it is intended to measure) and reliability (e.g. it is consistent in those measurements). When quantifying prestige, the scale must measure perceptions of the traits that constitute prestige and the relative influence these traits have on the general prestige construct. The scale should also assist researchers in accounting for differences in perceptions between groups of respondents—by culture, demographics, or otherwise—in order to avoid being misled by results from inappropriately aggregating across these groups (Guppy and Goyder 1984; Goyder 2005; Crawley 2014). In addition, the scale should be developed using replicable methods to allow for adaptations for use with new groups that may hold different values. Lastly, in developing the scale, researchers should endeavor to be data-driven and theory-neutral (Kitchin 2014; Mazzocchi 2015) to minimize the potential bias posed by researchers' expectations and to maximize the real-world utility and validity of the scale.

Rather than individual prestige, existing prestige scales focus on the prestige of collective social institutions or constructs, such as organizational prestige (regard for an institution, e.g. Mael and Ashforth 1992; Smidts et al. 2001), brand prestige (status associated with products, e.g. Deeter-Schmelz et al. 2000; Vigneron and Johnson 2004), and occupational prestige (standing of professions, e.g. Duncan 1961; Nakao

and Treas 1992; Ganzeboom et al. 1992), that are not directly derived from or attributable to individual-level traits. Some of the most widely-used "scales" of occupational prestige—including the NORC Duncan Socioeconomic Index (Duncan 1961), the Nakao-Treas Prestige Score (Nakao and Treas 1992), and the International Socio-Economic Index of Occupational Status (Ganzeboom et al. 1992) (and its predecessors, e.g. Treiman 1977)—are not measurement tools, but rather lists of prior composite ratings for each occupation. Researchers obtained some of these existing prestige "scales" (and others, e.g. Kaufman 1945; Steenkamp et al. 2003) by directly asking participants to rank others by their own internal concept of prestige, left undefined, or by how participants think society in general would or should rank them. These ambiguities in previous indices of prestige leave findings open to theoretically-biased interpretations (Blaikie 1977; Gusfield and Schwartz 1963).

The distinction between data-driven and theory-driven research is also relevant when considering the suitability of another published scale for measuring individual prestige: the prestige-dominance scale developed by Cheng et al. (2010). This scale was built to conform to a specific theoretical framework (Henrich and Gil-White 2001) and contrasts "prestige" and "dominance" as opposing unidimensional constructs. To maintain theoretical soundness, Cheng and colleagues chose to retain multiple scale items that did not meet their stated inclusion criteria and contributed to a poorly-fitting final model ($CFI < 0.95$, $GFI < 0.90$, $RMSEA > 0.05$) (Cheng et al. 2010). Here, for the purpose of developing an accurate measurement tool, we consider that the characteristics of an individual that may contribute to prestige could also overlap with those that contribute to dominance, rather than belonging to either of two fully discrete avenues to status. Previous research (Goldthorpe and Hope 1972; Seligson 1977; Reyes-García et al. 2008; von Rueden et al. 2008) suggests that peoples' mental models for one or both of these constructs may also be multidimensional rather than unidimensional. Importantly, these hypotheses can be assessed using an empirical, theory-neutral approach.

The purpose of our work is to construct a valid and reliable scale of individual prestige, as defined by participants within two broadly "Western" societies—the United States and the United Kingdom—using replicable methods that we intend to be extensible to other contexts and cultures. We take a minimal theoretical approach, elements of which have been suggested in disparate parts of the literature but never

explored together in one measurement tool. Our approach makes only three fundamental assumptions about prestige:

1) Prestige can be seen as a trait possessed and used by an individual in the course of everyday social life, distinct from but not independent of the prestige accorded to the societal institutions and constructs of which they may be a part (Blaikie 1977; Davis and Moore 1945; Wegener 1992);
2) Prestige is based upon the subjective assessments of others, through the lens of their individually, socially, and culturally acquired beliefs, values, attitudes, and experiences (Inkeles and Rossi 1956; Svalastoga 1959; Goldthorpe and Hope 1972; Barkow 1975; Blaikie 1977; Wegener 1992); and
3) Prestige may be composed of multiple dimensions (Goldthorpe and Hope 1972; Seligson 1977; D'Aveni 1990; Wegener 1992; Vigneron and Johnson 1999; Reyes-García et al. 2008; von Rueden et al. 2008), each representing differential contributions from individual, social, or cultural domains.

We made no further assumptions about what constitutes prestige or of its specific societal mechanisms and consequences, as our goal was to obtain the necessary information from respondents' own views of prestige in the real world (Blaikie 1977). Our approach was driven to a large degree by the responses of participants, rather than relying on any specific, theoretically-entrenched prestige concept.

One methodological challenge of our approach involved finding a valid, widely-recognized signal of prestige that could be presented to participants to evaluate the pool of prospective prestige scale items. Ideally, this instrument would also avoid pre-defining for participants what prestige means. For this purpose, and because this is one component of a larger study on prestige and the transmission of spoken information, we chose to use accented regional variation in speech to highlight differences in individual prestige. Work by sociolinguists has consistently shown that linguistic characteristics such as dialect and accent can index macro-social categories related to prestige (such as class) in the perceptions of listeners, as well as acquiring socially significant meanings of their own. Accents and regional varieties are therefore perceived as strong indicators of prestige and tend to be stable over time (Giles 1970; Bishop et al. 2005; Coupland and Bishop 2007; Fuertes et al. 2012). Accents are hard-to-fake signals (Cronk 2005) and because accents that are regarded as locally "standard" or associated with desirable upper class membership tend to be evaluated highly by a majority of listeners, they often serve as an index of membership in a high-status

group (Giles 1970; Kroch 1978; Kahane 1986). Naturally, some disagreement will exist between different demographic groups on the evaluation of particular accents (Labov 1966; Giles 1970). However, our focus is not on how respondents rate specific accents but on the relationships between the items used in the evaluation of prestige.

The development of a valid and reliable scale will enable researchers from diverse disciplinary backgrounds to measure individual prestige using a shared prestige concept. The scale can thus contribute to the evaluation and reconciliation of competing theories on prestige and serve as a foundation for the development of new theoretical and experimental trajectories across the social and behavioral sciences.

3.2 Results

The scale development process involved first constructing the prospective scale by collecting items and determining their structure through exploratory factor analysis, then evaluating the fit of the model using confirmatory factor analysis with a separate data set, and finally assessing the validity and reliability of the scale using a mixture of qualitative and quantitative criteria.

3.2.1 Study 1: Scale construction

We began by conducting a study to generate a pool of words or phrases ("items") related to prestige, reducing the items to those most indicative of prestige, and constructing the scale by establishing the factor structure of those items using exploratory factor analysis ("EFA"). We collected items from three sources: the most salient terms in a free-listing task completed by participants; a previously unpublished pilot study on sociolinguistic prestige; and a review of published scales that measure language attitudes and incorporated a prestige or status dimension. We also collected items from two contrasting domains—"solidarity" and "dynamism"—from published sources, to ensure that scale items adequately discriminated between prestige and other unrelated concepts with positive connotations. We used the resulting list of items (**Table 3.1**) for this study and for the follow-up scale evaluation study.

Table 3.1. Pool of attitudinal items retained and used in the scale construction and scale evaluation studies. Reversed items used in the scale evaluation study are noted parenthetically.

PRESTIGE	SOLIDARITY	DYNAMISM
prestigious	*friendly*	*aggressive*
wealthy	*kind (unkind)*	*active*
high social status	*good-natured*	*confident*
powerful	*warm*	*enthusiastic*
respected	*comforting*	
educated		
hardworking		
successful		
intelligent (unintelligent)		
reputable		
ambitious (unambitious)		

We recruited participants from the US (n = 153) and UK (n = 155) to complete an online survey using these items to evaluate the characteristics of four speakers with varying regional accents of English. As a second complementary source of data on perceptions of association between items without involving accents, participants were also asked to group the prestige domain items into like and unlike categories using a triad test.

By sequentially applying EFA and eliminating items that failed to reach the predetermined acceptance criteria (see Methods), we obtained the best-supported factor structure for the attitudinal items across all three domains (**Table 3.2a** and **Figure 3.4**), as well as the internal factor structure of the attitudinal and triad items in the prestige domain (**Figure 3.1**; **Table 3.2b** and **2c**). Using EFA, items within the prestige domain were partitioned into three factors: *wealthy*, *powerful*, and *high social status* in the first factor, hereafter referred to as "position"; *reputable* and *respected* in the second factor, referred to as "reputation"; and *educated* and *intelligent* in the third factor, referred to as "information." We therefore denote the resulting factor structure as Position-Reputation-Information, or "PRI." Subsequent cluster analyses on the same data generated clusters that matched the three PRI factors (**Figure 3.6A**), as did results from comparable analyses of the triad data (**Figure 3.6B**), supporting the robustness of this structure.

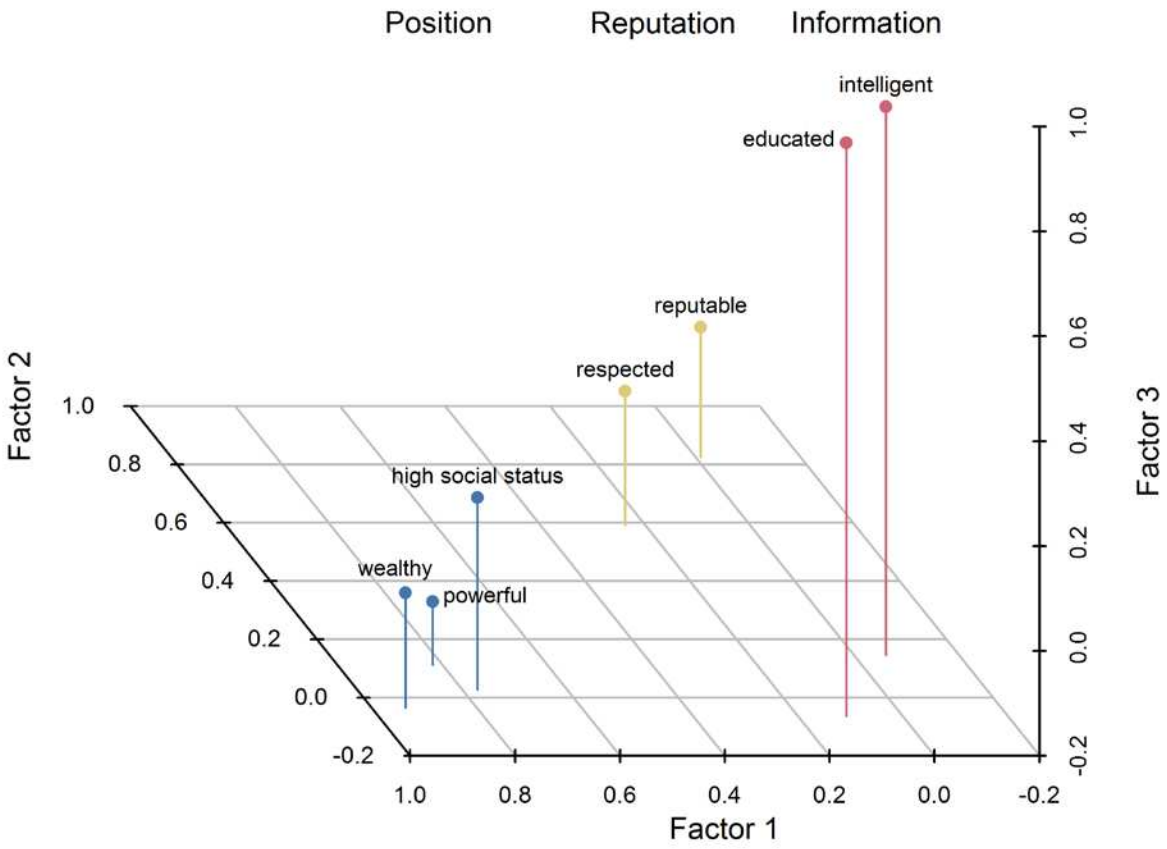


Figure 3.1. Prestige domain item loadings from exploratory factor analysis of attitudinal data. Position, reputation, and information items are shown in light blue, gold, and pink, respectively.

3.2.2 Study 2: Scale evaluation

We then conducted a second study with an independent data set to validate the findings of the scale construction study using confirmatory factor analysis ("CFA"). The validation step evaluates the fit of the structural model proposed by EFA and examines any potential systematic variance due to sampling (Hair et al. 2010). We used the full set of relevant items from the scale construction study in the CFA, with three

items presented in reversed form to reduce potential response bias (but this was found to be ineffective, see Methods).

For this study, we recruited a new, independent sample of participants from the US (n = 151) and UK (n = 144) to provide attitudinal ratings for a greater variety of accented speakers than in the previous study (n = 8 in each country, 4 of which were presented to participants in both countries; see **Table 3.3**), again using an online survey.

After controlling for potential differences between participant demographics, we found that the PRI model exhibited good fit (CFI = 0.959, TLI = 0.983, RMSEA = 0.031 [90% CI: 0.026, 0.036], SRMR = 0.023). Following this validation by CFA, we obtained the complete PRI scale (**Figure 3.2**).

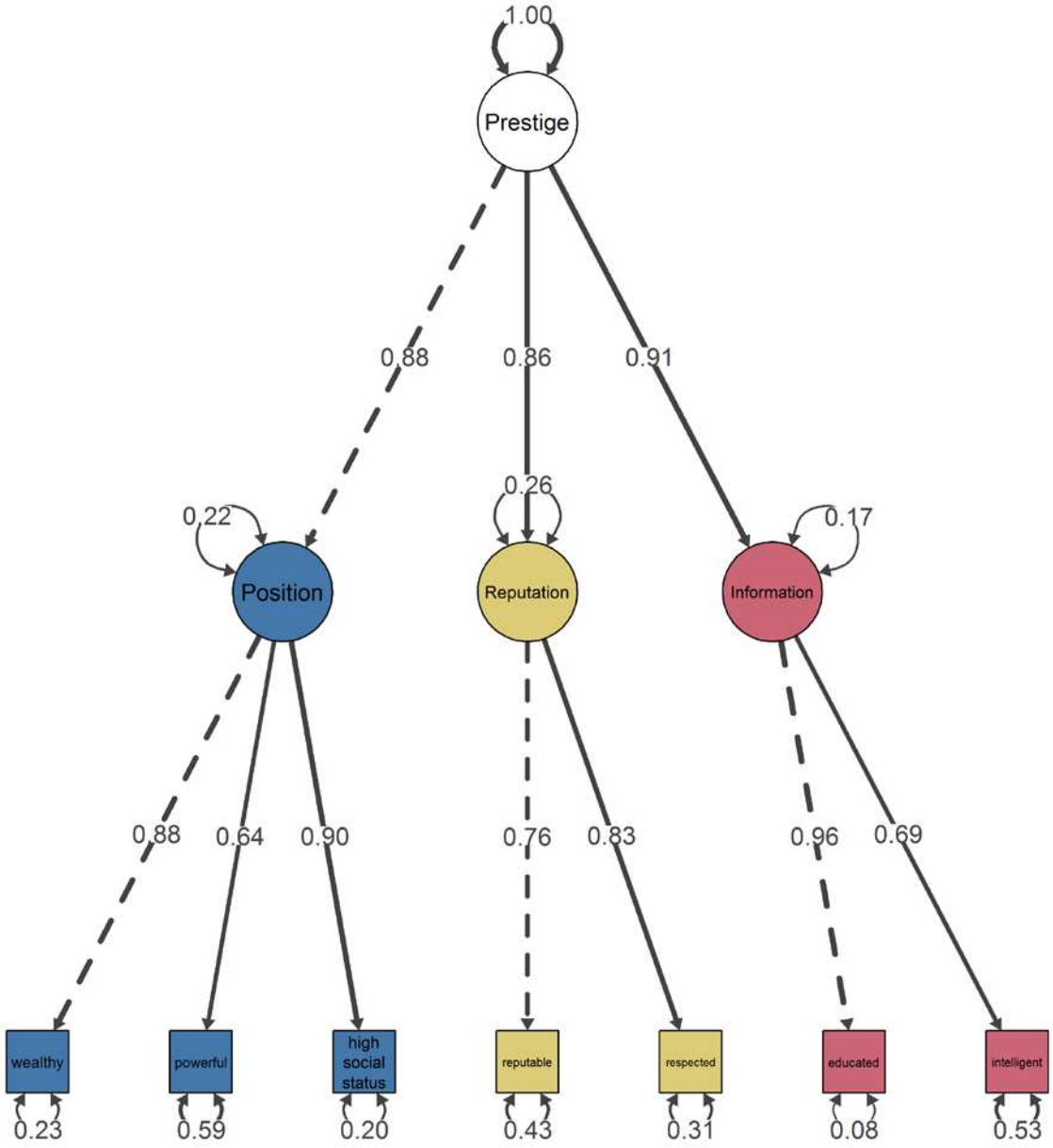


Figure 3.2. Path diagram and estimates from confirmatory factor analysis of the Position-Reputation-Information scale model. Standardized parameter estimates are shown as weighted edges. Residual variances are shown as self-loops. Dotted lines indicate that the loadings of the first indicator of each factor were fixed to 1.0 for estimation.

3.2.3 Scale validity and reliability

The PRI scale displayed both validity and reliability in the context of our samples. Using predetermined criteria to judge the acceptability of each index (see Methods), we found support for the components of construct validity: convergent validity measures exceeded the criterion for all subscales (average variance

explained, or "AVE": position = 0.670, reputation = 0.629, information = 0.696) and discriminant validity measures (heterotrait-monotrait ratio, or "HTMT": **Table 3.6**) remained below the threshold in all cases except in one comparison between internal position and information subscales. Reliability measures of internal consistency (coefficients alpha and omega: **Table 3.7**) were high within each PRI subscale (M = 0.813, SD = 0.036) and for the scale as a whole (M = 0.892, SD = 0.018). Criterion validity was demonstrated by high correlations between scale items and a separate *prestigious* item (M = 0.692, SD = 0.097). As added support for the criterion validity of the PRI scale, in a comparative data set the factor scores predicted by the PRI scale were highly correlated with those of the prestige factor of the Cheng et al. (2010) prestige-dominance scale (PRI overall: 0.850, position: 0.805, reputation: 0.861, information: 0.828) and the PRI scale displayed better model fit overall (ΔCFI = 0.025, ΔTLI = 0.029, ΔRMSEA = -0.045, ΔSRMR = -0.064; see Methods).

These assessments demonstrate that the PRI scale adequately represents the prestige construct and that it is distinct from the other positive traits tested (i.e. solidarity and dynamism). The three subscales (position, reputation, and information) represent cohesive parts of a whole while being relatively distinct from one another. Additionally, perceptions of the PRI structure were consistent across respondents and the scale compares well with existing prestige concepts. We take these results as support for the PRI scale as the most accurate and realistic reflection of our participants' internal views on the content and structure of the individual prestige construct.

3.3 Discussion

In the process of developing the PRI scale, we intentionally minimized the role of theory and allowed the structure inherent in the data—structure provided by participants' own internal conceptions of prestige and revealed through exploratory factor analysis—to dictate what was most relevant. However, in examining this structure and the constituent items of the scale after its formation, we found that the PRI prestige construct is highly consistent with different streams of prior research on prestige. The terms

chosen to represent the three subscales, "position," "reputation," and "information," characterize three relatively distinct axes of individual prestige, and we examine each in turn.

The position components of the scale signify an individual's relative place in the social hierarchy, determined to a large extent by the circumstances of birth, family, and inheritance. Max Weber, in his classic theory of social stratification, argued that one's social position can be attributed to three dimensions: economic "class," or wealth; "status," or honour gained through prestige; and "party," or political power and influence (Weber 1922, 1946). These closely mirror the three items found in the position subscale (*wealthy*, *high social status*, and *powerful*) and this finding reflects the continuing utility of Weber's ideas in sociological theory and practice (Rhoads 2010).

The items in the reputation subscale (*reputable* and *respected*) relate to social opinion and esteem and are terms frequently used to describe prestige (e.g. Henrich and Gil-White 2001; Mael and Ashforth 1992; Smidts et al. 2001), and are even used synonymously with it (e.g. Shenkar and Yuchtman-Yaar 1997). In the sociological literature on prestige, reputation and respect have the connotation of a collective judgment of character independent of individual variation in judgments (Wegener 1992). Reputation and respect represent the general societal evaluation of an individual in a certain position or role, subjectively interpreted through social and cultural values. By contrast, the items in the position subscale may be established through privilege without necessarily undergoing the same degree of collective evaluation (Weber 1922, 1946).

The third subscale, information, and its items (*educated* and *intelligent*) represent the value placed by society on the holders of wisdom, expertise, and learning. These constructs are supported by the occupational prestige literature, which emphasizes that—in a stratified society with specialized occupations—an individual's educational background and achievement are highly predictive of their future occupational class which, in turn, contributes significantly to individual prestige (e.g. Bajema 1968; Sewell et al. 1969; Cheng and Furnham 2012). The salience of this subscale and its focus on information holders could also indicate support for arguments from information theory about the evolution of prestige and its role in cultural transmission. The information theory-based account, presented alongside (but not integral to) the dichotomous prestige-dominance distinction by Henrich & Gil-White (2001), asserts that

individuals gain prestige by having desirable skills and knowledge that others compete within a social group for the opportunity to learn. Alternatively, an occupation attained through greater education could be another avenue to wealth and power. This question, and to what extent—if any—some form of the information subscale would be relevant to prestige across the diversity of non-Western or non-industrialized societies remains open to future study.

Indeed, there is a great need to explore concepts of prestige cross-culturally to reach beyond the perspectives given by Western and westernized participants. Many existing prestige indices have been explicitly promoted for their universality, in spite of having been developed using data almost exclusively from "WEIRD" (Western, Educated, Industrialized, Rich, and Democratic) societies (Henrich et al. 2010) in the 1960s, '70s, and '80s. The utility of these indices across cultures and over the significant span of time and sociocultural change that has occurred since they were developed has been called into question (Goldthorpe and Hope 1972; Guppy and Goyder 1984; Hauser and Warren 1997; Goyder 2005; Crawley 2014).

The concept of prestige, the individual components that comprise prestige, the degree of importance attached to each component, and the relationships between components are all—to some degree—culturally constructed and malleable through cultural evolutionary processes. Therefore, we recognize that the PRI scale is not universally applicable, as this is an unrealistic expectation. We developed the PRI scale using data collected from adults in the highly WEIRD societies of the United States and United Kingdom and it should not be generalized beyond that context without adequate validation. The high degree of consistency in the PRI structure across our representative samples of demographically diverse participants in the US and UK suggests that the PRI scale should function well across other highly Westernized, English-speaking societies. However, distinct demographic or cultural groups within these societies may hold different values and have substantially different internal models of prestige. For these reasons, and in the interest of following best practices in psychometrics (Haynes et al. 1995), we strongly recommend testing the validity and reliability of the PRI scale with each application and testing for invariance across as many demographic variables as may be potentially relevant.

We have made the process of constructing and validating the PRI scale extensible to any additional population for which a scale of individual prestige is needed, through the emphasis on the participants in the item generation and evaluation stages, the use of straightforward and appropriate methods and criteria, the use of open-source analytical tools, and the open sharing of all data and code used to run analyses. A new variant of the PRI scale can be constructed by repeating these methods in a new group, with awareness and care for local cultural norms and power structures. Examining systematic differences in responses and extending the PRI scale to other contexts and cultures can further improve the representation and inclusion of minority and non-Western perspectives on prestige, and we argue is the most important avenue for future research presented by this study.

The PRI scale for the measurement of individual prestige fills a crucial niche by establishing a measurement tool driven by the real-world perceptions of individuals across two Western societies. The PRI scale enables the study of prestige—a central yet divisive concept throughout the social and behavioral sciences—using a common foundation, which we hope will encourage fruitful engagement, conversation, and collaboration that spans across disciplinary boundaries. We have shown the broad utility of this scale for conducting research by finding support for the PRI structure in both of two separate sources of data: attitudinal responses to variations in accented speech, and triadic conceptual associations absent the sociolinguistic context.

Future research should endeavor to untangle the complex and varied patterns in how prestige is perceived and how it operates in the practice of real social interactions across the breadth of human experience. The availability of the PRI scale allows researchers to explore in greater detail the relationships between different aspects of prestige, dominance, status, and success. Some of these relationships may be quite complex, or even circular, as suggested by the presence of *high social status* as an indicator of prestige within the position subscale (whereas scholars would normally consider prestige to be a contributor to status) or by the possible contributions of specific indicators like *educated* toward other indicators like *wealthy*. Additionally, there may be some degree of overlap between the construct of prestige, as measured by the PRI scale and the prestige factor of the Cheng et al. (2010) prestige-dominance scale, and other related concepts like dominance and leadership. Many questions remain about the breadth and

interconnectedness of the varied routes to the acquisition of social status. We view the establishment of the PRI scale as a necessary step toward a more integrated and comprehensive understanding of prestige, through the clarification of preceding debates and the beginning of new lines of inquiry into the core concepts that shape interactions, relationships, social structure and inequality, and the evolution of culture.

3.4 Methods

3.4.1 Study 1: Scale construction

3.4.1.1 Item generation

In the development of this scale, we used a combination of deductive and inductive methods to collect the items most relevant to the concept of individual prestige. This methodological approach incorporated emic, operational determinants of prestige from a real-world Western context, as well as shared items from previous scales, in order to evaluate all possible components of a prestige scale concurrently. We sampled items from a salience analysis of responses to a free listing task, from existing attitudinal scales in the literature, and from responses to a pilot study investigating sociolinguistic prestige. We favoured the use of inductive methods, specifically the free listing task, because they are generalizable and facilitate replication and extension to other contexts and cultures.

Free listing is a tool from cultural domain analysis used to elicit responses on a particular classification of knowledge (Bernard 2011, pp. 224–228; Quinlan 2005; Weller 2015). The task conducted as part of this study consisted of a survey in which participants responded to the following three prompts, in order:

1. *List all of the words or phrases that you can think of that are related to "prestige."*
2. *List all of the words or phrases that you can think of that describe "prestigious" people.*
3. *List all of the characteristics that you can think of that make a person "prestigious."*

Responses were limited to 2 minutes per question. We allowed repetition of terms from prior questions, but participants could not refer back to previous responses. We recruited participants for this task through advertisements in local undergraduate courses (n = 6 US) and social media networks (n = 42 US, 20 UK),

for a final sample of 68 participants. We compensated undergraduate students for their participation and social media participants engaged voluntarily. Participants ranged in age from 18 to 50 (M = 28.9, SD = 7.3), with 18 that identified as male and 50 that identified as female. All participants were native English speakers. All participants self-identified as white, except for one person of mixed ethnicity from the US and one person of colour from the UK. Participants came from a variety of backgrounds with respect to the size of their childhood settlement and educational attainment, but for occupation most were either students (25.0%) or were in management or professional positions (26.5%), with others in service (11.8%) and sales (5.9%) positions.

After obtaining the three free lists of items from each participant, we grouped items for common meaning, reducing the pool of unique items from 717 to 303. Generally, this procedure consisted of replacing multi-word phrases with single-word synonyms and converting words to adjective form (e.g. "lots of education" to "educated" and "influence" to "influential"). We left given terms as-is if their intended meaning was ambiguous. On the whole, groupings were done with the intent of minimal replacement, so as to allow participants to speak for themselves, and all co-authors verified the groupings. We then calculated a salience value for each of the 303 items using Smith's S (Smith and Borgatti 1997), which takes into account both the frequency of an item's occurrence across lists and order of occurrence within lists. From a scree plot of the items by their salience values, we chose the cutoff near the inflection point at the highest local proportional drop in salience (0.0148) to capture the set of most salient items (**Figure 3.3**) (Bernard 2011). The items retained from this exercise were: *wealthy*, *high social status*, *powerful*, *respected*, *educated*, *hardworking*, and *successful*.

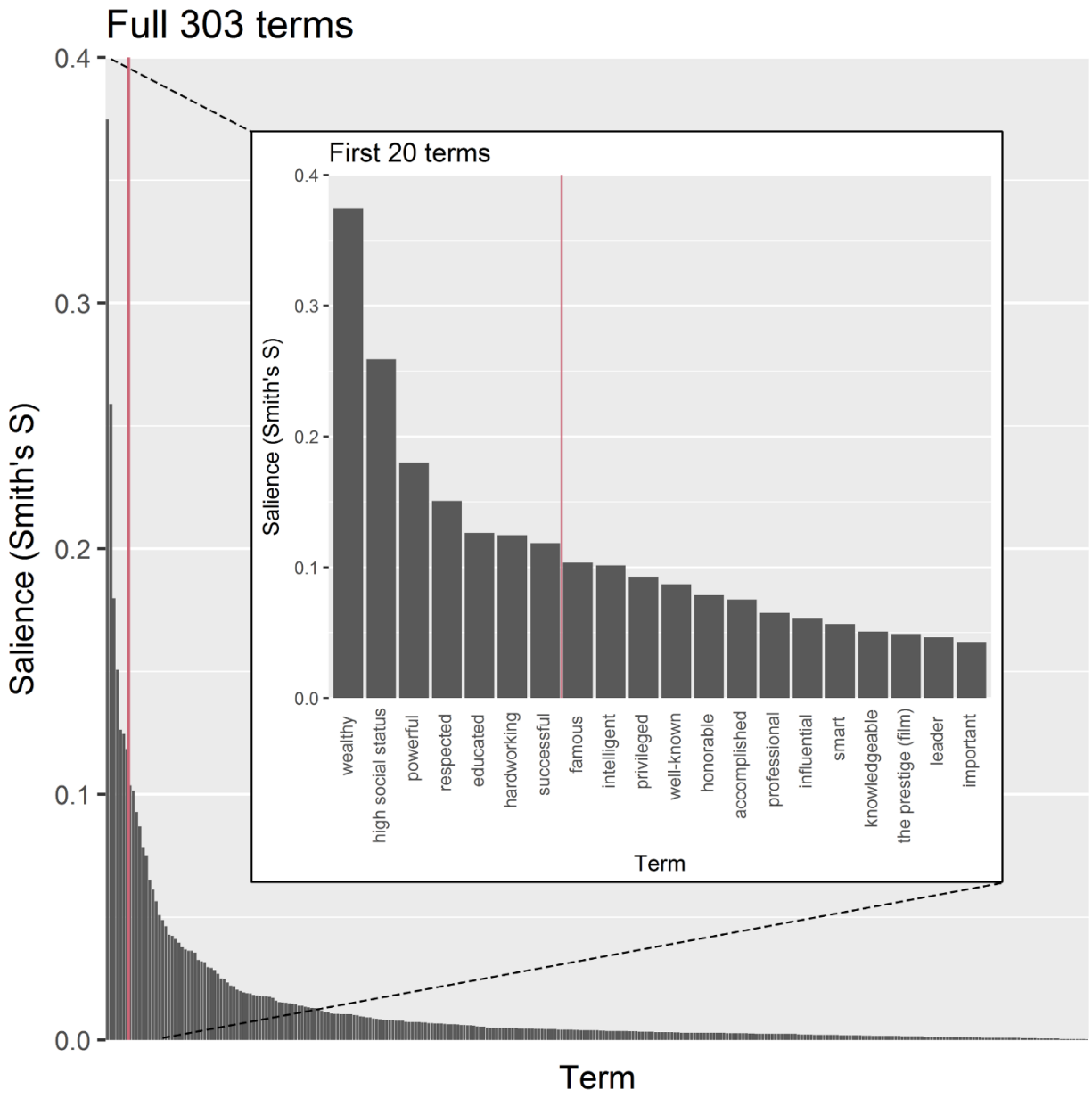


Figure 3.3. Scree plot of free list items by salience value. Chosen cutoff includes successful (S = 0.1185) and items of higher salience and excludes famous (S = 0.1037) and items of lower salience.

Given the use of attitudes toward regional accents as a measurement tool in this study, and in the interest of full coverage of the domain of interest (i.e. content validity), we chose to supplement the pool of potential scale items by reviewing items used in established scales of language attitudes that incorporated a prestige or status dimension. The two scales we selected for this purpose were the Speech Dialect Attitudinal Scale ("SDAS": Mulac 1975) and its revised version ("SDAS-R": Mulac 1976) and the Speech

Evaluation Instrument ("SEI": Zahn and Hopper 1985) and its short form version ("SEI-S," as used by Gundersen and Perrill 1989). The following items were represented in some form within both scales under a dimension of "prestige," "status," or "competence" and were therefore retained: *wealthy*, *high social status*, *educated*, and *intelligent* (as a note, we collapsed *upper class* into the broader *high social status* and *literate* into *educated*). These items agreed closely with those used in other sociolinguistic studies for these dimensions (Fuertes et al. 2012), and therefore can be regarded as representative of the literature. We also collected items from the selected scales to represent two other domains commonly used in speech evaluation studies (Fuertes et al. 2012; Giles 1970): "solidarity" and "dynamism." We included these domains, which are unrelated to prestige but similarly positively valenced, to assess the ability of prestige items to represent prestige itself and not merely a positive evaluation of the speaker (i.e. discriminant validity). The additional items we selected were: *friendly*, *kind*, *good natured*, *warm*, and *comforting* for the "solidarity" dimension, and *aggressive*, *active*, *confident*, and *enthusiastic* for the "dynamism" dimension. One item, *clear*, was also initially included within "dynamism," but we later removed it from analyses due it clustering more closely with items in other dimensions.

A third and final source of items was a previously unpublished pilot study that we conducted on speech, accent, and prestige in October and November of 2015. The sample of this pilot study consisted of 100 US and 44 UK participants (undergraduate and graduate/postgraduate students) ranging in age from 18 to 64 years (M = 21.8, SD = 5.3). Of the participants, 47 identified as male and 95 as female. The majority of participants, 141, identified as native English speakers, with 2 non-native speakers. Participants were asked to rate two speakers—one with a locally standard accent (US or UK) and the other with a nonstandard accent—on 15 attitudinal items using a 7-point Likert-type scale. The items in this pilot study were also drawn from prior linguistic studies. Following exploratory factor analysis and the sequential elimination of items following the same criteria described below for the present study, as well as examining inter-item correlations with a *prestigious* item to find the most closely associated items, we retained the following items from the pilot study: *hardworking*, *reputable*, *intelligent*, and *ambitious*.

The combined pool of items retained from all three sources (**Table 3.1**) were then used in the scale construction and scale evaluation studies to establish and verify the scale.

3.4.1.2 Questionnaire construction and administration

We developed an online questionnaire for use in the United States and United Kingdom using the pool of attitudinal items retained from the item generation stage.

For the stimulus, we presented each participant with four audio recordings of the same short passage (approximately 30 seconds in length), each read by a speaker with a different regional accent of English, and asked them to rate each speaker on all 20 attitudinal items using a 7-point Likert-type scale from low (1) to neutral (4) to high (7). All recordings consisted of the first paragraph of *Comma Gets a Cure* (see Acknowledgements), a passage which uses the Wells Standard Lexical Sets for English (Wells 1982) to highlight the most differentiable elements of accents.

We selected accents from the dialect regions defined by Labov et al. (2005) for the United States and Shackleton (2007) for the United Kingdom. The US-based accents in this study were American West and Inland South and the UK-based accents were Received Pronunciation ("RP") and Northwest England. We recorded a speaker from urban Colorado to represent the American West accent, and for the other three accents we used recordings under license from the International Dialects of English Archive ("IDEA"; see Acknowledgements).

The IDEA data sources predominately represented white male speakers. As a result of controlling for speaker demographics and audio quality from the available recordings, our speakers all self-identified as white males ranging from 42 to 59 years old. In the sociolinguistic sense, American West (which phonologically is in the spectrum of the "General American" accent) and Received Pronunciation represent standard or "high-prestige" variants within the US and UK, respectively, and Inland South and Northwest England are nonstandard "low-prestige" variants (Giles 1970; Milroy 2000; Bishop et al. 2005). The American West and RP speakers used for this study held university degrees and the Inland South and Northwest England speakers did not. The American West and RP speakers were employed in professional teaching occupations and the Northwest England and Inland South speakers were employed in skilled trades. Therefore, their educational and occupational attainment matched the indexical class and status

associated with their accents. We presented all participants with all four recordings, regardless of their location.

Prior to being presented with the recordings or giving attitudinal responses, participants each completed a triad test (Bernard 2011, pp. 230–233) with a lambda-3 balanced incomplete block design (Burton and Nerlove 1976) for the 11 prestige domain items, resulting in 55 triadic comparisons per participant. In each comparison, participants chose which of the three items was perceived to be least like the others, thereby creating a pair of like items. This could be used to assess whether the perception of the structure of prestige items was consistent beyond the sociolinguistic context of the prestige of regional accents.

We collected a number of demographic variables from participants, to be able to examine any systematic differences in responses. The demographic variables chosen were: country, age, gender, ethnicity, locality size, English proficiency, education, occupation, and income. The distributions of each variable within the sample are displayed in **Figure 3.7** in comparison with those of the subsequent scale evaluation study.

We collected data in May and June 2016 using online surveys implemented on SurveyMonkey and distributed using social media (n = 5 US, 2 UK), the Amazon Mechanical Turk and TurkPrime (Litman et al. 2017) platforms (n = 148 US), and the Prolific platform (n = 153 UK), for a final sample of 308 (153 US, 155 UK). There were 5 participants (4 US, 1 UK) that completed the triad test but not the attitudinal speech evaluation, so the final sample for the attitudinal data was 303 (149 US, 154 UK). There were otherwise no missing attitudinal or triad data, as we required participants to complete every item in order to receive payment.

3.4.1.3 Exploratory factor analysis

First, we checked the data for conformity to the assumptions of exploratory factor analysis ("EFA"). Though strict multivariate normality is not required for exploratory or confirmatory methods using categorical models, and violations are allowable under continuous models (i.e. maximum likelihood) if measurement

invariance is established (Lubke and Muthén 2004), we found that the distribution of responses to the attitudinal items was not multivariate normal, with $p \cong 0$ for Mardia's test (Mardia 1970, 1974), the Henze-Zirkler test (Henze and Zirkler 1990), and Royston's test (Royston 1982, 1983). We identified multivariate outliers using adjusted chi-square quantile-quantile plots of Mahalanobis distances and removed one participant (from the US sample) with extreme outlier values.

We then assessed the distributions of attitudinal items for approximate univariate normality, as well as for acceptable values of skewness and kurtosis. Following Bulmer (1979), absolute values of skewness below 0.5 indicated an approximately symmetric distribution, values between 0.5 and 1.0 were considered moderately skewed, and values above 1.0 were highly skewed. According to the findings of West et al. (1995) and Curran et al. (1996), issues of bias due to non-normality may result from the analysis of data distributed with absolute skewness values above 2.0 or kurtosis values above 7.0. We found individual variables to be approximately normal and values of skewness (M = -0.242, SD = 0.407) and kurtosis (M = -0.536, SD = 0.476) to be within acceptable ranges.

We evaluated linear relationships between items and their factorability by examining inter-item correlations, using the Kaiser-Meyer-Olkin ("KMO") test of sampling adequacy (Kaiser and Rice 1974), with values greater than or equal to 0.50 considered suitable (Nunnally 1978; Tabachnick et al. 2001; Hair et al. 2010), and using Bartlett's test of sphericity (Bartlett 1937) to test whether the correlation matrix was factorable. We calculated a polychoric correlation matrix because attitudinal items were measured using an ordinal scale (Holgado-Tello et al. 2010). Following Savalei (2011), no adjustments were made to zero frequency cells in the bivariate tables. A large proportion of inter-item correlations (73/210, or 34.8%) were above 0.50, indicating the presence of linear relationships. KMO values were well above 0.50 for all variables (overall = 0.946, M = 0.935, SD = 0.039) and the result of the Bartlett's test was highly significant ($p \cong 0$), together indicating suitable factorability.

Lastly, we evaluated whether our sample sizes were adequate, using the guidelines of having a total sample size of at least $\frac{p(p-1)}{2}$ (Jöreskog and Sörbom 1996, p. 171), where p is the number of items or variables, and a subjects-to-variables ratio of at least 10:1 (Nunnally 1978, p. 276) or 20:1 (Hair et al. 2010). The sample

size for this study (after outlier removal) was 302, which (at $p = 20$) exceeds the suggested minimum of 190, and the subjects-to-variables ratio was 15.1:1, which lies above the recommendation of 10:1 and below 20:1.

We then conducted exploratory factor analysis for the purpose of exploring the structure and dimensionality of the prestige construct. Our analyses used a three-stage robust diagonally weighted least squares estimation technique (weighted least squares, mean and variance adjusted, or "WLSMV") due to its suitability for use on ordinal data with an adequate number of categories (Jöreskog and Sörbom 1996, pp. 23–24; Rhemtulla et al. 2012; DiStefano and Morgan 2014). We used a conservative oblimin (oblique) factor rotation method to allow for potential intercorrelations between factors, which may be expected in real-world attitudinal data (Kline 1991, pp. 19–20).

We eliminated items sequentially, first to remove items that had poor value in discriminating the prestige domain from the other two domains included—solidarity and dynamism—and then to determine the most parsimonious structure within the prestige domain. Items needed to meet all of the following acceptance criteria to be retained: *a*) primary factor loading with an absolute value > 0.32; *b*) cross-loadings with absolute values < 0.32; *c*) gap between primary and cross-loadings > 0.2; and *d*) communality > 0.4 (Costello and Osborne 2005). We re-evaluated the optimal number of factors at each step using the parallel analysis with comparison data method of Ruscio & Roche (2012).

Through this process, we obtained the overall factor structure for the attitudinal items across all three domains (**Table 3.2a**; **Figure 3.4**), as well as the internal factor structure of the prestige domain items (**Table 3.2b**; **Figure 3.1**). Using EFA, items within the prestige domain were partitioned into three factors: *wealthy*, *powerful*, and *high social status* in the first factor, hereafter referred to as "position"; *reputable* and *respected* in the second factor, referred to as "reputation"; and *educated* and *intelligent* in the third factor, referred to as "information." We therefore denote the resulting factor structure as Position-Reputation-Information, or "PRI."

After completing EFA using the attitudinal data, we then repeated the process using the data from the triad test as a second, parallel source of information on the structure of the prestige construct absent the embedded sociolinguistic context. Since the pairings in the triad data are represented as a series of

dichotomous observations, we calculated a tetrachoric correlation matrix (Hershberger 2005), using a correction of 0.5 for empty bivariate cells (following Savalei 2011) and eigenvector smoothing to ensure the matrix was positive definite. We chose related methods to maximize comparability between the attitudinal and triad data sources. We used a non-robust weighted least squares ("WLS") estimator with standard parallel analysis and identical acceptance criteria to those used for the EFA of the attitudinal data described above.

The inter-item correlations between triad items had 4/55 (7.3%) above 0.50. The overall KMO value was 0.364 (M = 0.368, SD = 0.160), with the lowest individual values being *successful* at 0.075 and *powerful* at 0.157, and the highest being *wealthy* at 0.585. While the result of the Bartlett's test was highly significant ($p \cong 0$), it is also dependent upon sample size, which was reasonably large (n = 308). Taken together, these results suggested that factorability could be poor due to the nature of how the data were represented; specifically, the triadic comparisons generated a matrix with a large amount of "missing" data, as only 3 items in each observation (out of 11 total) had values. The sample size for the triad data was much higher than the suggested minimum of 45 in this case (given the lower number of items), and the subjects-to-variables ratio was 30.8:1, which is above both recommended values. We obtained the internal factor structure for the prestige domain items in the triad data (**Table 3.2c**) using the EFA methods described. The structure closely resembled the attitudinal results in all respects except that *powerful* was dropped from the position factor due to negative loadings and low communality.

Table 3.2. Factor loadings and communalities from exploratory factor analysis of attitudinal and triad data. Values are from analyses of: **(a)** all items from attitudinal data over the three domains; **(b)** internal prestige domain items from attitudinal data; and **(c)** internal prestige domain items from triad data. All cases show the items remaining after eliminating prestige domain items that failed to meet acceptance criteria, and after removing *prestigious* from **(b)** and **(c)**. *Note:* Factor loadings with absolute value < 0.20 are suppressed.

(a)

	PRESTIGE	**SOLIDARITY**	**DYNAMISM**	communality
educated	0.962	-0.201		0.852
intelligent	0.921			0.806
high social status	0.893			0.862
successful	0.880			0.805
prestigious	0.861			0.781
wealthy	0.847			0.818
respected	0.736	0.237		0.638
powerful	0.734		0.260	0.727
reputable	0.694	0.278		0.573
warm		0.893		0.787
friendly		0.890		0.795
kind		0.865		0.749
good-natured		0.837		0.705
comforting		0.808		0.660
enthusiastic	0.278	0.442	0.383	0.460
aggressive		-0.441	0.409	0.394
active	0.341		0.394	0.364

(b)

	Position	**Reputation**	**Information**	communality
wealthy	0.935			0.862
powerful	0.819			0.688
high social status	0.771			0.872
reputable		0.824		0.729
respected	0.238	0.590		0.668
educated			0.893	0.880
intelligent			0.845	0.826

(c)

	Position	**Reputation**	**Information**	communality
wealthy	0.776			0.571
high social status	0.657			0.497
reputable		0.820		0.655
respected		0.705		0.532
intelligent			0.962	0.891
educated			0.832	0.749

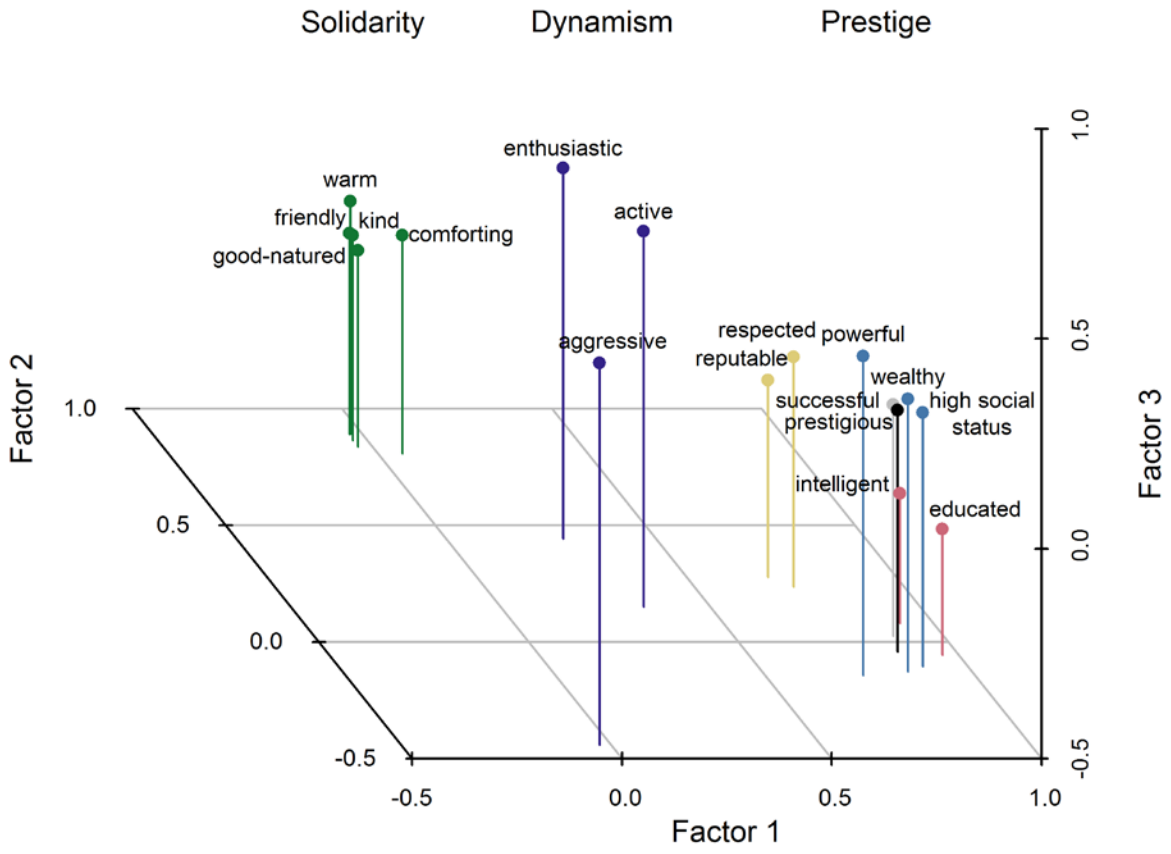


Figure 3.4. Factor loadings from exploratory factor analysis of attitudinal data. Visual display of the values in **Table 3.2a**. Position, reputation, and information items are shown in light blue, gold, and pink, respectively. Other prestige items are shown in black (prestigious, not used in scale) and grey (later dropped from internal prestige structure, shown in **Figure 3.1**). Solidarity items are in green. Dynamism items are in purple.

5.4.1.4 Cluster analysis

Following the EFA for both the attitudinal data and the triad data, we also elected to conduct cluster analysis on the items in both data sets to compare results with the EFA findings on the internal structure of

the prestige construct. Though the outputs of EFA and cluster analysis are qualitatively similar, the two methods have substantively different goals (dimensionality reduction to latent constructs versus classification to subgroups, respectively) and algorithms. We chose the Partitioning Around Medoids ("PAM") method (Kaufman and Rousseeuw 1990), a type of *k*-medoids algorithm in the *k*-means family, due to its flexibility in accommodating various dissimilarity measures and its robustness against outliers. For the attitudinal data, we used Manhattan distances rather than Euclidean due to their suitability for ordinal data (Kaufman and Rousseeuw 1990). Visual examination of the Manhattan distance matrix using multidimensional scaling suggested that the attitudinal data were amenable to cluster analysis.

We eliminated items sequentially to remove items with poor discriminant value and to determine the internal prestige structure, retaining items which had a positive silhouette width of at least 0.1 and the removal of which did not substantially improve the overall clustering structure (as measured by average silhouette width of the solution). The silhouette width of an item represents the relative consistency of that item within its cluster. At each step, we used the Duda-Hart test (Duda et al. 1973) to determine whether more than one cluster was supported and the number of clusters was determined by the highest average silhouette width.

The PAM method resulted in a 2-cluster solution for all attitudinal items (**Figure 3.5**) and a 3-cluster solution for the internal prestige domain items (**Figure 3.6A**). The average silhouette width of the 2-cluster solution for all items was 0.428, while the next highest, at 4 clusters, was 0.294. For the internal prestige domain items, the average silhouette width of the 3-cluster solution was 0.282, with 0.300 for 2 clusters. However, the Dunn index, or the ratio of minimum inter-cluster distance to maximum intra-cluster distance (Dunn 1974), was 1.052 for the 3-cluster internal solution and 0.882 for the 2-cluster internal solution, indicating that the 3-cluster solution has better validity. These results support the 3-cluster solution for the internal prestige domain items and this solution matches exactly the PRI structure found through EFA.

Applying the PAM method to the triad data gave similar results, with the highest average silhouette width overall (0.388) found for a 3-cluster solution that matched the PRI structure (**Figure 3.6B**). However, we reached this solution by eliminating the *hardworking* and *ambitious* items based on information from

the EFA showing their poor fit within the prestige domain. The triadic comparisons included only prestige domain items so, within the context of the triad data alone, this information about the ability to discriminate from other domains would be unavailable. Additionally, the Dunn index suggested better support for this 3-cluster solution (1.112) than for a 4-cluster solution that included *hardworking* and *ambitious* (1.051). These results are consistent with what we found from the attitudinal data and replicate the PRI structure in the best-fitting solution.

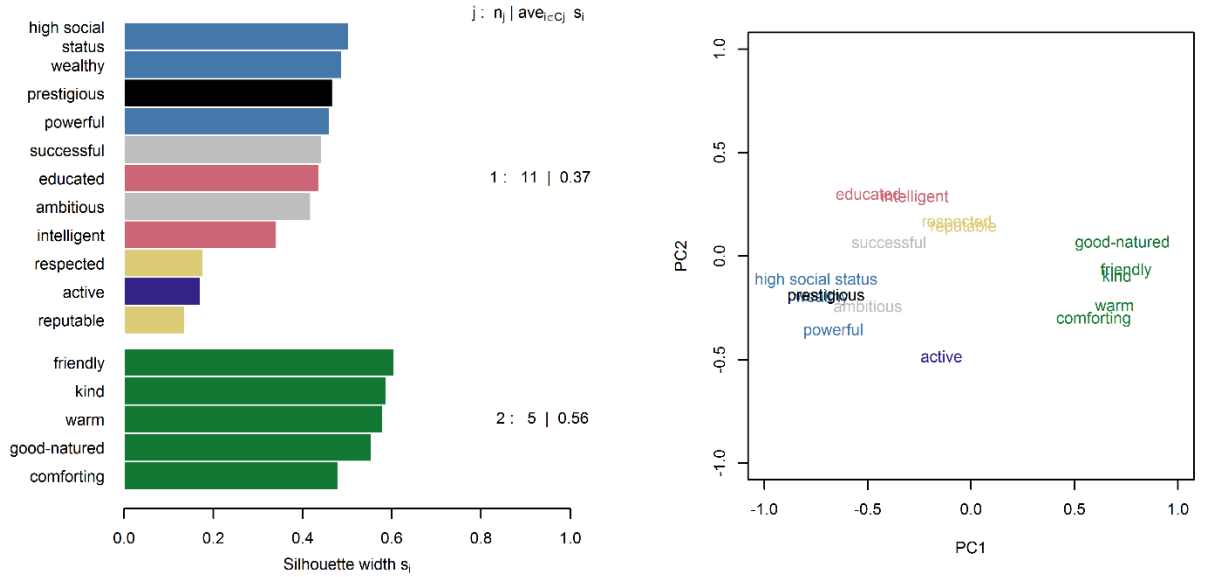


Figure 3.5. Silhouette and multidimensional scaling plots of the clustering of prestige, solidarity, and dynamism attitudinal items. Position, reputation, and information items are shown in light blue, gold, and light red, respectively. Other prestige items are shown in black (*prestigious*, not used in scale) and grey (later dropped from internal prestige structure, shown in **Figure 3.6A**). Solidarity items are in green. The remaining dynamism item (*active*) is in purple. To the right of each cluster is the number of items in that cluster and its average silhouette width. Silhouette width values represent the relative consistency of each item within its cluster.

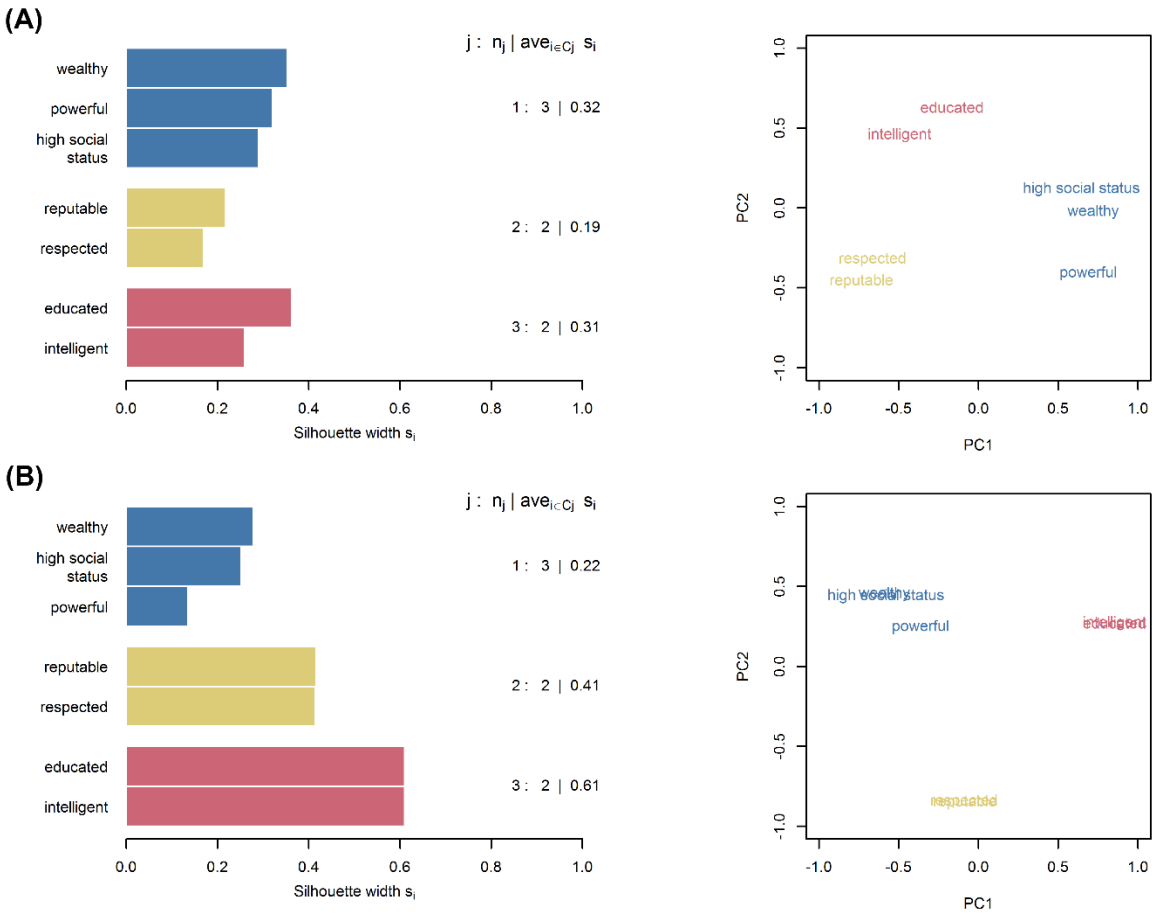


Figure 3.6. Silhouette plots and multidimensional scaling plots of the clustering of prestige domain items. Plots depict clustering of: **(A)** internal prestige domain attitudinal items, after eliminating items that failed to meet acceptance criteria; and **(B)** prestige domain triad items, after eliminating items that failed to meet acceptance criteria as well as *hardworking* and *ambitious* (see text). Position, reputation, and information items are shown in light blue, gold, and light red, respectively. To the right of each cluster is the number of items in that cluster and its average silhouette width. Silhouette width values represent the relative consistency of each item within its cluster. Multidimensional scaling was done using Manhattan distances for attitudinal items and tetrachoric correlations for triad items.

3.4.2 Study 2: Scale evaluation

3.4.2.1 Item generation

We used the full set of items generated for the previous scale construction study (**Table 3.1**) for evaluation and validation of the scale. We selected three additional prestige items (*talented*, *driven*, and *skilled*) from those generated by the free listing exercise to explore whether the inclusion of additional terms would have any effect on the PRI structure or provide additional explanatory power. As a number of the existing terms could be interpreted as measures of "ascribed" prestige (i.e. traits that are largely assigned or fixed based on

the circumstances of one's birth), we chose these terms as representative of the concept of "achieved" prestige (i.e. traits that can be earned or acquired; Linton 1936; Svalastoga 1959, p. 16).

We also reverse-scored three items (*intelligent-unintelligent*, *ambitious-unambitious*, and *kind-unkind*) to reduce potential bias in responses (Schriesheim and Hill 1981), selected intentionally to avoid potentially ambiguous reversals. However, during exploratory analyses, we found that the distributions of responses to the reversed items were significantly skewed toward higher values than for the same items in the scale construction study. This suggests that participants were less likely to agree with a negative assessment of a speaker (i.e. *unintelligent*) than they were to disagree with its opposite positive assessment (*intelligent*). These differences caused issues with the consistency of responses and negatively affected model fit, similar to the problems seen later with reversed items in the Cheng et al. (2010) scale (see Criterion validity) but to a lesser degree. Due to these issues, we do not recommend reversal for future studies using attitudinal items scored on a Likert-type scale (cf. Harrison and McLaughlin 1993).

3.4.2.2 Questionnaire construction and administration

In the online questionnaire for the scale evaluation study, we presented each participant with 10 audio recordings of the same passage used in the scale construction study: the first paragraph of *Comma Gets a Cure*. Each recording used a speaker with a different regional accent of English, and we asked participants to rate each speaker on all 23 attitudinal items (**Table 3.1**, plus *talented*, *driven*, and *skilled* under prestige) using a 7-point Likert-type scale from strongly disagree (1) to strongly agree (7).

We presented participants in the US with 8 US-based accents and 2 UK-based accents, while participants in the UK were presented with 8 UK-based accents and 2 US-based accents, for a total of 16 different accents across the entire sample, 4 of which were cross-tested in both countries (**Table 3.3**). The recordings for the 4 cross-tested accents were identical to those used in the scale construction study. All recordings were used under license from IDEA (see Acknowledgements) except for American West (Urban) and Wales, which we recruited from local contacts and recorded.

Table 3.3. Regional accents and the participants to which they were presented in the scale evaluation study.

United States	All Participants	United Kingdom
American West (Rural)	American West (Urban)	Southwest England
Midland	American Inland South (Blue-Collar)	Southeast England
Inland North	Received Pronunciation	Yorkshire
American Inland South (White-Collar)	Northwest England	Scotland
Mid-Atlantic		Ireland
New York City		Wales

As in the scale construction study, we selected speakers for consistency from the recordings available. All speakers self-identified as white men and ranged in age from 31 to 59 years. Speakers varied in their level of education, occupation, and settlement size during childhood. The speaker from Wales was 45 years old at the time of recording, held an advanced degree, and was employed in an academic profession.

We collected data in June 2016 using online surveys implemented on SurveyMonkey and distributed using Amazon Mechanical Turk and TurkPrime (Litman et al. 2017) (n = 151 US) and Prolific (n = 144 UK), for a sample size of 295. We excluded participants from the prior scale construction study to ensure an independent sample. The results did not contain any missing data for attitudinal items.

3.4.2.3 Demographic comparisons

Demographic characteristics of the scale evaluation sample were similar to the scale construction sample (**Figure 3.7**). Permutation tests of independence (Hothorn et al. 2006), adjusted for multiple comparisons to control for the false discovery rate, confirmed that significant differences were present only in the distributions of the age ($p < 0.001$) and occupation ($p < 0.001$) variables between the two studies, as a result of a larger proportion of relatively younger students in the scale evaluation sample. Given the similarity across all other variables, we considered this to be a relatively minor issue, and one that could be checked analytically by examining measurement invariance (see Confirmatory factor analysis).

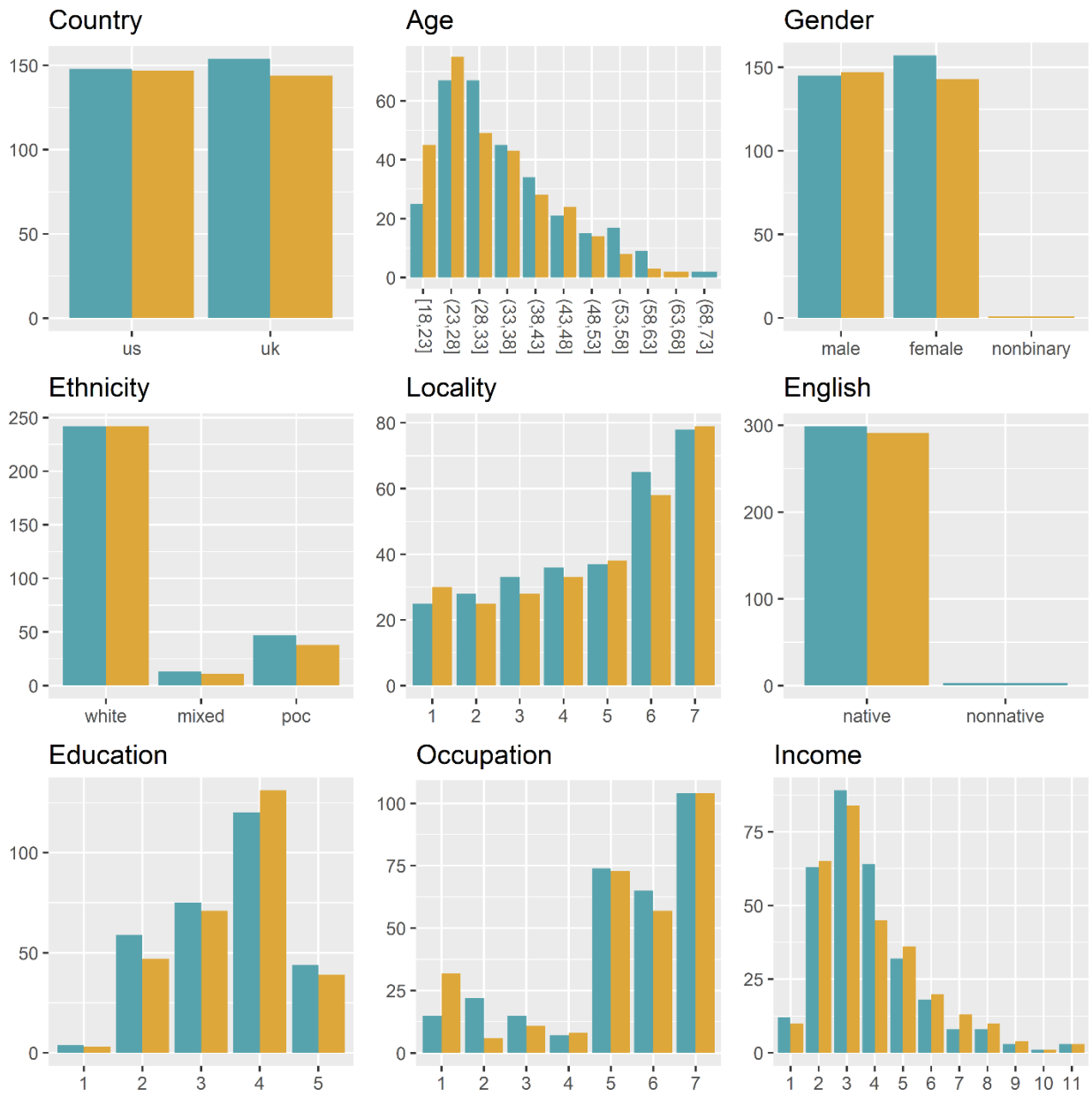


Figure 3.7. Demographic comparisons of the samples from the scale construction and scale evaluation studies. Vertical axes display counts of participants for each variable. Teal bars represent participants in the first (scale construction) study and orange bars represent participants in the second (scale evaluation) study.

3.4.2.4 Exploratory factor analysis

Following checks of assumptions, outliers, item relationships, item factorability, and sample size, we conducted EFA on the scale evaluation data using methods and criteria identical to those used in the scale construction study, to address the question of whether the items generated adequately represented the

breadth and structure of the individual prestige concept. The items that were previously eliminated in the EFA of the scale construction study were eliminated again in the process of conducting this EFA, due to violations of acceptance criteria. All three additional "achieved" prestige items—*talented*, *driven*, and *skilled*—were also eliminated, particularly because of high cross-loadings or primary loadings on other factors. We therefore made no changes to the structure of the model or the items included and found the scope of the existing PRI model to be adequate for use in CFA.

3.4.2.5 Confirmatory factor analysis

The distribution of responses to the attitudinal items was not multivariate normal ($p \cong 0$ for all tests). We removed four participants with six extreme outlier values (all from the US sample) as a result of examining Mahalanobis distances, leaving a final sample size of 291. The individual variables were approximately normal, and values of skewness (M = -0.209, SD = 0.369) and kurtosis (M = -0.617, SD = 0.279) were within acceptable ranges.

We then performed measurement invariance testing (Putnick and Bornstein 2016), to ensure that the relationships between indicators and latent variables within the prestige construct were consistent across participant demographic groups by country, age, gender, ethnicity, locality size, educational attainment, occupation, and income. The sample contained an insufficient number of non-native English speakers to test for invariance by native English proficiency; therefore, we excluded this variable. We tested five increasingly constrained models in sequence: configural invariance (Model 1), metric or "weak" invariance (Model 2), scalar or "strong" invariance (Model 3), residual or "strict" invariance (Model 4), and residual invariance with constrained means (Model 5). We established configural invariance using the permutation method proposed by Jorgensen et al. (2016). We looked at changes in two noncentrality-based fit indices, the Comparative Fit Index ("CFI") and the Root Mean Square Error of Approximation ("RMSEA"), to evaluate the relative fit of each successive nested model, with ΔCFI values less than or equal to 0.010 and ΔRMSEA values less than or equal to 0.015 indicating invariance (Chen 2007). Fulfilment of

scalar invariance was considered sufficient to proceed with confirmatory factor analysis (Putnick and Bornstein 2016).

Measurement invariance of the model was upheld across the demographic variables of country, age, gender, occupation, and income. We found metric non-invariance by locality size (ΔCFI = 0.011, ΔRMSEA = 0.030), and ethnicity and educational attainment were borderline metric non-invariant (ΔCFI = 0.007, ΔRMSEA = 0.022; and ΔCFI = 0.009, ΔRMSEA = 0.026, respectively). Given these results, we defined a complex survey design which re-fit the model using pseudo-maximum likelihood and provided adjusted point and variance estimates (Lumley 2011; Oberski 2014). In this design, the potentially non-invariant demographic variables were incorporated as weighted sampling strata using weights approximated from US (United States Census Bureau and American FactFinder 2010, 2016a, 2016b) and UK census data (Department for Environment, Food & Rural Affairs 2012; Office for National Statistics and Nomis 2011a, 2011b).

We then performed confirmatory factor analysis ("CFA") to assess the fit of this model to the scale evaluation data. As the WLSMV estimation method used in previous analyses could not be applied to a complex survey design, we used maximum likelihood with robust standard errors (mean and variance adjusted using the Satterthwaite approach: Satorra and Bentler 1994; "MLMVS") for the CFA based on the complex survey design. Equivalent results should be obtained from either method, as the two perform comparably for 7-point ordinal data (Rhemtulla et al. 2012).

We assessed the goodness of fit of confirmatory models with and without the complex survey design using two incremental fit indices (the CFI, as above, and the Tucker-Lewis Index, or "TLI") and two absolute fit indices (the RMSEA, as above, and the Standardized Root Mean Square Residual, or "SRMR"). We drew cutoff criteria from Hu & Bentler (1999) and adjusted them to the recommendations of Yu (2002) as follows: CFI > 0.95; TLI > 0.96; RMSEA < 0.05; and SRMR < 0.07. We obtained parameter estimates using both robust maximum likelihood and robust weighted least squares methods, and compared fit indices for the models using MLMVS estimation, MLMVS estimation with a complex survey design, and WLSMV estimation (**Table 3.4**).

Table 3.4. Goodness of fit indices for the Position-Reputation-Information scale model. Robust indicators were estimated using: maximum likelihood methods, maximum likelihood methods with fit adjustments from a complex survey design to account for demographic non-invariance, and weighted least squares methods. Bounds for 90% confidence intervals are provided for RMSEA.

Model	CFI	TLI	RMSEA [90% CI]	SRMR
MLMVS	0.948	0.983	0.056 [0.048, 0.064]	0.020
MLMVS with Complex Survey Design	0.959	0.983	0.031 [0.026, 0.036]	0.023
WLSMV	0.994	0.989	0.094 [0.085, 0.104]	0.022

All three models shared the identical PRI structure and had comparable fit indices. We selected the model using MLMVS with adjustments from the complex survey design as the preferred model (**Figure 3.2**) because it fulfilled the cutoff criteria for all fit indices and properly incorporated information on all potentially non-invariant demographic variables.

3.4.3 Scale validity and reliability

3.4.3.1 Content validity

Content validity is the assessment of whether the scale adequately represents the extent of the domain of interest. As content validity is essentially a qualitative judgment rather than a statistical one (Haynes et al. 1995), we worked to establish and report the content validity of the PRI scale through the methods used to generate the items and those used to construct and verify the scale.

As mentioned previously, items were generated in part by participants through an inductive, endogenous process in the free listing task, which produced a broad but consistent sample of items. We supplemented this with more traditional deductive sampling of terms from previous literature and a pilot study. Rather than consulting external subject matter experts (cf. Lawshe 1975), we valued more highly the validity of judgments by the study participants in generating and associating items.

Additionally, we included three "achieved" prestige items (*talented*, *driven*, and *skilled*), drawn from the free listed terms, to confirm the content validity of the model being tested. These items (and all of the same items dropped previously from the scale construction study) were dropped due to failure to meet the

acceptance criteria, which lends support to the validity of the PRI scale and the sufficiency of its domain breadth.

Finally, we considered that the relative lack of demographic diversity among free listing participants in the initial scale construction study (compared to that of our other samples) could have negatively impacted the breadth of items generated and hence the content validity of the scale. However, we found no specific evidence to suggest this was the case, aside from potential issues of measurement non-invariance (see Confirmatory factor analysis) which could have occurred regardless. We therefore do not consider this to have been a point of concern for the present study but would recommend future studies endeavor to recruit a maximally diverse and representative sample from the population of interest for item generation.

3.4.3.2 Construct validity

Construct validity is the property that the scale measures what it is intended to measure, which is generally confirmed by showing correlations among elements expected to be similar ("convergent validity") and a lack of correlation among elements expected to be dissimilar ("discriminant validity"). The construct validity of the PRI scale was established by examining the convergent validity of scale items, the discriminant validity between PRI subscales (position, reputation, and information), and the discriminant validity between the prestige scale and the other two domains included in the data (solidarity and dynamism).

We assessed convergent validity within the scale by examining the polychoric correlation matrices of the scale items in both studies and the average variance explained ("AVE") of the scale items in the scale evaluation study. Following common practice, correlation coefficients between 0.10 and 0.30 were considered small, between 0.30 and 0.50 were moderate, and greater than 0.50 were large (Cohen 1988). AVE values greater than 0.50 were deemed acceptable, as they indicate sufficient variance attributed to the construct as opposed to measurement error (Fornell and Larcker 1981).

We found polychoric correlations (ρ) between all PRI scale items to be high (M = 0.631, SD = 0.094) and correlations were higher between items within the same subscale than between items in different subscales (**Table 3.5**). The AVE values for each of the three subscales—position, reputation, and information—were 0.675, 0.630, and 0.699, respectively; all were above the criterion of 0.50, supporting convergent validity.

Table 3.5. Polychoric correlations between Position-Reputation-Information scale items. Mean (and standard deviation) polychoric correlations between Position-Reputation-Information items within the same subscale are shown on the main diagonal and those for items between different factors are shown below the main diagonal. Values were calculated using the combined scale construction and scale evaluation data sets. Correlations within 2-item factors have no mean or standard deviation because they consist of only one measurement.

	Position	**Reputation**	**Information**
Position	0.733 (0.097)		
Reputation	0.580 (0.043)	0.707	
Information	0.625 (0.118)	0.594 (0.054)	0.733

The discriminant validity of constructs, which naturally opposes convergent validity, was assessed using the heterotrait-monotrait ratio of correlations criterion ("HTMT"), a method developed to avoid the potential issues of other indices (Henseler et al. 2015). For this criterion, lower values indicate greater discriminant validity. HTMT values between the prestige PRI subscales and the other two constructs—solidarity and dynamism—were all below the cutoff of 0.85 advised by Voorhees et al. (2016), verifying discriminant validity of the prestige construct (**Table 3.6**). Similarly, HTMT values showed good discriminant validity between the three PRI subscales. This shows that the three PRI subscales, along with showing good convergent validity (as their items are all measuring elements of the same prestige construct), also exhibit substantial discriminant validity from other constructs and from one another. We consider these results to be support for the PRI scale's overall construct validity and simple structure.

Table 3.6. Heterotrait-monotrait ratio of correlations between items from Position-Reputation-Information subscales and solidarity and dynamism constructs. HTMT values between each Position-Reputation-Information subscale and the solidarity and dynamism constructs are shown below the main diagonal. Lower HTMT values indicate greater discriminant validity. Values were calculated using the scale evaluation data set.

		PRESTIGE			**SOLIDARITY**
		Position	***Reputation***	***Information***	
PRESTIGE	***Position***				
	Reputation	0.818			
	Information	0.841	0.835		
SOLIDARITY		0.086	0.442	0.246	
DYNAMISM		0.727	0.773	0.735	0.670

3.4.3.3 Criterion validity

The criterion validity of a scale relates to its ability to be used as a measurement tool for the construct of interest, either assessed concurrently with a direct measure of that construct, in comparison with other available tests, or as a predictive indicator of independent or future outcomes. Predictive validity could not be assessed in this instance, as we did not have any future measurements or any independent prestige-related traits that were not already used in scale construction and evaluation, so we assessed the concurrent criterion validity of the scale through the other two avenues.

We first compared each item's polychoric correlation with the *prestigious* item. The *prestigious* item was included in the surveys but excluded from the scale, and was used as a direct representative of the general construct of prestige that we intended to measure. In the scale evaluation data set, polychoric correlations between scale items and the *prestigious* item were high overall (M = 0.678, SD = 0.104), as were mean correlations with *prestigious* within each of the PRI factors (position: M = 0.748, SD = 0.096; reputation: M = 0.626, SD = 0.026; information: M = 0.627, SD = 0.143). Estimated factor scores for each PRI factor (using the Empirical Bayes Modal approach of Skrondal and Rabe-Hesketh 2009 for ordinal variables and the MLMVS model with adjustments from the complex survey design) were even more highly correlated with *prestigious* than the raw item scores (PRI individual prestige: ρ = 0.815; position: ρ = 0.844; reputation: ρ = 0.764; information: ρ = 0.745).

Secondly, to compare with another test of prestige, we asked a new set of participants (n = 91 US, 53 UK; again recruited through Amazon Mechanical Turk and Prolific) to rate two new speakers (having the Inland South and Received Pronunciation accents) using the present scale alongside the prestige-dominance scale of Cheng et al. (2010; as detailed in the Electronic Supplementary Material). We modified the text of the items in the Cheng et al. scale (from "members of your/the group" to "people") to better fit the context of our study. We removed outliers from the data and, using the same methods as above (with WLSMV estimation for the Cheng et al. scale data as the previous estimation method was not specified; Cheng et al. 2010), calculated factor scores for the PRI subscales, the solidarity and dynamism dimensions, and the prestige and dominance factors from the Cheng et al. prestige-dominance scale. We calculated polychoric correlations to examine the level of agreement between these measures.

In this additional comparative data set, we found substantial correlations between factor scores of the PRI scale and the prestige factor of the Cheng et al. scale (PRI overall: $\rho = 0.850$, position: $\rho = 0.805$, reputation: $\rho = 0.861$, information: $\rho = 0.828$) and, in general, we found that the individual prestige items of each scale were correlated ($M = 0.567$, $SD = 0.221$). However, one item in particular from the Cheng et al. scale (item 17: "Other people do NOT enjoy hanging out with him") was relatively uncorrelated with PRI items and with the other Cheng et al. prestige items. Notably, this is one of the three reversed items in the Cheng et al. prestige factor, the other two of which (items 2 and 6: "People do NOT want to be like him" and "People do NOT value his opinion") had only moderate correlations with PRI items and other Cheng et al. prestige items. The removal of all three reversed items had little effect on correlations between the Cheng et al. prestige factor and the PRI subscales (PRI overall: $\rho = 0.856$, position: $\rho = 0.810$, reputation: $\rho = 0.867$, information: $\rho = 0.832$) but improved the mean correlation between individual items ($M = 0.690$, $SD = 0.066$).

The reversed items contributed to the poor fit of the Cheng et al. scale overall in this data set (CFI = 0.875, TLI = 0.856, RMSEA = 0.229 [90% CI: 0.219, 0.238], SRMR = 0.154; using WLSMV estimation). The model fit improved with the removal of all reversed items (CFI = 0.973, TLI = 0.966, RMSEA = 0.151 [90% CI: 0.137, 0.165], SRMR = 0.083), but remained unacceptable under criteria for the two absolute fit indices, RMSEA and SRMR. We found the fit of the PRI scale using the same data and estimation method (WLSMV)

met the cutoffs for all indices except RMSEA (CFI = 0.998, TLI = 0.995, RMSEA = 0.106 [90% CI: 0.075, 0.139], SRMR = 0.019). Notably, polychoric correlations between—first—the factor scores for dominance in the Cheng et al. scale (reversed items removed) and—second—the Cheng et al. prestige factor scores, the *prestigious* item, and the PRI factor scores, were all moderate to high (Cheng et al. prestige: $\rho = 0.449$, *prestigious*: $\rho = 0.561$, PRI prestige overall: $\rho = 0.533$, position: $\rho = 0.569$, reputation: $\rho = 0.489$, information: $\rho = 0.501$), which may indicate issues with the validity of the dominance construct.

3.4.3.4 Interrater reliability

In these studies, we did not expect participants to rate each speaker identically for each item, nor is such agreement required to obtain a reliable scale of individual prestige. As mentioned in the Introduction, prior work has shown that different demographic groups will evaluate accents differently. By testing and adjusting the fit of the confirmatory model, we already incorporated information on patterns of variation in item ratings, both by individual and between demographic groups. Our results showed that participants displayed a consistent understanding of the overall prestige construct regardless of disagreements about particular speakers. This being said, measures of interrater reliability can be obtained and so we provide them here for completeness.

We calculated Krippendorff's alpha coefficient (Krippendorff 2012, pp. 221–250) using ordinal weights, as well as the intraclass correlation coefficient ("ICC," specifically ICC(C,1) of McGraw and Wong 1996). The level of Krippendorff's alpha indicating agreement was 0.8, with values between 0.667 and 0.800 allowing for "tentative conclusions" (Krippendorff 2012, p. 241). For the ICC, values less than 0.40 were considered to be poor, between 0.40 and 0.60 were fair, between 0.60 and 0.75 were good, and greater than 0.75 were excellent (Fleiss and Fleiss 1986). The reliability values of Krippendorff's alpha obtained for the scale construction and scale evaluation data sets were 0.414 and 0.383, respectively. ICC values for the two data sets were 0.473 [95% CI: 0.359, 0.625] and 0.459 [95% CI: 0.346, 0.612], using only the ratings of speakers that were cross-tested in both countries.

3.4.3.5 Internal consistency

Lastly, the internal consistency of a scale measures the similarity of results across scale items. We examined this by calculating Cronbach's alpha (Cronbach 1951) as well as three variations of the omega coefficient (Raykov, Bentler, and McDonald, as described in Revelle and Zinbarg 2009). The criterion used for acceptable values of internal consistency measures, given that this study is basic research for the purpose of developing a scale, was 0.80 (Lance et al. 2006; Nunnally 1978, pp. 245–246).

Using the fitted MLMVS model with adjustments from the complex survey design, internal consistency measures were well above the cutoff for the overall scale, and above or slightly below it for the three PRI latent factors (**Table 3.7**). Analyses showed that these values would only decrease we removed any individual scale item, suggesting that they are all vital to the structure of the scale.

Table 3.7. Internal consistency measures for the Position-Reputation-Information scale and its subscales.

	Cronbach's alpha	**Omega**		
PRESTIGE	0.892	0.918		
		Raykov	**Bentler**	**McDonald**
Position	0.844	0.858	0.858	0.859
Reputation	0.772	0.773	0.773	0.773
Information	0.794	0.818	0.818	0.818

4. PRESTIGE AND CONTENT BIASES IN THE EXPERIMENTAL TRANSMISSION OF NARRATIVES

4.1 Introduction

Storytelling is a powerful and universal tool that humans use to know and understand the world (Bruner 1991, 2009), to preserve history and traditional knowledge (Vansina 1985; Lejano et al. 2013), to educate (Cajete 1994; Piquemal 2003), to persuade (Chang 2009; Delgadillo and Escalas 2004), and to heal (Struthers et al. 2004; White et al. 1990). Stories encode complex cultural and ecological information, and have the capability to endure for at least 7,000 years (da Silva and Tehrani 2016; Nunn and Reid 2016), and possibly much longer (Tehrani and d'Huy 2017). In addition, skilled storytelling may increase an individual's reproductive fitness (Scalise Sugiyama 1996) and social value, and promote cooperation within groups (Smith et al. 2017). Stories are an efficient and effective vector for information transfer (Boyd 2009), and a body of established literature in the interdisciplinary field of cultural evolution suggests that the success or failure of a story is determined by the mechanisms of biased cultural transmission (Barrett and Nyhof 2001; Bebbington et al. 2017; Heath et al. 2001; Mesoudi, Whiten, and Dunbar 2006; Stubbersfield et al. 2015; Stubbersfield and Tehrani 2013).

The extent to which cultural selection, by way of biased transmission, is the primary factor responsible for cultural change is a central and enduring debate within cultural evolution (Henrich et al. 2008; Claidière et al. 2014; Acerbi and Mesoudi 2015; Morin 2016b). Cultural selection theory argues that cultural diversity is largely shaped by direct and indirect cognitive biases that unconsciously drive the selection of cultural variants over successive transmission events (Cavalli-Sforza and Feldman 1981; Boyd and Richerson 1985; Henrich 2001). Without some sort of biased selection, cultural learning is unlikely to be more advantageous than individual learning (Enquist et al. 2007; Rendell et al. 2009; Rogers 1988). In this study, we provide a novel and realistic approach to studying cultural change through investigating the relative effects of an array of competing biases within the transmission of narrative stories. This framework allows us to gain a better understanding of the microevolutionary processes that have shaped and continue to shape human culture.

Despite the critical role that transmission biases appear to play in driving cultural evolution, critical gaps exist in our understanding of the relative strengths of these biases (Acerbi and Mesoudi 2015; McElreath et al. 2008; Kendal et al. 2018; Jiménez and Mesoudi 2019). In particular, prior studies have tended to focus on individual biases, yet multiple biases are always present simultaneously (Heath et al. 2001; Atkisson et al. 2012; Morgan et al. 2012; Stubbersfield et al. 2015; Acerbi and Tehrani 2018). Narratives are especially dense in information that contains a number of proposed content-based or "direct" biases (Boyd and Richerson 1985) that have been shown to aid in the salience and retention of information (Mesoudi, Whiten, and Dunbar 2006; Boyer and Ramble 2001; Eriksson and Coultas 2014; Nairne et al. 2007; Norenzayan and Atran 2004).

Content biases influence transmission through some inherent properties of the variant itself that make it more appealing and memorable (Boyd and Richerson 1985). These preferences can vary between individuals and across cultures, but some have been seen to be remarkably consistent (Barrett and Broesch 2012). Here, we conduct the first simultaneous test of the relative effects of the most frequently cited content biases from the cultural evolution literature. This includes content linked to the following types of information: *social*, either in the sense of everyday basic social interaction or of "gossip" about third parties (Mesoudi, Whiten, and Dunbar 2006; Stubbersfield et al. 2015); *survival*, for fitness-relevant ecological situations (Stubbersfield et al. 2015; Nairne et al. 2007; Otgaar and Smeets 2010); *emotional*, that elicits strong positive or negative responses such as disgust (Heath et al. 2001; Eriksson and Coultas 2014; Fessler et al. 2014; Stubbersfield et al. 2017); *moral*, regarding acceptable behavior and social norms (Heath et al. 2001; Baumard and Boyer 2013), which has not been previously studied explicitly using transmission experiments; *rational*, cause-and-effect connections (Glenn 1980); and *counterintuintuive*, which defies ontological expectations in biological, physical, mental, and other domains (Barrett 2008; Boyer and Ramble 2001). Additionally, counterintuitive information can influence transmission in different ways: singly, counterintuitive elements can be more salient than other types of information (Boyer and Ramble 2001); or a minority of counterintuitive elements can lead to a minimally counterintuitive ("MCI") bias that enhances overall recollection of a story (Norenzayan et al. 2006; Stubbersfield and Tehrani 2013). We crafted the narratives used in this study to resemble real-world creation stories in both form and the

aforementioned types of content biases. Creation stories have each individually been subject to many generations of transmission and transformation and tend to contain biased content at high frequencies.

Beyond the types of information included in a story, learners are also sensitive to the identity and reputation of the storyteller. These transmission biases are referred to as context-based biases, and include model-based or "indirect" (Boyd and Richerson 1985) biases such as *prestige* (Henrich and Gil-White 2001), *success* (Mesoudi 2008), and *similarity* (Mahajan and Wynn 2012; McElreath et al. 2003), and the frequency-dependent *conformity* and *anti-conformity* biases (Henrich and Boyd 1998). In this study, we specifically examine prestige bias, which involves a preference to learn from individuals of high social position, reputation, and knowledge (Berl et al. [in prep.]). Prestige bias is one of the most commonly cited transmission biases (Jiménez and Mesoudi 2019), and has been implicated as one of the predominant forces in cultural change (Henrich and Gil-White 2001; Henrich and Boyd 2002; Henrich et al. 2015). However, the limited empirical work on prestige bias to date has shown mixed support regarding the extent to which prestige actually affects the adoption of particular variants or behaviors (Acerbi and Tehrani 2018; Reyes-García et al. 2008; Chudek et al. 2016; Garfield et al. 2019) (see Jiménez and Mesoudi 2019 for a recent general review on the topic).

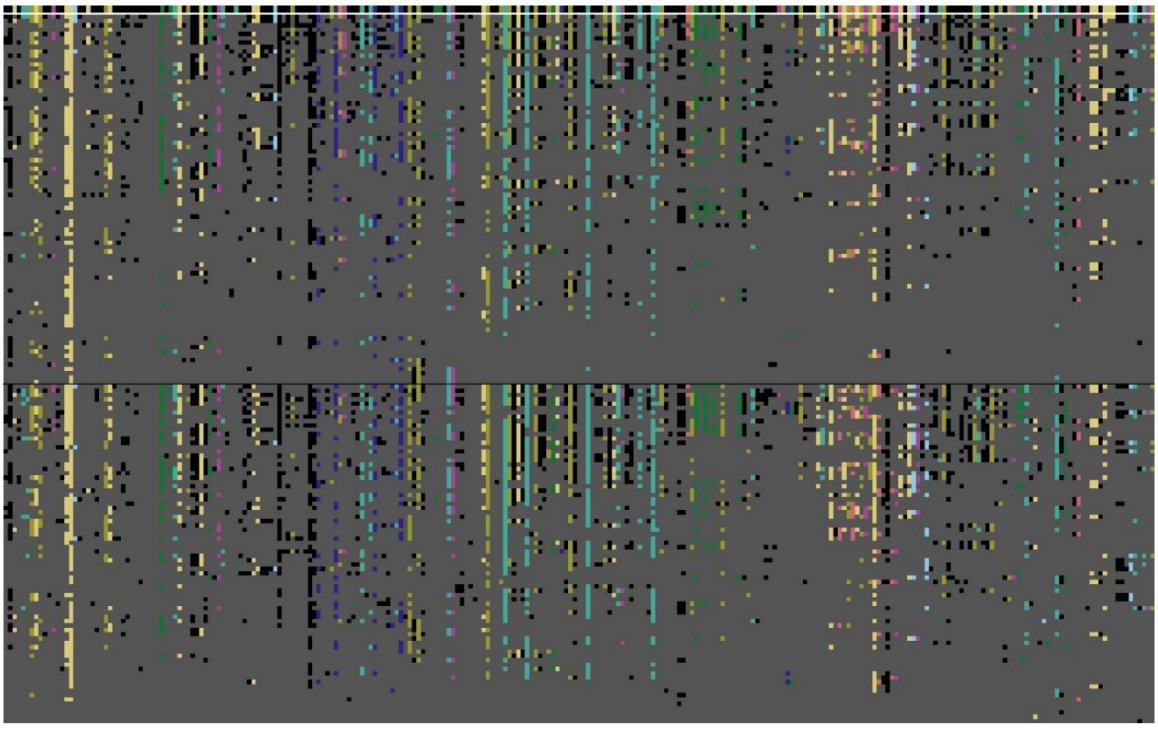
In this study, we use regional accents of speech as a novel experimental cue for prestige information. As has been established within the field of sociolinguistics (Labov 1966; Giles 1970; Bishop et al. 2005; Coupland and Bishop 2007; Fuertes et al. 2012) and verified by two previous studies using accent in this context (Berl et al. [in prep.]; Samarasinghe et al. [in prep.]), accents are perceived as strong indicators of prestige. Accents are hard-to-fake signals (Cronk 2005) and tend to be stable over time; because of this, some varieties become associated with desirable upper class membership and index membership in high-status groups (Giles 1970; Kahane 1986; Kroch 1978). These perceptions of accent are consistent with how prestige is understood in cultural evolution studies and provide a methodological alternative to the traditional use of attention, gaze, or group consensus to represent prestige, which potentially suffer from a number of flaws (Morin 2016b; Ohlsen et al. 2013; Barkow 2014; Roberts et al. 2019). In our experiment, we present stories aurally and ask for oral recall rather than written responses, to limit the number of cognitive domains involved.

Humans are highly attuned to the biases present in the information we consume and to the identities of potential cultural models that hold that information. Here, we address multiple gaps in the literature by explicitly quantifying learners' recall of multiple distinct types of content, transmitted by speakers with varying levels of prestige. By testing content and context biases together in the experimental transmission of a narrative, we can examine the relative effects of a large suite of biases: biases that theory suggests shape the spread of information and the evolution of human culture.

4.2 Results

Participants showed preferential recall of biased information. Of the final data set consisting of 87,420 narrative propositions presented to participants in total, 12,492 (6.998%) were recalled (Appendix 3, Table A3.1). A significant difference was found between the proportions of content types presented and those recalled (z = -2.036, p = 0.042), showing that participants recalled some types of biased information more frequently than other types, including unbiased information (i.e. propositions that did not contain any of the examined content biases; **Figure 4.1**).

(A)



(B)

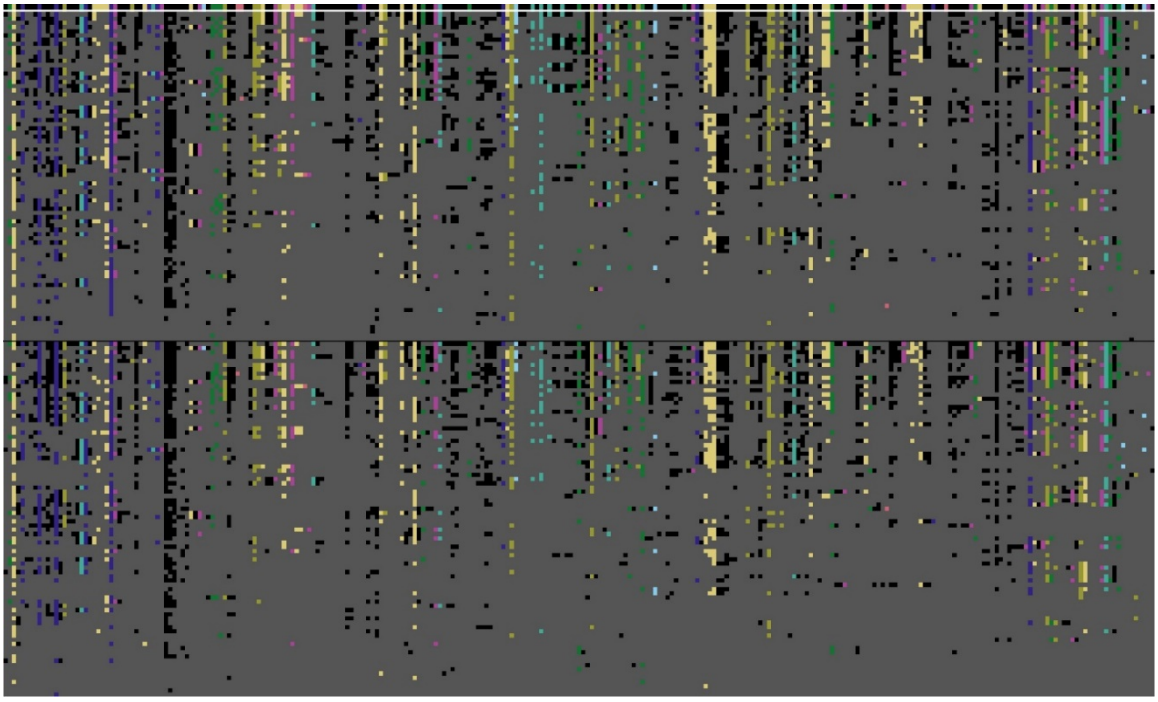


Figure 4.1. Color matrices of the presence or absence of propositions in recalled stories. Each row represents one participant's recall, sorted by hierarchical clustering using McQuitty's complete linkage method. Each column is a proposition from the Muki (A) and Taka & Toro (B) artificial creation stories, in the order in which they appeared in the stories, from left to right. The first two rows of each matrix, separated by a white line, show the full set of propositions contained in the original stories. Within each panel, rows above the black horizontal line were read by a high-prestige speaker, while rows below the black line were read by a low-prestige speaker. Dark gray propositions were not recalled (absent). Recalled propositions (present) are each represented by a color that indicates the content biases they contained: *social* information is yellow, *survival* is green, *positive emotional* is light blue, *negative emotional* is dark purple, *moral* is pink, *rational* is magenta, *counterintuitive* is teal, and propositions containing more than one bias are gold. Unbiased propositions, those that did not contain any biased information, are shown as black.

Recall for each type of content bias ranged from a mean proportion of 0.066 of the propositions presented (moral) to 0.338 (biological counterintuitive). In general, small but non-significant differences were observed in the recall of content biases in high- versus low-prestige speaker conditions (**Figure 4.2**). However, corrected pairwise comparisons of proportions (Appendix 3, Table A3.2) showed that prestige had a significant impact on the recall of unbiased information ($p < 0.001$) and basic social information ($p = 0.001$). Additionally, unbiased information was recalled significantly less often than biased information under the same prestige condition, except for positive emotional, moral, rational, and physical and mental

counterintuitive information. Of these, positive emotional, moral, and mental counterintuitive information were recalled significantly less frequently than unbiased information.

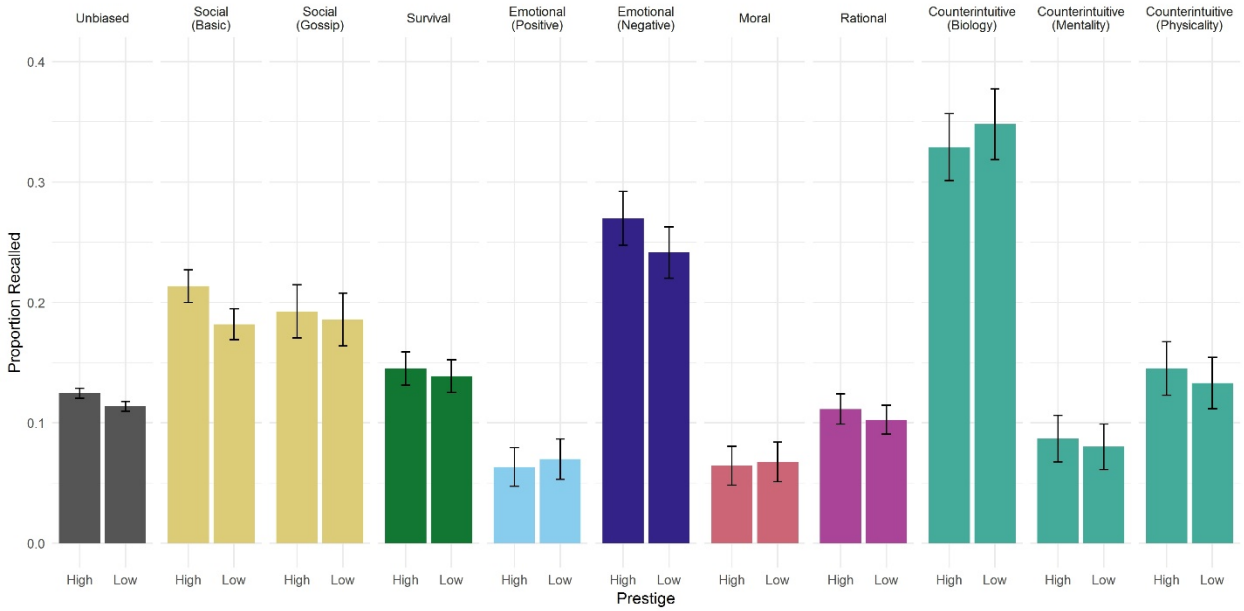


Figure 4.2. Mean proportion of propositions recalled from artificial creation stories by type of content bias and by speaker prestige. Error bars represent 95% confidence intervals. Propositions containing more than one type of content bias are excluded.

Content biases were more influential than prestige bias. To explain the variance in recall of specific propositions, we fit a total of 58 proposed models (Appendix 3, Table A3.3) incorporating story-based, transmission bias, and demographic variables using maximum likelihood estimation. Eleven of the best-fitting models had a resulting ΔAIC score < 2, indicating no single "best" model exists. The majority of the best-fitting models included variables for story presentation order, for prestige, social, survival, negative emotional, and counterintuitive biases, and for gender and working memory (**Table 4.1**).

Table 4.1. Twenty best-supported models of proposition recall. Degrees of freedom (df) and log likelihood (logLik) and Akaike Information Criterion (AIC) values are provided for each model fit. ΔAIC is the change in AIC relative to the best-supported model. Akaike weights (w) were used in weighted model averaging and represent the relative likelihood of each model.

Name	Model	df	logLik	AIC	ΔAIC	w
Significant variables from full model without income ("A"), with gender	present ~ firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	14	-26399.56	52827.13	0.00	0.117
A with gender and line number	present ~ firstStory + line + prestige + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	15	-26398.58	52827.15	0.02	0.116
A with gender and moral	present ~ firstStory + prestige + social + survival + emotionalNegative + moral + counterintuitiveDomain + gender + memory	15	-26398.72	52827.44	0.31	0.100
A with gender and positive emotional	present ~ firstStory + prestige + social + survival + emotionalPositive + emotionalNegative + counterintuitiveDomain + gender + memory	15	-26398.79	52827.58	0.45	0.093
A with gender and quadratic line number	present ~ firstStory + line + line^2 + prestige + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	16	-26398.19	52828.37	1.24	0.063
A with gender and country	present ~ firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + country + gender + memory	15	-26399.48	52828.96	1.83	0.047
Significant variables from full model without income ("A")	present ~ firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + memory	13	-26401.49	52828.98	1.85	0.046
A with line number	present ~ firstStory + line + prestige + social + survival + emotionalNegative + counterintuitiveDomain + memory	14	-26400.50	52829.00	1.87	0.046
A with gender and town low prestige	present ~ firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + gender + townLowP + memory	15	-26399.51	52829.02	1.89	0.045
A with gender and story	present ~ story + firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	15	-26399.55	52829.10	1.97	0.044
A with gender and rational	present ~ firstStory + prestige + social + survival + emotionalNegative + rational + counterintuitiveDomain + gender + memory	15	-26399.56	52829.12	1.99	0.043
A with moral	present ~ firstStory + prestige + social + survival + emotionalNegative + moral + counterintuitiveDomain + memory	14	-26400.65	52829.29	2.16	0.040
A with positive emotional	present ~ firstStory + prestige + social + survival + emotionalPositive + emotionalNegative + counterintuitiveDomain + memory	14	-26400.72	52829.43	2.30	0.037
A with gender and education	present ~ firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + gender + education + memory	17	-26398.09	52830.19	3.06	0.025
A with quadratic line number	present ~ firstStory + line + line^2 + prestige + social + survival + emotionalNegative + counterintuitiveDomain + memory	15	-26400.11	52830.23	3.10	0.025
A with gender and ethnicity	present ~ firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + gender + ethnicity + memory	16	-26399.31	52830.63	3.50	0.020
A with town low prestige	present ~ firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + townLowP + memory	14	-26401.35	52830.70	3.57	0.020
A with country	present ~ firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + country + memory	14	-26401.47	52830.95	3.82	0.017
A with story	present ~ story + firstStory + prestige + social + survival + emotionalNegative + counterintuitiveDomain + memory	14	-26401.48	52830.96	3.83	0.017
A with rational	present ~ firstStory + prestige + social + survival + emotionalNegative + rational + counterintuitiveDomain + memory	14	-26401.49	52830.97	3.84	0.017

Our results (**Figure 4.3**; **Table 4.2**) show that the transmission biases with the greatest effect on recall were, in descending order: counterintuitive (but only for biological violations), negative emotional, social, survival, and prestige. All other biases had negligible effects according to their model-averaged coefficients and confidence intervals and their relative variable importance values. Though we did find a significant effect for prestige, it was the weakest of the transmission biases, with an odds ratio of 1.163 (95% CI [1.118, 1.216]) compared to the next lowest, survival, with 1.855 (95% CI [1.214, 2.836]) and the strongest effect, biological counterintuitive, with 7.525 (95% CI [3.895, 14.537]). For story effects, participants had better recall for the second story they were presented, regardless of which story it was. The placement of propositions within the story had no effect on recall. For demographic variables, only working memory had a significant positive effect.

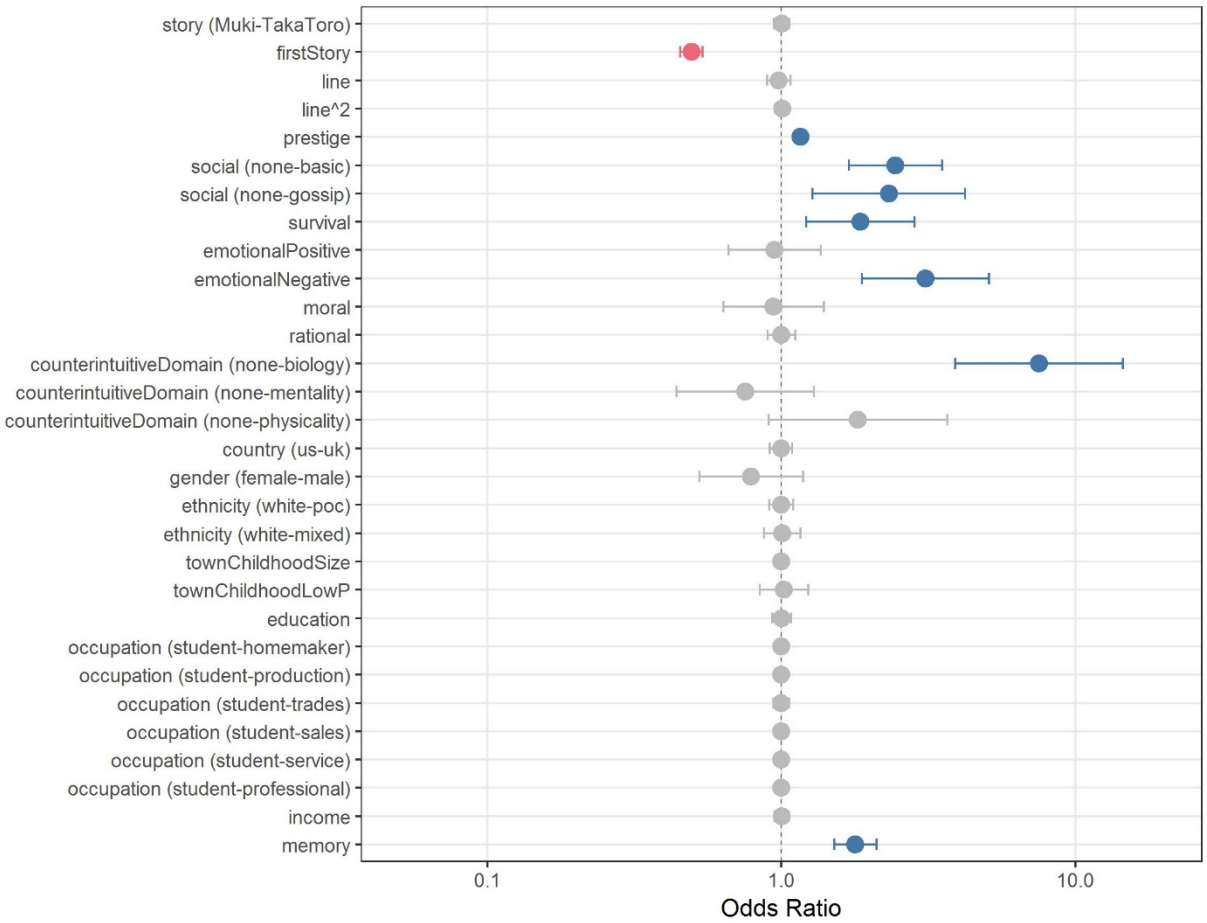


Figure 4.3. Forest plot of odds ratios from full model-averaged coefficients for fixed effects. Odds ratios and 95% confidence intervals are depicted such that variables for which confidence intervals do not overlap with 1 have a significant positive (above 1; blue) or negative (below 1; red) effect on proposition recall. Binary and categorical variables are represented relative to the reference level (false/not present unless specified otherwise). For ordinal variables (*townChildhoodSize*, *education*, and *income*), only linear contrasts are shown.

Table 4.2. Full model-averaged coefficients for proposition recall. Relative variable importance ("RVI") is the sum of Akaike weights for all models that include that variable. Bolded p-values indicate statistically significant results at the 0.05 level.

Variable	Coefficient	SE	p-value	RVI
intercept	-2.876	0.149	< 0.001	
story	0.001	0.030	0.970	0.06
firstStory	-0.706	0.045	< 0.001	1.00
line				
(linear)	-0.020	0.047	0.662	0.24
(quadratic)	0.005	0.027	0.844	0.09
prestige	0.151	0.023	< 0.001	1.00
social				1.00
(none-basic)	0.893	0.187	< 0.001	
(none-gossip)	0.841	0.305	0.006	
survival	0.618	0.216	0.004	1.00
emotionalPositive	-0.054	0.184	0.771	0.13
emotionalNegative	1.129	0.254	< 0.001	1.00
moral	-0.062	0.201	0.758	0.14
rational	-0.001	0.055	0.984	0.06
counterintuitiveDomain				1.00
(none-biology)	2.018	0.336	< 0.001	
(none-mentality)	-0.283	0.274	0.302	
(none-physicality)	0.599	0.357	0.094	
country (us-uk)	-0.004	0.045	0.935	0.06
gender (female-male)	-0.238	0.207	0.252	0.71
ethnicity				0.03
(white-poc)	-0.003	0.048	0.951	
(white-mixed)	0.006	0.072	0.929	
townChildhoodSize				< 0.01
(linear)	0.000	0.008	0.995	
(quadratic)	0.000	0.009	0.984	
(cubic)	0.000	0.008	0.999	
townChildhoodLowP (false-true)	0.020	0.097	0.837	0.09
education				0.03
(linear)	0.003	0.038	0.935	
(quadratic)	0.005	0.043	0.901	
(cubic)	-0.007	0.046	0.886	
occupation				< 0.01
(student-homemaker)	0.000	0.017	0.999	
(student-production)	0.000	0.019	0.997	
(student-trades)	-0.001	0.031	0.981	
(student-sales)	0.000	0.015	0.996	
(student-service)	0.000	0.015	0.991	
(student-professional)	0.000	0.014	0.998	
income				< 0.01
(linear)	0.001	0.028	0.985	
(quadratic)	0.003	0.073	0.970	
(cubic)	0.000	0.025	0.989	
memory	0.580	0.085	< 0.001	1.00

Transmission biases explain little variance in recall. The set of best-fitting models (ΔAIC < 2) had relatively high mean conditional R^2_{GLMM} values at 0.524 (*SD* < 0.001), but a lower marginal R^2_{GLMM} at 0.106 (*SD* = 0.002). The difference between the two values represents the proportion of the variance explained by the random effects of the model, which were the participant ID (i.e. individual differences) and proposition number. Comparisons of the lowest-AIC model with ones excluding either random effect were both significant (participantID X^2 [1] = 6516.1; proposition X^2 [1] = 9718.2; both $p << 0.001$), indicating that the individual participant and proposition effects were both influential. These results tell us that there is a great deal of variance in our responses that is not accounted for by the transmission biases and other fixed effects included in the models, and that this variance includes both individual variation and the stories themselves.

4.3 Discussion

Prestige bias has a minor effect on transmission. We asked participants in two countries to orally recall stories told by speakers with accents of different status, and we found significant effects for prestige, social, survival, negative emotional, and biological counterintuitive biases (see **Table 4.2**, **Figure 4.3**). Prestige-biased transmission has been prominent in the cultural evolution literature (Boyd and Richerson 1985; Jiménez and Mesoudi 2019; Atkisson et al. 2012; Henrich and Gil-White 2001; Henrich and McElreath 2003; Richerson and Boyd 2005; Chudek et al. 2012; Cheng et al. 2013). However, prestige bias as proxied by accent had the smallest effect on transmission, increasing the likelihood of a proposition's recall by only 15%. One possible explanation for the secondary importance of prestige concerns the nature of the narratives transmitted. Transmission biases can lead to the development of group markers and ingroup cooperation (Boyd et al. 2011; Boyd and Richerson 2009; McElreath et al. 2003), and creation stories themselves are representative of a shared group identity (Smith et al. 2017). If the audience does not perceive some cultural relationship between themselves and the storyteller or narrative, prestige may be a less pertinent cue for social learning. Indeed, prestige itself often exists as an ingroup hierarchy with less relevance to outgroup individuals (Halevy et al. 2012; Henrich et al. 2015).

Assuming that shared identity could be a factor mediating the efficacy of prestige bias—in effect, a similarity bias (McElreath et al. 2003)—we examined links between participant and storyteller demographics. We would predict from this argument that participants should better recall a narrative read by a speaker whose accent they could personally identify with. However, our results show no effect on recall from matching participants' childhood location with the region of the low-prestige speaker's accent (*townChildhoodLowP*; see **Figure 4.3**). Other potential effects of similarity bias were represented through standardization of speaker demographics and inclusion of participants' demographics in the models; however, no significant associations were found between participants' identities and those of the speakers.

Prestige is unconsciously employed as a secondary bias. Another potential explanation for the low importance of prestige in determining recall is that participants may adjust their social learning strategies depending on which biases are present in different parts of the narrative (McElreath et al. 2008; Morgan et al. 2012; Rendell et al. 2011). We see clearly that when content biases were present participants largely ignored prestige cues, but tended to recall unbiased propositions more frequently when the narrative was told by a speaker with a high-prestige accent (**Figure 4.2**).

The finding that prestige takes a secondary role to content supports the conclusion of the only other study we know to have compared prestige and content (Acerbi and Tehrani 2018). In that study, the authors found that the effects of prestige were minimal compared to content effects (in the form of "inspiration" or general likability rather than specific biases) when rating their preference for quotations from famous or unknown authors. We suggest that, together, the results of the previous study and our own demonstrate the importance of content biases in directing cultural transmission. These content cues can be more nuanced than general context-based copying rules such as prestige, but our results show that content biases can take a primary role over context. The next step is to understand how the relative importance of content versus context biases may vary across different sociocultural contexts and the potential interactive effects between different forms of biases (for example, one character feeding another encoding both social and survival information).

Content biases have distinct effects. As previously noted, we found that the effects of content types on information transmission varied widely (**Figure 4.3**). Although we might have expected a greater attention to "gossip" over basic social interactions (Mesoudi, Whiten, and Dunbar 2006), the lack of a significant difference between the two in our results (**Figure 4.2**) could be due to variation in how gossip was defined. In this study, gossip was qualified by the presence of third parties in social interactions and not by the "intensity" of interaction as has been done previously (Mesoudi, Whiten, and Dunbar 2006). Furthermore, as entire narratives have been ascribed as gossip in previous work (Mesoudi, Whiten, and Dunbar 2006), any recall was attributed to this bias, whereas we coded specific propositions with social interaction as basic or gossip. The advantageous impact of social "gossip" on transmission also may have been tempered by the cognitive load of processing multiple levels of theory of mind in these interactions (Dunbar 1998, 2004).

Our results also support multiple prior empirical studies that found strong positive effects on transmission for survival information (Nairne et al. 2007; Nairne and Pandeirada 2010; Otgaar and Smeets 2010; Stubbersfield et al. 2015), and for negative emotional information but not positive emotional information (Bebbington et al. 2017; Heath et al. 2001; Kensinger and Corkin 2003). Indeed, negative emotional information was found to be one of the most powerful biases in our stories (**Figure 4.2**). As negative information arouses strong emotional responses such as fear, disgust, and anger, it has been theorized that humans evolved broad cognitive domains receptive to negative information as a survival response to predators and toxic food sources (Al-Shawaf et al. 2016; Al-Shawaf and Lewis 2017; Barrett 2015; Boyer and Barrett 2015; Tooby and Cosmides 2008), which may explain why both survival and negative emotional information are particularly salient.

We did not find evidence to support a preference for moral, rational, or most counterintuitive information. Moral and mental counterintuitive information (as well as positive emotional, above) were actually recalled less often than unbiased information (**Figure 4.2**), though not enough to lead to negative odds ratios when other variables were accounted for (**Figure 4.3**). However, there has been very little prior work to test these biases in an experimental transmission paradigm. For instance, previous evidence of a bias for "rational" or causal information in this context has been anecdotal (Bartlett 1920), though there has been related work on causal reasoning and imitation (Berl and Hewlett 2015; Buchsbaum et al. 2011; Hoehl

et al. 2019; e.g. Horner and Whiten 2005). The transmission of rational information relies upon the retention of a predicate, hence, rational bias may affect the recall of surrounding information but may not be reliably recorded. Further, we defined successful transmission of rational information as requiring the retention of the subordinating conjunction ("because," "so that," "when," etc.; the proposition coded as having rational content), which may explain the lack of an effect. Hence, rational bias may have had a proximity effect on the recall of surrounding information, without being recalled itself, that was not detected by our analyses.

For moral information, according to social norm theory individuals should be expected to retain and transmit moral information depending, firstly, on the strength of the social norm and, secondly, on the extent to which they identify with the social group to which it applies (Cialdini and Trost 1998; McDonald and Crandall 2015). That participants did not recall moral information is less surprising if they recognized that the creation stories did not describe their own society's origins or rules of accepted behavior.

Narrative structural features may aid transmission. To the best of our knowledge, no existing theory addresses why particular counterintuitive domains should be recalled more frequently than others; however, our data demonstrates that biologically counterintuitive information was significantly more likely to be transmitted. This is not necessarily due to biased content *per se*, but rather could be a consequence of narrative construction. Many of the biological counterintuitive propositions in our stories were repetitive in structure (for example, in "Muki," spiders were transformed into other animals four times in sequence), and recollection may be affected by what Jakobson (1960) called the "poetic function" of language (Waugh 1980), or the artistic quality of the message itself. In our study design, we credit a causal role to linguistic factors in social learning through our use of accent-based prestige; however, narrative theory itself remains a rich and largely untapped resource in cultural evolutionary accounts of information transmission (Rivkin and Ryan 2004).

For stories to be impactful, the content must engage the audience (Busselle and Bilandzic 2009; Duranti 1986; Graesser et al. 2002) and compete for space in working memory (Graesser et al. 2003; Kormos and Trebits 2011; Montgomery et al. 2009; Ward et al. 2016). To this end, stories (and their tellers)

employ a suite of features to enhance their salience, including elements that evoke emotional arousal (Andringa 1996; Hänninen 2007; Komeda et al. 2009; Benelli et al. 2012) and the use of familiar narrative devices such as rich encoding and repetition (Genter 1976; Thorndyke 1977). As such, there are multiple factors influencing the success of story transmission and the data demonstrate that transmission biases alone do not capture this variation.

Implications for the understanding of transmission. The overall fit of our model is high (R^2_{GLMMc} = 0.524), but fixed effects only explain a small portion of this (R^2_{GLMMm} = 0.106). One possible explanation for this result is that some as-yet unidentified biases exist in the characteristics of the models or in the content of the stories, and this drives the variation in proposition transmission. However, our methodological approach included every type of content bias supported in the literature, and we could not test the remaining well-documented context biases, such as conformity bias (Efferson et al. 2008) and success bias (Baldini 2012), because they do not apply to the one-to-one transmission context of this experiment. In the future, if additional content biases are identified in the literature, it would be possible for researchers to re-code our data to test them.

Instead, the substantial explanatory power of the random effects in our models may represent the noise of individual variation. The trade-off for gaining real-world experimental validity is typically a greater amount of noise due to uncontrolled circumstances. Our methodological approach did not allow us to control the testing environments, including levels of distraction, participant's levels of attention, or participant's personal short and long-term histories. In this way the experiment mimics real-world cultural transmission, which tends to be filled with random noise that can lead to low fidelity in one-off transmission events (Efferson et al. 2007; Strimling et al. 2009). Much debate exists regarding the degree of transmission fidelity required for cumulative culture. Some argue that high-fidelity transmission is required (Tomasello et al. 1993; Tennie et al. 2009; Lewis and Laland 2012; Dean et al. 2014; Caldwell et al. 2018), while others counter that low-fidelity transmission is sufficient (Sperber 1996; Sasaki and Biro 2017; Zwirner and Thornton 2015; McElreath et al. 2018; Miton and Charbonneau 2018; Truskanov and Prat 2018; Miu et al. 2018) and that weak biases can be amplified over repeated rounds of transmission to create strong

universal patterns (Strimling et al. 2009; Kirby et al. 2007; Thompson et al. 2016). We found that participants' responses to identical stimuli varied significantly and transmission fidelity was often low. Participants knew they would need to retain and recite the information, but on average they recalled only 14% of the propositions presented (*SD* = 10%). In the context of a single-shot experimental transmission event, however, participants have no real incentive to retain information. Furthermore, there is evidence to suggest that repeated exposure to a story increases comprehension (Dennis and Walter 1995), and narratives that particularly define a group such as creation stories are often told multiple times (Norrick 2007) or are collaborative, with opportunities for audience engagement that allowing audience members to transform and take ownership of the narrative (Lawrence and Thomas 1999; Norrick 1997). Future work, both theoretical and empirical, should consider how models of transmission processes can accurately incorporate individual variation in cultural transmission and responses to content.

Our novel methodological and analytical framework provides a template for future tests of the simultaneous effects of context and content biases. We have performed the first experimental study that tests the relative effects of multiple types of cultural transmission biases presented within a realistic package of narrative information, while also incorporating linguistic factors that have, until now, gone unexplored in the cultural evolution literature. Although we found that prestige was the least important transmission bias, it was still a significant factor in participants' choices of what information to retain and recall, especially for information lacking any internal biases. Our results suggest that the prominent role of prestige-biased transmission models in cultural evolution studies should be scrutinized more heavily and qualified by the presence or absence of other biases, which may have stronger effects under certain conditions. The experimental framework presented here sets the stage for future research to test longstanding questions in cultural evolution, such as: which biases are necessary or sufficient for the development of cumulative culture (Tomasello et al. 1993), which conditions cause learners to favor one type of bias over another (Rendell et al. 2011), whether and how the effects of different biases differ cross-culturally (Efferson et al. 2007; Mesoudi et al. 2015; Eriksson et al. 2016; Leeuwen et al. 2018), how micro-level transmission processes lead to macro-level cultural change (Mesoudi, Whiten, and Dunbar 2006; Schwartz and Mead 1961), and how we can identify the bias or biases responsible for a *post hoc* distribution

of traits (Kandler and Powell 2015). The results of this study go beyond academic discourse in cultural evolution to impact other disciplines that rely on the theory and application of communication as a means of disseminating information and motivating behavioral change, including education, marketing, conservation, public health, and political science. Storytelling persists as a powerful and enduring tool, dense in cultural information, and utilized across the world to share knowledge and shape the diversity of human culture.

4.4 Methods

Story Production. We selected creation stories, which often pertain to the origins of life, death, ecology, and human society, as the narrative form to be used for this study because they are rich in the types of content proposed to be relevant to cultural transmission. Further, creation stories are a familiar pattern cross-culturally for the transmission of knowledge, values, and meaning, and have each individually been subject to many generations of transmission and transformation.

We undertook a survey of creation stories using ethnographic data from the electronic Human Relations Area Files (eHRAF) World Cultures database (see Acknowledgements). We conducted the survey by searching for "creation" (and its derivatives) or "origin" within texts indexed under the "mythology" subject code (#773). We performed the search in the Probability Sample Files (PSF) subset, which is a stratified random sample of 60 cultures, each representative of a different "culture area." Our search returned 100 story extracts from 35 cultures, and from this we selected 4 texts for analysis on the basis of appropriate length (~300-800 words) and being written and shared by in-group authors (rather than foreign ethnographers). The stories selected belonged to the A·chik Mande (referred to in eHRAF as "Garo"), Baganda ("Ganda"), Kainai ("Blackfoot"), and Kānaka Maoli ("Hawaiian") peoples. We also included the Genesis creation story (from the ancient Israelites), as presented in the New Revised Standard Version Bible (Coogan et al. 2010, Gen. 1.1-2.3). We coded the resulting 5 ethnographic creation stories at the level of propositions (word clusters consisting of "a predicate plus a series of ordered arguments"; Mesoudi, Whiten, and Dunbar 2006, p. 411) for the presence of social, survival, emotional, moral, rational, and

counterintuitive content biases. Definitions of these biases as used for coding are listed in Appendix 3 (Table A3.4). We carried out propositional analysis under the protocol established by Turner and Greene (Turner and Greene 1977).

For the experiments, we commissioned two written artificial creation stories (see Acknowledgements). We did this rather than using the ethnographic stories we sampled in order to avoid issues of cultural appropriation surrounding the use of stories from real societies and to ensure that our participants would all be equally unfamiliar with the stories. The first story, "Muki," explains how a rugged landscape and its varieties of life-forms were shaped by the actions of a child abandoned by its parents. The second story, "Taka & Toro," describes two jealous seafaring siblings and their competition over the friendship of the people they created. Over many iterations, we edited the texts of these artificial creation stories to ensure the proportions of each type of biased proposition in each story matched one another, and also fell within 90% confidence intervals of the proportions seen in the coded ethnographic creation stories (Appendix 3, Table A3.5). We tuned both stories to be approximately 850 words (Muki 887, Taka & Toro 835) and 270 propositions (Muki 265, Taka & Toro 273) to avoid ceiling effects for recall and to be of roughly equal complexity. Readability scores for these artificial stories were roughly equivalent and used simpler language than the ethnographic stories they were modeled after (Flesch-Kincaid grade level: Muki 4.91, Taka & Toro 5.03, Ethnographic Mean 8.22 [90% CI: 6.42, 10.02]; Flesch reading ease: Muki 84.5, Taka & Toro 81.9, Ethnographic Mean 71.24 [90% CI: 62.24, 80.24]).

Recordings. We used language accent to index prestige, in line with findings from sociolinguistics (Giles 1970; Fuertes et al. 2012; Garrett 2007; Labov 1964, 1972). Language attitude studies have demonstrated that non-localized "standard" accents are associated with high prestige (Giles 1973; Milroy 2007; Milroy and Milroy 1999; Stewart et al. 1985) based on ideological values (Coupland 2003; Coupland and Bishop 2007), although regional non-standard accents demonstrate differential prestige (Giles 1970; Bishop et al. 2005; Coupland and Bishop 2007; Giles 1971). We recorded self-identified middle-aged white male speakers with high- and low-prestige accents calibrated for the participants' locations telling the two stories ("Muki" and "Taka & Toro"). The high- and low-prestige accents were selected based on the results of a previous study

(Samarasinghe et al. [in prep.]). For both the UK and USA participants, the high-prestige accent used was Received Pronunciation ("RP"). For the UK sample, the low-prestige accent was West Country, from South West England; and for the US sample, the low-prestige accent was Inland South, spanning the southern Appalachian, Ozark, and Ouachita mountain ranges. We standardized the recordings for volume and length (5 min, 19 s).

For an independent assessment of accent prestige, we also recorded our speakers reading the first paragraph of the *Comma Gets a Cure* passage (see Acknowledgements). This passage contains words from Wells's lexical set, designed to highlight phonological variation between different accents of English (Wells 1982). We presented these recordings (range 35 s to 39 s) to participants to confirm that their perceptions of the prestige of each speaker matched what was expected (see Experimental Protocol).

Participants. We recruited UK participants on the Prolific Academic platform (n = 96), and US participants on Amazon Mechanical Turk (n = 100) using TurkPrime (Litman et al. 2017). Participants were eligible to take part in this study if they: had not taken part in any previous studies by the researchers; had taken part in and had successfully completed over 95% of at least 100 studies on Prolific Academic or over 98% of at least 5,000 tasks on Amazon Mechanical Turk; and were native English speakers.

We excluded data from 23 participants due to technical recording errors or external interference (e.g. a second person contributing to a story). We compensated participants for their time at rates above local minimum wages based upon the time taken to complete the tasks.

Experimental Protocol. The experiment was administered through a custom web browser application using the SurveyJS library (source code available in the state it was used for the experiment at: https://github.com/seannyD/StoryTransmission/tree/a8a1a995dd0ce000222435bf70741ec2df237b29). Participants were directed from their respective recruitment platforms to the web application on University of Bristol servers. Participants first selected their location, which determined which of the locally-calibrated accent recordings they would hear. Participants were instructed to listen once to a recording of the first

artificial creation story and were told that they would be asked to recall the story in as much detail as possible.

After listening to a creation story, participants took part in a working memory distraction task based on the Visual Spatial Learning Test (Malec et al. 1991). This task involved playing three rounds of a game where participants had to recall symbols and their positions on a grid. For the symbols, we used the 9 most dissimilar characters from the "BACS-1" artificial character set (Vidal et al. 2017). This distraction task took approximately 5 minutes to complete and provided a measure of unbiased working memory, which we calculated as the number of cards placed on the grid that matched the positions displayed (regardless of the symbol), plus the number of cards placed on the grid that matched both the positions and symbols displayed, averaged across all trials (equivalent to the Position Learning Index, or "PLI" score, of Malec et al. 1991).

Once this task had been completed, participants recorded their oral recollection of the creation story. They were given the opportunity to pause and continue recording, but were not allowed to return or re-record after advancing to the next task. This process, including the working memory distraction task, was then repeated for the second story and with the accent of opposite prestige. Story order and accent were both randomized for presentation in the experiment. Each participant heard "Muki" in one accent condition and "Taka & Toro" in the alternate accent condition.

After recording their recollections of both stories, participants listened to recordings of the *Comma Gets a Cure* passage read by the speakers providing the stories. To test that the accents were indexing prestige and these cues were differentiated across accents, participants rated the speakers using the items for the PRI scale of individual prestige (Berl et al. [in prep.]) as well as additional solidarity and dynamism domains (Fuertes et al. 2012). Finally, participants completed a demographic questionnaire including participants' residence history and self-reported accents of English. Data pertaining to gender and ethnicity were collected in line with local and ethical guidelines.

Data Coding and Transcription. We transcribed the audio files containing participants' story recordings, and coded each for the presence or absence of each proposition from the original texts. Because

participants were instructed that they did not need to recall the stories verbatim, we counted the presence of a proposition if a participant used different word choices or constructions if the meaning remained constant, e.g. we accepted synonyms and we did not penalize the order of recall. If an error in the retellings was carried forward in the story, we only marked it absent in the first instance. We only counted biased propositions as present if the retelling retained the biased element (e.g. social interaction, counterintuitive properties, etc.).

To assess intercoder reliability, a second researcher re-coded a subset of 33 recordings (representing approximately 10% of the sample). We found substantial agreement between the coders (Cohen's $\kappa = 0.737$, $p < 0.01$), and coders discussed any disagreements until reaching consensus.

Data Analysis. We used a set of generalized linear mixed models (GLMMs) to model the presence or absence of a particular proposition. Here, we tested the effects of eight different transmission biases by fitting a set of 58 candidate models that account for the potential effects of these biases in isolation and in combination with one another (Appendix 3, Table A3.3). For these models, the fixed effects we examined can be broken down into three categories of: 1) *story-based effects* (story, presentation order, and line number and quadratic line number representing primacy or recency effects); 2) *transmission biases* (prestige, social, survival, positive emotional, negative emotional, moral, rational, and counterintuitive domain); and 3) *demographic effects* (country, gender, ethnicity, accent matching low-prestige speaker, childhood town size, childhood town matching region of low-prestige speaker, education, occupation, income, and working memory score). Age was excluded from the demographic variables because of a lack of any predictive theory for its effects on recall beyond those of working memory. We also included random effects for participant and proposition number in all models to capture the remaining variance from these sources.

After model fitting, model comparisons were made on the basis of each model's Akaike Information Criterion (AIC) score. Due to the lack of a single dominant model with a weight greater than 0.95, we averaged the parameters of all models according to their Akaike weights (Burnham and Anderson 2002). As our main interest was in determining which factors had the strongest effects (Nakagawa and Freckleton

2011), we determined full model-averaged parameter estimates using the "zero method" (Burnham and Anderson 2002; Grueber et al. 2011). This substitutes a value of zero for parameter estimates and errors in models where the parameter does not appear and computes a weighted average for each parameter using the models' Akaike weights.

We re-fit the full set of models using a continuous measure of the participants' perceptions of the speaker's prestige—as factor scores from the PRI scale of individual prestige (Berl et al. [in prep.])—rather than the binary high-low prestige variable, for the subset of participants that provided this information (roughly two thirds of the full data set). Results were qualitatively similar; however, direct comparisons cannot be made due to these analyses being performed on a nonrandom subset of the data.

We used the R statistical environment, version 3.5.1 (2018-07-02), for all analyses (R Core Team 2018).

5. CONCLUSION

5.1 Emergent Themes

Several common threads run through the three distinct studies described here. First, we find that prestige is a complex and ubiquitous cultural concept that affects and is affected by all levels of social structure. Additionally, in the Western contexts we sampled, we found that people of varying demographic groups had a consistent idea of the components that constitute prestige. Prestige-based status is a central aspect of human social life, and one that has taken a prominent role across the social sciences and in many other disciplines, including the interdisciplinary field of cultural evolution. However, we should be cautious about ascribing too much importance to prestige as a factor in the cultural transmission process. Our experimental results show that, at least in this context, its effects were minimal and were contingent upon whether sources of biased content were present. This finding is surprising in that it contradicts decades of theory in cultural evolution that have promoted prestige-biased transmission as one of the predominant forces that has shaped human evolution (Henrich and Gil-White 2001; Henrich and Boyd 2002; Henrich et al. 2015). However, these previous decades of theory were relatively light on the empirical verification of mathematical models of cultural transmission, and very rarely considered the influence of multiple biases simultaneously, as we did in our experimental design. These findings should motivate additional work in this area to investigate the details of when prestige bias is favored over other, potentially more powerful biases such as the particularly salient content biases we examined.

Within the field of cultural evolution, the research outlined in this dissertation should also spur a re-examination of the Henrich and Gil-White (2001) model of prestige versus dominance and the feasibility of its evolutionary explanation, which relied on prestige being an important enough factor in transmission that learners would take on negative fitness consequences simply to have access to a particular cultural model. We did not design our studies with the intent to directly evaluate the Henrich and Gil-White (2001) model, but our findings often contradicted its predictions. For instance, as mentioned above, the results of our transmission experiment showed that prestige was not a powerful effect in motivating the recall of realistic narratives in comparison to some content effects. Further, the comparison of our prestige scale

with that of Cheng et al. (2010), which was built to measure the prestige-dominance dichotomy, showed that the Cheng et al. (2010) scale did not have a great deal of validity and did not differentiate well between prestige and dominance. Instead, dominance exhibited a good deal of covariation with prestige both in the Cheng et al. (2010) scale and in our own (correlations of $\rho = 0.449$ and $\rho = 0.533$, respectively), contradicting the account that prestige and dominance are fully distinct routes to status (Cheng et al. 2013). Lastly, in our literature review, terms from the Henrich and Gil-White (2001) model such as *deference*, *attention*, and *social learning* appeared often in the Western academic literature as purported consequences of prestige, but were hardly ever mentioned in the ethnographic accounts of other societies. Similarly, *skilled* and *knowledgeable* were not the most important determinants of prestige in non-Western societies. This could indicate that the importance of terms related to social learning as a causal factor in prestige is overstated by academics due to the popularity of the Henrich and Gil-White (2001) model and that benefits related to deference are less relevant in real societies. Alternatively, the frequencies of these terms could be an artifact of sampling and the interests of researchers and ethnographers. Further work is needed to clarify these potential issues with the Henrich and Gil-White (2001) model, and to explore alternative models that may better fit the present observations.

A second, related theme that was raised in all three studies described here is the undue reliance upon Western samples in research on cultural transmission biases. Researchers should be cautious about drawing general conclusions from studies restricted to Western participants, including our own work. In cultural evolution, many classic theoretical predictions have only been validated against empirical data in limited laboratory-based studies (Mesoudi and Whiten 2008), and nearly all empirical work on transmission biases has taken place in Western, educated, industrialized, rich, and democratic ("WEIRD": Henrich et al. 2010) societies (but see: Reyes-García et al. 2008, 2009; Henrich and Henrich 2010; Henrich and Broesch 2011). The poor representation of cross-cultural research potentially limits the conclusions that can be drawn about the general processes that shape human cultural evolution, and about the generalizability of findings about transmission dynamics in an artificial setting with WEIRD participants. Importantly, recent evidence suggests that, in addition to receiving the intended information over the course of cultural transmission, we also learn about the cultural transmission process, and recent research

shows notable cross-cultural differences in learning preferences (Heyes 2012b; Berl and Hewlett 2015; Mesoudi et al. 2015; Eriksson et al. 2016; Mesoudi, Magid, et al. 2016; Mesoudi, Chang, et al. 2016; Legare and Harris 2016). In other words, we learn how to learn, and the process of cultural transmission is shaped in turn by its cultural context, such that the cultural transmission process is not invariant across individuals. Adding a cross-cultural component to any study adds an additional layer of complexity, but confronting the complexity of cultural variation is necessary for the development of accurate conclusions regarding both the basic mechanisms of cultural transmission and the broader trends seen in the biological and cultural evolution of our species as a whole.

5.2 Limitations and Future Directions

Each of our studies had important limitations that we must consider, and each of these limitations presents an opportunity to expand upon the novel methods and outputs we have produced, or to attempt to replicate our findings and test their validity and reliability in other contexts. Many of these limitations were discussed within the content of each chapter, but I expand upon them here.

The literature review and ethnographic review described in Chapter 2 were both conducted on samples that were limited as a matter of necessity. In an effort to sample broadly across disciplines in the academic literature on prestige, we made the choice to deliberately undersample the social sciences and oversample other subject areas such as business, medicine, and computer science. Though these other fields did provide very different ideas on prestige than the realm of social science literature more traditionally associated with prestige (for example, algorithms for ranking the prestige of pages in a web search, and the prestige of specific diseases and the medical specialties that work on them), there could be potential deficiencies in the sample because of the social science literature that was not fully reviewed. In our analyses, we saw that the terms we sampled for prestige determinants and consequences approached saturation, and we did not see any indication that there were major ideas or bodies of theory in the social sciences that we overlooked, but we must still acknowledge that limited sampling introduces this as a possibility.

In a similar vein, we limited our ethnographic sample to 15 of the original 32 that matched our criteria. The coverage of the eHRAF World Cultures database is variable, even within some of its more highly-studied subsets such as the Standard Cross-Cultural Sample (Gray 1996), and we additionally found that individual sources and authors varied in their use of the term "prestige" and their theoretical interest in the concept of prestige. As a result, 2 of the eligible societies had no matches with variations of "prestige" at all, and we chose to eliminate 15 others due to low numbers of matching paragraphs from comparably few sources. The 15 societies we did sample were, in our opinion, sufficient to illustrate the point that ideas on prestige vary cross-culturally; however, greater sampling would have allowed us to make more detailed comparisons between cultures. For instance, only 3 language families were represented by more than 1 society, and greater sampling would have allowed us to look more closely at within-family versus between-family distinctions in prestige. An ideal opportunity for extending this study would be to sample more broadly within well-represented language families, such as Niger-Congo and Austronesian, to gather data that would be suitable for phylogenetic analyses of prestige across cultures. A phylogenetic comparative analysis of the presence of specific prestige determinants and consequences across a linguistic tree would provide insight into the evolution of prestige over time and, in combination with the microevolutionary results from prestige-biased transmission studies, would build a bridge between the micro- and macroevolutionary scales of cultural evolution.

The primary limitation of the study described in Chapter 3, which constructed a scale of individual prestige, is that it was conducted entirely with WEIRD participants in the United States and United Kingdom. We noted this in the study itself and echoed the warning above about generalizing results across cultural contexts from which we had no data. To extend the PRI scale to additional samples, we emphasized that it would be necessary to test the validity and reliability of the scale, at a minimum, or to build a localized version of the scale using the tools and methods we described. With these concerns in mind, we provided the full details of how the scale was constructed and all of the materials used to construct it. An important future direction of all three studies described here is to extend the methods we developed to other cultures and social contexts, and we have worked to provide the tools necessary to do so as part of the conduct and reporting of each study.

We built the framework for the final study, the transmission experiment (described in Chapter 4), over the course of conducting our other studies: first, we built the prestige scale (Chapter 3) to validate the use of regional accents of English as proxies for prestige in the context of oral narration; next, we conducted a separate study (Samarasinghe et al. [in prep.]) to identify the accents that participants perceived as having the highest and lowest prestige in local contexts; lastly, the experiments were conducted while reviewing the literature and ethnographies on prestige (Chapter 2) and we used the initial findings of these reviews to inform our experimental design. Nevertheless, even with these preliminary steps established, our results have limitations. Firstly, the order of the studies themselves could have influenced the outcome, in that we constructed the scale prior to the completion of the literature and ethnographic reviews. We therefore were not able to take into consideration the prestige concepts examined in the reviews or the integrative framework we developed. The development of the scale was driven largely by participant responses and we make the point that it would need to be re-examined in different cultural contexts, so this is not a major concern, but it presents the opportunity for future work to measure the concept of prestige in the multilevel, integrative sense rather than only using a list of uncategorized terms generated through free listing.

One important challenge for the experimental study is our inability to distinguish other possible reasons for the lack of strong support for prestige as a factor in the results. For instance, one possible explanation could be that there are untested interaction effects between prestige conditions and the presence of certain content biases (such as social, survival, or moral information). We are unable to test this possibility because we did not design our experiment with this in mind: the artificial creation stories we used had proportions of biased content that were roughly equivalent to each other (designed to match the distributions of frequencies in stories from real cultures), but the proportions of different biases were not equal to one another. This prevents us from having a fully crossed experimental design with the high-or low-prestige condition variable. A future extension of this study could be designed to test the possibility of interactions between content and context biases.

In a broader sense, there could be conditions under which prestige matters comparatively more or less depending on the domain of knowledge being discussed, or due to narrative structural effects. It could

be that features of creation stories tend to be salient, with less importance placed on the identity of the speaker; whereas, if one were seeking information on an academic topic (the history of the Second Punic War, for instance), someone speaking with Received Pronunciation may be assumed to have more scholarly authority. There could also be circumstances where there is actually a preference for traditionally lower-prestige individuals: for instance, if someone were seeking local knowledge (e.g. directions to a landmark) in a rural area, they may prefer information from someone with a local accent; or, if someone needed help with a trade skill (e.g. auto repair), they may trust the information more if it comes from someone with an accent associated with a blue-collar working class.

Our sample pool for the transmission experiment, as with the prestige scale, was drawn entirely from WEIRD cultures in the United States and United Kingdom. For the ability to make broader generalizations about the relative roles of prestige and content in cultural transmission, future work is needed to replicate this experimental study in a variety of other cultures. We have established the framework for doing so with our study, and the results of the ethnographic study suggest non-Western cultures that would be good candidates for investigating the power of prestige to influence cultural transmission in cultures with prestige concepts that differ significantly from Western perceptions.

There are a number of theoretical concerns that our studies do not address directly, but that may affect the interpretation of our results under different models of social collectivities, institutions, and cultures (D'Andrade 2006; de Munck and Bennardo 2019). Across our studies, we attempted to elicit a singular concept of prestige within a society, one that has been collectively agreed upon and enshrined in social institutions, and that is held and enforced by individuals. However, presuming that only one such prestige concept exists within a society is a theoretical simplification of a more complex reality (as all models are). Though there may be one (or more) collectively-held attitudes prestige concepts, there may also be individual attitudes that conflict with these collective views, or concepts that coexist with or replace the consensus in different spaces. Similar to the linguistic concepts of covert and overt prestige, private and public concepts of prestige that are based upon distinct hierarchies with differing determinants and consequences can both exist, and individuals may belong to many of these systems simultaneously. Thus, in

future studies, there are opportunities to examine in finer detail the prestige systems of different types of collectivities within a society.

With the limitations of these three studies in mind, the practical utility of our results extends beyond theoretical arguments in cultural evolution and the social sciences. All instances of human communication are inherently transmission processes, and many elements of society are concerned with the efficacy and retention of transmitted information. There has already been a recognition of the role of transmission in diverse fields, from education (Lubeck 1984; Nash 1990) to marketing (Colarelli and Dettmann 2003; Colbert and Courchesne 2012) to graphic design (Frascara 1988; Fuad-Luke 2013). Knowledge of cultural transmission, and of the biases that affect transmission in various ways depending on context and content, are crucial in crafting messages that are heard, retained, and recalled, and that have the desired downstream effects on values, attitudes, and behaviors. Organizations already carefully select the content of their messaging and utilize prestigious individuals in an attempt to enhance their reach and influence (Kaikati 1987; Stone et al. 2003; Fleck et al. 2012). Our studies lay the foundation for bridges to be built to these different fields, in that our results could help to explain and evaluate the outcomes of communication efforts and to craft more successful campaigns in the future.

A primary goal of human dimensions and conservation social science research is to understand the factors that influence human behavior and to shape the processes that motivate behavior for shared social and environmental benefit. Cultural transmission is directly responsible for the success or failure of this process. Applied conservation and management efforts such as environmental communication and education, outreach, and awareness campaigns all draw upon knowledge about human values, attitudes, behavior, and learning, and—similar to other organizations—sometimes leverage the influence of prominent individuals to make those attempts more successful (Brockington 2008; Duthie et al. 2017). Environmental behavior itself can serve as a signal of prestige (Griskevicius et al. 2010), and could therefore potentially have a multiplying effect on motivating further behavior change. Knowledge of prestige and cultural transmission could likewise aid efforts to preserve traditional or Indigenous ecological knowledge, beliefs and practices, as the pathways by which these are learned are inherently cultural, and should thus be subject to the same transmission mechanisms as any other type of culturally transmitted information

(though these could vary cross-culturally, as we have noted). An improved understanding of cultural transmission and the effects of prestige, in addition to being valuable for the sake of basic scientific research, can assist in the design of effective, inclusive, and lasting solutions to the world's most pressing social and environmental problems.

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APPENDIX 1. ETHNOGRAPHIC DATA FOR SOCIETIES IN A UNIFIED FRAMEWORK OF PRESTIGE: BRIDGING CONCEPTS FROM THEORY, EXPERIMENT, AND CROSS-CULTURAL RESEARCH

OWC	EA	SCCS	eHRAF Name	EA Date	SCCS Date	Language Family	Number of Matching Documents	Number of Matching Paragraphs
AA01	Ed01	116	Korea	1950	1947	Language isolate	27	187
AW42	Ef01	62	Santal	1940	1940	Austro-Asiatic	8	36
AZ02	Eh01	79	Andamans	1870	1860	Great Andamanese	2	2
EP04	Cg04	52	Saami	1950	1950	Uralic	12	62
FE12	Af03	19	Akan	1900	1895	Niger-Congo, Atlantic-Congo	18	111
FF57	Ah03	16	Tiv	1920	1920	Niger-Congo, Atlantic-Congo	15	179
FK07	Ad07	12	Ganda	1880	1875	Niger-Congo, Atlantic-Congo	21	100
FL12	Aj02	34	Maasai	1900	1900	Nilo-Saharan, Eastern Sudanic	5	26
FO04	Aa05	13	Mbuti	1930	1950	Nilo-Saharan, Central Sudanic	4	9
FQ05	Ac03	7	Bemba	1900	1897	Niger-Congo, Atlantic-Congo	7	29
FQ09	Ab03	4	Lozi	1890	1900	Niger-Congo, Atlantic-Congo	6	23
MO04	Ca02	36	Somali	1950	1900	Afro-Asiatic	13	102
MP05	Ca07	37	Amhara	1950	1953	Afro-Asiatic	10	118
MS12	Cb26	26	Hausa	1950	1900	Afro-Asiatic	16	210
MS30	Cb02	21	Wolof	1950	1950	Niger-Congo, Atlantic-Congo	19	72
ND08	Na03	124	Copper Inuit	1920	1915	Eskimo-Aleut	6	14
NG06	Na33	127	Ojibwa	1870	1930	Algic	18	113
NQ18	Nf06	142	Pawnee	1867	1867	Caddoan	8	13
NR10	Nc08	138	Klamath	1860	1860	Language isolate	7	30
OA19	Ia03	112	Ifugao	1920	1910	Austronesian	12	120

OWC	EA	SCCS	eHRAF Name	EA Date	SCCS Date	Language Family	Number of Matching Documents	Number of Matching Paragraphs
OC06	Ib01	85	Iban	1950	1950	Austronesian	21	202
OG11	Ic05	87	Eastern Toraja	1910	1910	Austronesian	3	7
OI08	Id01	91	Aranda	1900	1896	Pama-Nyungan	5	8
OJ29	Ie01	94	Kapauku	1950	1955	Trans-New Guinea	8	86
OL06	Ig02	98	Trobriands	1910	1914	Austronesian	33	135
OR19	If02	109	Chuuk	1940	1947	Austronesian	14	44
OT11	Ii02	100	Tikopia	1930	1930	Austronesian	13	78
RY02	Ec03	121	Chukchee	1900	1900	Chukotko-Kamchatkan	1	1
SB05	Sa01	158	Kuna	1940	1927	Chibchan	9	89
SF05	Sf02	172	Aymara	1940	1940	Aymaran	8	71
SQ18	Sd09	163	Yanoama	1965	1965	Yanomaman	4	9
SQ19	Se05	167	Tukano	1940	1939	Tucanoan	10	91

APPENDIX 2. SUPPLEMENTARY INFORMATION FOR A UNIFIED FRAMEWORK OF PRESTIGE: BRIDGING CONCEPTS FROM THEORY, EXPERIMENT, AND CROSS-CULTURAL RESEARCH

Table A2.1. Traditional prestige concepts referenced in the literature review. Presented in order of descending frequency of occurrence in the data set. A "general" prestige concept is one that refers to prestige as a broader social construct rather than any of the specific concepts below.

Prestige Concept	Definition	Definition Source	Additional Sources
Occupational prestige	*the relative chance that a member of an occupational category has of experiencing deference, acceptance or derogation in his relations with members of other categories*	Goldthorpe & Hope (1974, p. 5)	North & Hatt (1949); Inkeles & Rossi (1956); Duncan (1961); Hodge et al. (1964); Goldthorpe & Hope (1972); Treiman (1977); Nakao & Treas (1992)
Brand prestige	*the relatively high status of product positioning associated with a brand*	Steenkamp et al. (2003)	Dubois & Czellar (2002); Baek et al. (2010)
Organizational prestige	*the degree to which the institution is well regarded both in absolute and comparative terms*	Mael & Ashforth (1992, p. 111)	Perrow (1961); Smidts et al. (2001); Carmeli (2005); Fuller et al. (2006); Bartels et al. (2007)
Academic prestige	*an effect of the position of academic departments within networks of association and social exchange*	Burris (2004, p. 240)	Armstrong (1980); Keitch & Babchuk (1998); Long et al. (1998)
Prestige goods	*foreign goods which are assigned high status*	Frankenstein & Rowlands (1978, p. 75)	Gell (1986); Grossman & Shapiro (1988); Dubois & Duquesne (1993); Vigneron & Johnson (1999); Trubitt (2000); Trubitt (2003); Mills (2004)
Literary prestige	*the symbolic value attributed to authors by criticism and other institutions in the literary field*	Verboord (2003, p. 262)	Van Rees (1983); De Nooy (2002)
National prestige	*a nation's self-image, what it radiates and how other nations regard it*	Wood (2013, p. 391)	Shimbori et al. (1963)

Prestige Concept	Definition	Definition Source	Additional Sources
Prestige bias	*the tendency to learn from and imitate the most highly skilled and competent (i.e., prestigious) individuals in one's social group*	Cheng et al. (2013, p. 104)	Boyd & Richerson (1985); Henrich & Gil-White (2001)
Network prestige	*visibility based on the extensive relations directed at them*	Knoke & Burt (1983)	Russo & Koesten (2005); Rusinowska et al. (2011)
Linguistic prestige	*the social evaluations that speakers attach to a language rather than to the characteristics of the language system as such*	Sairio & Palander-Collin (2012, p. 626)	Labov (1964); Labov (1966); Giles (1970); Labov (1972); Trudgill (1972); Kroch (1978); Kahane (1986); Ibrahim (1986); Gordon (1997)

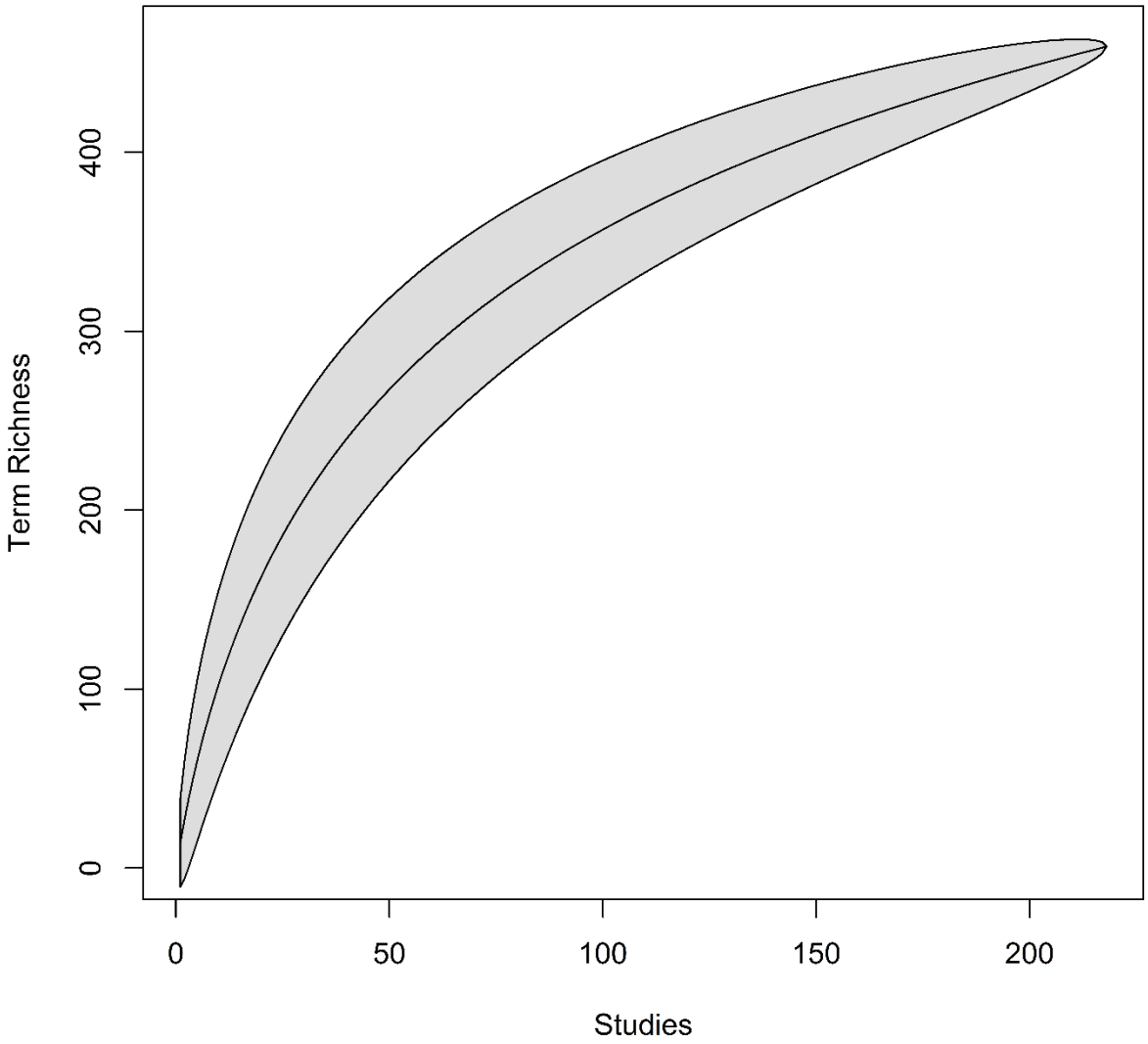

Figure A2.1. Accumulation curve of unique prestige determinant and consequence terms, following grouping by synonyms, by number of studies. Expected (mean) values and 95% confidence intervals are depicted.

Table A2.2. Most frequent terms for prestige determinants and consequences in literature review, by level of social structure (A) and stages in social role processes (B).

(A)

DETERMINANTS

Level	Term	Count
Environmental	place	5
Cultural	important	36
	valued	33
	quality	32
	moral	14
	culture	10
Institutional	educated	50
	occupation	36
	powerful	36
	academic	27
	trained	20
Collective	centrality	14
	history	14
	ethnicity	12
	exclusive	10
	department	9
Relational	influential	27
	well-connected	19
	cited	17
	network	12
	associations	10
	relationships	10
Individual	skilled	50
	knowledgeable	38
	reputable	38
	gender	36
	respected	34
Symbolic	income	36
	wealthy	34
	expensive	13
	technology	13
	goods	11

CONSEQUENCES

Level	Term	Count
Environmental	<none>	<n/a>
Cultural	valued	12
	legitimate	6
	quality	6
	important	4
	culture	3
Institutional	powerful	26
	employment	14
	leader	9
	politics	9
	privilege	8
Collective	group	4
	secure	4
	conflict resolution	3
	conformity	2
Relational	influential	42
	deference	38
	social learning	20
	imitation	13
	attention	12
Individual	attractive	31
	respected	19
	admired	18
	self-esteem	18
	fitness	15
	satisfaction	15
Symbolic	signaling	32
	wealthy	16
	profitable	10
	income	8
	funded	6

(B)

DETERMINANTS

Stage	Term	Count
Role	status	39
	occupation	36
	powerful	36
	authority	22
	elder	22
Competence	educated	50
	skilled	50
	knowledgeable	38
	academic	27
	intelligent	21
Products	reputable	38
	important	36
	income	36
	respected	34
	wealthy	34

CONSEQUENCES

Stage	Term	Count
Role	status	35
	powerful	26
	employment	14
	authority	12
	image	12
Competence	signaling	32
	committed	9
	loyal	8
	cooperative	5
	proud	5
Products	influential	42
	deference	38
	social learning	20
	respected	19
	admired	18
	self-esteem	18

Table A2.3. Results of pairwise tests of independence of proportions of terms in each level of social structure or stage in social role processes by society. Shared letters indicate a lack of significant difference between those societies (at alpha = 0.05 level); lack of a shared letter indicates a significant difference in proportions between societies. *p*-values were adjusted for multiple comparisons to control the false discovery rate using the Benjamini and Hochberg (1995) method.

	Determinants		**Consequences**	
	Level	**Stage**	**Level**	**Stage**
Western	ab	a	n	n
Ashanti	cdef	b	nopqr	nopqr
Ganda	c e g	cde	o q	o q
Tiv	h	f	p	p
Iban	ij	ghij	nopqr	nopqr
Ifugao	i k	g	no q	no q
Tikopia	j l	a h k	nopqr	nopq
Trobriands	a d l	hi	o q	o q
Trukese	ab d f j l	g i	nopqr	nopqr
Mee	k	j	o	o
Amhara	c	bcd k	r	r
Somali	m	c kl	nopqr	nopqr
Zazzagawa Hausa	efg	de	nopqr	nopqr
Northern Saulteaux	b	i	nopqr	nopqr
Guna	g	e	nopqr	nopqr
Koreans	m	l	pq	pq

Table A2.4. Most frequent terms for prestige determinants in each society of the ethnographic review, by level of social structure (A) and stages in social role processes (B). The environmental level is not depicted, as most societies had no terms under this level. Levels for which there were no terms that occurred more than once are left blank. If multiple terms were equally at the highest frequency, all are shown. Prestige consequences are not shown due to sparsity of data.

(A)

	Western	Ashanti	Ganda	Tiv	Iban	Ifugao	Tikopia	Trobriands	Trukese	Mee
Cultural	*important*		*culture*	*ceremony*	*resistance ritual*	*ritual*	*culture*	*tradition*		*ceremony*
Institutional	*educated*	*leader religion*	*leader*	*marriage*	*leader*	*marriage religion*	*leader*	*leader*	*leader*	*religion*
Collective	*centrality history*	*community*	*warfare*		*warfare*	*language*	*community family*	*kinship lineage*	*warfare*	
Relational	*influential*	*supported*	*associations*			*influential*		*transactions*		*influential*
Individual	*skilled*	*elder*	*brave deceptive performance*	*generous*	*travel*	*generous*	*generous*	*generous*	*knowledgeable*	*generous*
Symbolic	*income*	*goods*	*landowner*	*animals*	*goods wealthy*	*wealthy*	*goods*	*signaling*	*goods wealthy*	*wealthy*

(A cont.)

	Amhara	Somali	Zazzagawa Hausa	Northern Saulteaux	Guna	Koreans
Cultural		*resistance*	*culture*	*ritual*	*ritual*	*ritual*
Institutional	*religion*	*religion*	*religion*	*medical*	*leader*	*university*
Collective	*lineage*	*lineage*	*lineage*		*language*	*lineage*
Relational		*alliance*	*relationships*	*associations*		*influential*
Individual	*medicine*	*religious*	*religious*	*generous* *trapping*	*knowledgeable*	*famous* *knowledgeable* *respectful*
Symbolic	*landowner*	*animals*	*titled*	*goods*		*inheritance*

(B)

	Western	Ashanti	Ganda	Tiv	Iban	Ifugao	Tikopia	Trobriands	Trukese	Mee
Role	*status*	*elder*	*leader*	*ceremony*	*ritual*	*ritual*	*leader*	*leader*	*leader*	*religion*
Competence	*educated skilled*	*educated trading*	*educated warfare*	*generous*	*travel*	*generous*	*generous*	*transactions*	*knowledge*	*generous*
Products	*reputable*	*goods*	*animals*	*animals*	*accomplished goods wealthy*	*wealthy*	*goods*	*wealthy*	*goods wealthy*	*wealthy*

	Amhara	Somali	Zazzagawa Hausa	Northern Saulteaux	Guna	Koreans
Role	*religion*	*religion*	*religion*	*medical*	*leader*	*ritual*
Competence	*medicine*	*religious*	*religious*	*generous trapping*	*educated knowledgeable*	*knowledgeable respectful*
Products	*animals*	*animals*	*titled*	*goods*		*famous influential*

APPENDIX 3. SUPPLEMENTARY INFORMATION FOR PRESTIGE AND CONTENT BIASES IN THE EXPERIMENTAL TRANSMISSION OF NARRATIVES

Table A3.1. Three-way table of biases present in artificial story propositions. The first row within each bias gives the number of propositions (and percentage of the total) presented to each participant across both stories (N = 537 propositions), while the second row within each bias gives the number (and percentage) of propositions recalled across all participants (N = 12,492 propositions). Columns indicate an additional type of bias present in the same proposition, such that numbers on the diagonal (e.g. Social-Social) represent propositions with only the single indicated bias, while off-diagonals (e.g. Social-Moral) represent propositions that contained both indicated biases. Only one proposition in the original stories (at 0.2% of the total) contained three biases (Social, Survival, and Negative Emotional) and this proposition was recalled 51 times (0.4%). This proposition is not depicted in the table but was included in analyses and the calculated percentages reflect its inclusion. The last two rows and column indicate unbiased propositions, or those that did not contain any of the content biases examined.

		Social	Survival	Emotional (Positive)	Emotional (Negative)	Moral	Rational	Counter-intuitive	Unbiased
Social	Presented	58 (10.8%)	5 (0.9%)	4 (0.7%)	4 (0.7%)	2 (0.4%)		14 (2.6%)	
	Recalled	1841 (14.7%)	269 (2.2%)	85 (0.7%)	246 (2.0%)	70 (0.6%)		269 (2.2%)	
Survival	Presented		31 (5.8%)		2 (0.4%)		3 (0.6%)	2 (0.4%)	
	Recalled		715 (5.7%)		42 (0.3%)		80 (0.6%)	102 (0.8%)	
Emotional (Positive)	Presented			11 (2.0%)		1 (0.2%)		2 (0.4%)	
	Recalled			119 (1.0%)		4 (< 0.1%)		41 (0.3 %)	
Emotional (Negative)	Presented				18 (3.4%)	1 (0.2%)	1 (0.2%)	3 (0.6%)	
	Recalled				788 (6.3%)	20 (0.2%)	6 (< 0.1%)	130 (1.0%)	
Moral	Presented					11 (2.0%)	2 (0.4%)		
	Recalled					118 (0.9%)	38 (0.3%)		
Rational	Presented						30 (5.6%)	5 (0.9%)	
	Recalled						521 (4.2%)	184 (1.5%)	
Counter-intuitive	Presented							35 (6.5%)	
	Recalled							1123 (9.0%)	
Unbiased	Presented								291 (54.2%)
	Recalled								5630 (45.1%)

Table A3.2. Results of pairwise comparisons of proportions for content bias type and prestige speaker condition. *p*-values are adjusted for multiple comparisons using the Benjamini and Hochberg (1995) method to control for false discovery rate. Bold values are significant at the $\alpha = 0.05$ level. Each of the three counterintuitive types were tested separately, but average *p*-values across the types are presented for clarity except for differences that represent changes in significance (represented as "B" for biology, "M" for mentality, or "P" for physicality).

		Social (Basic)		Social (Gossip)		Survival		Emotional (Positive)		Emotional (Negative)		Moral		Rational		Counterintuitive		Unbiased
		High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Social (Basic)	High																	
	Low	**0.001**																
Social (Gossip)	High	0.149	0.466															
	Low	0.053	0.814	0.729														
Survival	High	**0.000**	**0.000**	**0.000**	**0.002**													
	Low	**0.000**	**0.000**	**0.000**	**0.000**	0.585												
Emotional (Positive)	High	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**											
	Low	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	0.684										
Emotional (Negative)	High	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**									
	Low	**0.036**	**0.000**	**0.003**	**0.001**	**0.000**	**0.000**	**0.000**	**0.000**	0.089								
Moral	High	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	1.000	0.742	**0.000**	**0.000**							
	Low	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	0.807	0.933	**0.000**	**0.000**	0.876						
Rational	High	**0.000**	**0.000**	**0.000**	**0.000**	**0.001**	**0.005**	**0.000**	**0.001**	**0.000**	**0.000**	**0.000**	**0.000**					
	Low	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.001**	**0.006**	**0.000**	**0.000**	**0.001**	**0.003**	0.374				
Counter-intuitive	High	**0.000**	**0.004**	**0.002**	**0.006**	**0.000** P: 1.000	**0.000** P: 0.699	**0.000** M: 0.089	**0.000** M: 0.245	**0.001**	**0.000**	**0.000** M: 0.108	**0.000** M: 0.179	**0.005** M: 0.065	**0.000** M: 0.239	**0.000**		
	Low	**0.000**	**0.000**	**0.000**	**0.000**	**0.000** P: 0.417	**0.000** P: 0.720	**0.000** M: 0.235	**0.000** M: 0.504	**0.000**	**0.000**	**0.000** M: 0.272	**0.000** M: 0.404	**0.009** P: 0.101	**0.008** M: 0.087	**0.001** B-B: 0.407	**0.000**	
Unbiased	High	**0.000**	**0.000**	**0.000**	**0.000**	**0.005**	0.052	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	0.077	0.002	**0.001** P: 0.075	**0.000** P: 0.501	
	Low	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	0.785	0.120	**0.009**	**0.003** P: 0.083	**0.001**

Table A3.3. Full set of candidate generalized linear mixed models tested. A plus sign indicates that a variable was included in the specified model. Random effects of participant and proposition number were included in all models.

Number	Name	story	first story	line	line^2	prestige	social	survival	emotional positive	emotional negative	moral	rational	counterintuitive domain	country	gender	ethnicity	childhood town size	childhood town low prestige	education	occupation	income	memory
1	Null																					
2	Full	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3	Story effects	+	+	+	+																	
4	Story	+																				
5	First story		+																			
6	Line number			+																		
7	Quadratic line number			+	+																	
8	Biases					+	+	+	+	+	+	+	+									
9	Prestige					+																
10	Content						+	+	+	+	+	+	+									
11	Social						+															
12	Survival							+														
13	Emotional								+	+												
14	Emotional (positive)								+													
15	Emotional (negative)									+												
16	Moral										+											
17	Rational											+										
18	Counterintuitive												+									
19	Demographics													+	+	+	+	+	+	+	+	+
20	Country													+								
21	Gender														+							
22	Ethnicity															+						
23	Town size																+					

Number	Name	story	first story	line	line^2	prestige	social	survival	emotional positive	emotional negative	moral	rational	counterintuitive domain	country	gender	ethnicity	childhood town size	childhood town low prestige	education	occupation	income	memory
24	Town low prestige																	+				
25	Education																		+			
26	Occupation																			+		
27	Income																				+	
28	Memory																					+
29	Story effects and biases	+	+	+	+	+	+	+	+	+	+	+	+									
30	Story effects and demographics	+	+	+	+									+	+	+	+	+	+	+	+	+
31	Biases and demographics					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
32	Significant variables from full model		+			+	+	+		+			+								+	+
33	Significant variables from full model without income (“A”)		+			+	+	+		+			+									+
34	A with story	+	+			+	+	+		+			+									+
35	A with line number		+	+		+	+	+		+			+									+
36	A with quadratic line number		+	+	+	+	+	+		+			+									+
37	A with positive emotional		+			+	+	+	+	+			+									+
38	A with moral		+			+	+	+		+	+		+									+
39	A with rational		+			+	+	+		+		+	+									+
40	A with country		+			+	+	+		+			+	+								+
41	A with gender (“B”)		+			+	+	+		+			+		+							+
42	A with ethnicity		+			+	+	+		+			+			+						+
43	A with town size		+			+	+	+		+			+				+					+
44	A with town low prestige		+			+	+	+		+			+					+				+
45	A with education		+			+	+	+		+			+						+			+
46	A with occupation		+			+	+	+		+			+							+		+

Number	Name	story	first story	line	line^2	prestige	social	survival	emotional positive	emotional negative	moral	rational	counterintuitive domain	country	gender	ethnicity	childhood town size	childhood town low prestige	education	occupation	income	memory
47	B with story	+	+			+	+	+		+			+		+							+
48	B with line number		+	+		+	+	+		+			+		+							+
49	B with quadratic line number		+	+	+	+	+	+		+			+		+							+
50	B with positive emotional		+			+	+	+	+	+			+		+							+
51	B with moral		+			+	+	+		+	+		+		+							+
52	B with rational		+			+	+	+		+		+	+		+							+
53	B with country		+			+	+	+		+			+	+	+							+
54	B with ethnicity		+			+	+	+		+			+		+	+						+
55	B with town size		+			+	+	+		+			+		+		+					+
56	B with town low prestige		+			+	+	+		+			+		+			+				+
57	B with education		+			+	+	+		+			+		+				+			+
58	B with occupation		+			+	+	+		+			+		+					+		+

Table A3.4. Definitions of content biases used in coding propositions.

Content Bias	Definition
Social (Basic)	*Interactions or relationships between individuals or groups*
Social (Gossip)	*Interactions or relationships between individuals or groups concerning third parties, or references to reputation or reputational costs, or the literal act of gossiping about other individuals*
Survival	*Explicit references to food, water, clothing, shelter, tools, predators, natural threats and disasters, seasonal cycles, reproduction, death, or disease in a survival context*
Emotional (Positive)	*Explicit displays or expressions of, or reference or reaction to, a positive emotional response beyond baseline, or an event that is expected to evoke a strong basic positive emotional response in the audience*
Emotional (Negative)	*Explicit displays or expressions of, or reference or reaction to, a negative emotional response beyond baseline, or an event that is expected to evoke a strong basic negative emotional response in the audience*
Moral	*Deals with social norms, taboos, and values, deviation from social norms, and rewards for adherence or punishment for deviance*
Rational	*Concerns cause-and-effect relationships or employing causal reasoning*
Counterintuitive	*Violations of ontological properties of folk-biology, folk-psychology or folk-physics*

Table A3.5. Number of instances of biased content in ethnographic creation stories and artificial creation stories, divided by word count.

Content Bias	90% CI for ethnographic creation stories	Muki	Taka & Toro
Social (Basic)	[0.707, 4.748]	3.833	3.952
Social (Gossip)	[0.000, 1.326]	1.240	1.198
Survival	[1.152, 2.718]	2.480	2.635
Emotional (Positive)	[0.009, 1.088]	1.015	1.078
Emotional (Negative)	[0.000, 2.137]	1.804	1.796
Moral	[0.466, 1.679]	1.015	0.958
Rational	[1.269, 2.894]	2.255	2.515
Counterintuitive	[0.216, 0.583]	0.338	0.359

APPENDIX 4. ADDENDUM TO PRESTIGE AND CONTENT BIASES IN THE EXPERIMENTAL TRANSMISSION OF NARRATIVES: INFLUENCE OF PRESTIGE FACTORS ON RECALL

A4.1 Background

As noted in the Results of the main experimental study exploring the transmission of narratives, the primary variable we used to represent prestige was a binary high prestige-low prestige distinction made on the basis of the accent of the story's speaker. We established the validity of this distinction through the results of two prior studies (Berl et al. [in prep.]; Samarasinghe et al. [in prep.]) that showed significant differences in perceptions of the prestige of these pairs of accents.

For this experiment, roughly two thirds of the participants (n = 111/163), most of which were located in the U.S. (n = 77/111), also provided Likert-type scale speech evaluations of the speakers using the Position-Reputation-Information ("PRI") scale of individual prestige (Berl et al. [in prep.]) after the experiment was concluded. The remaining participants also responded to the scale, but the data were not recorded due to a programming issue with the web application used for the survey and were lost. We elected not to use the scale ratings in the main study due to this sample size restriction; however, the continuous measurements could, in theory, be a more accurate representation of the influence of prestige on recall than a binary variable, and could yield finer-detail results. It is therefore important to evaluate the PRI scale and its components in comparison with the binary prestige variable.

Here, we present the results of additional assessments that explore the use of the PRI scale and its component subscales in predicting proposition recall. First, we evaluate the validity of the scale for this data set, which is a necessary prerequisite to its use (Berl et al. [in prep.]). Second, we see whether—by using the PRI variables—we obtain results comparable to the findings of the main study. This would tell us whether there are any differences that could be attributed to the use of a nonrandom subset of the data, or to one or more of the scale factors. Third, we determine whether the continuous scores determined by the scale are better predictors of differences in proposition recall than the binary high-low prestige variable. Lastly, we

examine which of the PRI subscales (position, reputation, or information) is most influential in determining recall.

A4.2 Methods and Results

To assess the fit of the PRI scale model to our speech evaluation data, we performed confirmatory factor analysis ("CFA"), using a three-stage robust diagonally weighted least squares estimation technique (weighted least squares, mean and variance adjusted, or "WLSMV") that has been shown to perform well for these types of data (Jöreskog and Sörbom 1996, pp. 23–24; DiStefano and Morgan 2014; Rhemtulla et al. 2012). We used the same fit criteria as those given in Berl et al. ([in prep.]), which were drawn from Hu & Bentler (1999) and Yu (2002): Comparative Fit Index ("CFI") > 0.95; Tucker-Lewis Index ("TLI") > 0.96; Root Mean Square Error of Approximation ("RMSEA") < 0.05; and Standardized Root Mean Square Residual ("SRMR") < 0.07. We found that the model displayed good fit according to every criterion except RMSEA (CFI = 0.998, TLI = 0.996, RMSEA = 0.100 [90% CI: 0.070, 0.133], SRMR = 0.018). This result is similar to that found in the evaluation of the criterion validity of the scale itself (Berl et al. [in prep.]) and we therefore interpret this as an adequate demonstration of the scale's fit.

We then replicated the analytical procedure described in the main study, in which we ran a set of candidate generalized linear mixed models ("GLMMs") and used an information theoretic approach to obtain a consensus result. In this case, we repeated the full set of GLMMs previously tested (*SI Appendix*, Table S2) using the reduced data set, both with the binary prestige variable as in the main study, and with the PRI factor score and each of its component scores (position, reputation, and information) each substituted in turn for the binary prestige variable. The resulting set, excluding duplicate models that did not contain a prestige variable and were thus unaffected, included 186 candidate models. We then computed full model averages, following the method described in the main study, for the set of all models (including those with the binary variable) and separately for the 154 models that exclude the binary variable to examine the PRI variables alone.

The results of the complete set of 186 models are qualitatively similar to those of the main study (**Figure A4.1**; compare with **Figure 4.3**), in that the same set of variables were found to be significant, with nearly identical odds ratios. Interestingly, the PRI prestige variables were not significant when the binary variable was included, and had very low relative variable importance ("RVI") values (PRI < 0.01, Position = 0.01, Reputation < 0.01, Information < 0.01). This was likely due to the continuous nature of these variables giving them less predictive power for a binary outcome (proposition recalled or not) than a binary predictor variable.

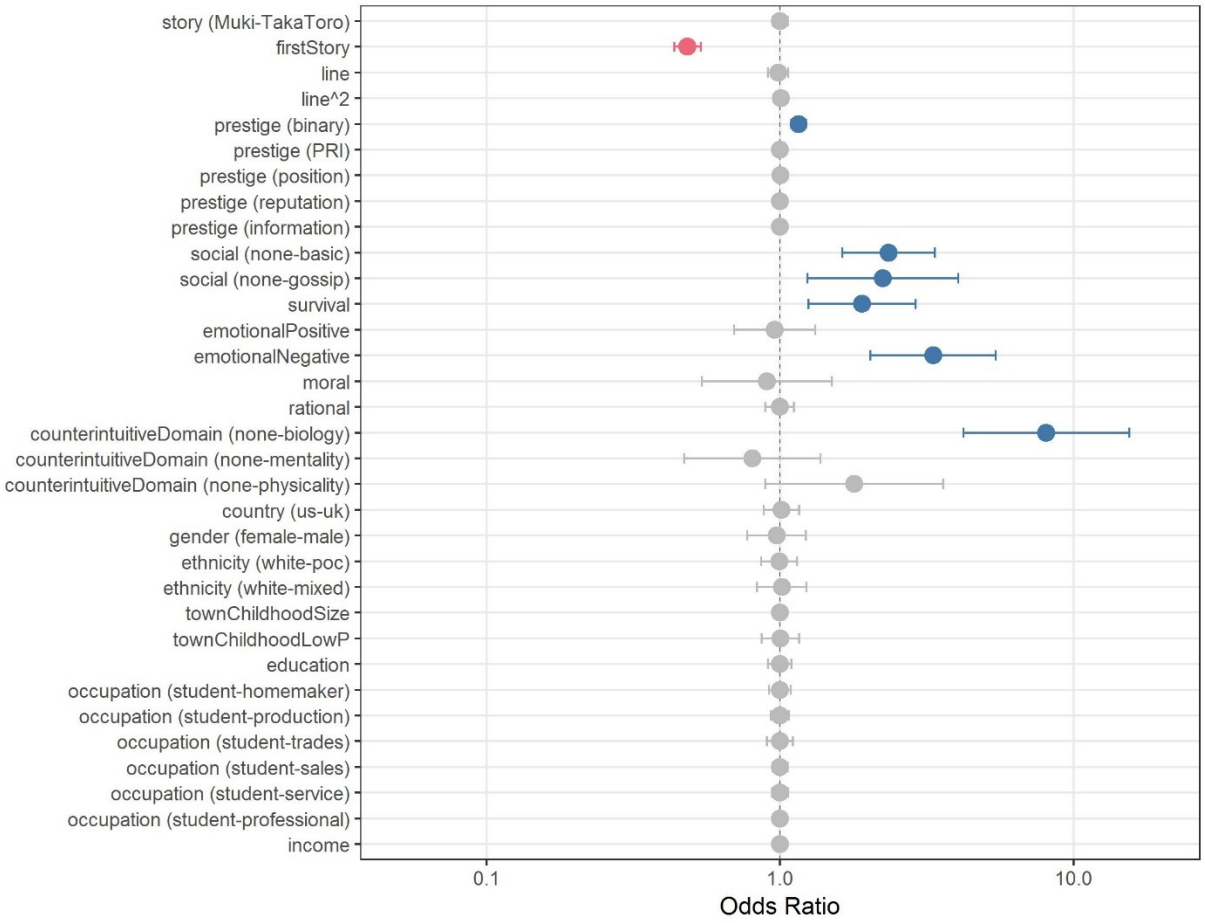

Figure A4.1. Forest plot of odds ratios from full model-averaged coefficients for fixed effects, including binary, PRI, Position, Reputation, and Information variables representing prestige. Odds ratios and 95% confidence intervals are depicted such that variables for which confidence intervals do not overlap with 1 have a significant positive (above 1; blue) or negative (below 1; red) effect on proposition recall. Binary and categorical variables are represented relative to the reference level (false/not present unless specified otherwise). For ordinal variables (townChildhoodSize, education, and income), only linear contrasts are shown.

For the set of models that excluded the binary prestige variable, the PRI score was, surprisingly, not the most influential prestige measure; rather, the score for the position subscale provided the best fit. All of the models with substantial support—represented by a $\Delta AIC < 2$ (Burnham and Anderson 2002, p. 70)—include the position variable (**Table A4.1**), and the results of multimodel averaging give the position variable a relative variable importance ("RVI") value of 0.94 (the sum of its Akaike weights), while the prestige variable with the next highest value is the full PRI score with an importance of 0.04 (**Table A4.2**).

Table A4.1. Twenty best-supported models of proposition recall, using PRI scale indices of prestige. Degrees of freedom (df) and log likelihood (logLik) and Akaike Information Criterion (AIC) values are provided for each model fit. ΔAIC is the change in AIC relative to the best-supported model. Akaike weights (w) were used in weighted model averaging and represent the relative likelihood of each model.

Name	Prestige Variable	Model	df	logLik	AIC	ΔAIC	w
Significant variables from full model without income ("A") with moral	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + moral + counterintuitiveDomain + memory	14	-18666.43	37360.85	0.00	0.141
Significant variables from full model without income ("A")	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + memory	13	-18667.62	37361.23	0.38	0.116
A with line number	Position	present ~ firstStory + line + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + memory	14	-18666.84	37361.68	0.83	0.093
A with positive emotional	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	14	-18666.99	37361.97	1.12	0.080
A with gender and moral	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + moral + counterintuitiveDomain + gender + memory	15	-18666.32	37362.63	1.78	0.058
A with quadratic line number	Position	present ~ firstStory + line + line^2 + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + memory	15	-18666.33	37362.66	1.81	0.057
A with country	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + country + memory	14	-18667.39	37362.79	1.94	0.053
A with gender	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	14	-18667.51	37363.01	2.16	0.048
A with rational	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + rational + counterintuitiveDomain + memory	14	-18667.59	37363.18	2.33	0.044
A with town low prestige	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + townLowP + memory	14	-18667.59	37363.18	2.33	0.044
A with story	Position	present ~ story + firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + memory	14	-18667.61	37363.23	2.38	0.043
A with gender and line number	Position	present ~ firstStory + line + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	15	-18666.73	37363.46	2.61	0.038
A with gender and positive emotional	Position	present ~ firstStory + positionPRI + social + survival + emotionalPositive + emotionalNegative + counterintuitiveDomain + gender + memory	15	-18666.88	37363.75	2.90	0.033
A with ethnicity	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + ethnicity + memory	15	-18666.99	37363.98	3.13	0.029
A with education	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + education + memory	16	-18666.13	37364.25	3.40	0.026
A with gender and quadratic line number	Position	present ~ firstStory + line + line^2 + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	16	-18666.22	37364.44	3.59	0.023
A with gender and country	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + country + gender + memory	15	-18667.31	37364.61	3.76	0.021
A with gender and rational	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + rational + counterintuitiveDomain + gender + memory	15	-18667.48	37364.95	4.10	0.018
A with gender and town low prestige	Position	present ~ firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + gender + townLowP + memory	15	-18667.49	37364.99	4.14	0.018
A with gender and story	Position	present ~ story + firstStory + positionPRI + social + survival + emotionalNegative + counterintuitiveDomain + gender + memory	15	-18667.5	37365.01	4.16	0.018

Table A4.2. Full model-averaged coefficients for proposition recall, using PRI scale indices of prestige. Relative variable importance ("RVI") is the sum of Akaike weights for all models that include that variable. Bolded p-values indicate statistically significant results at the 0.05 level.

Variable	Coefficient	SE	*p*-value	RVI
intercept	-2.832	0.144	< 0.001	
story	0.000	0.030	0.990	0.06
firstStory	-0.732	0.053	< 0.001	1.00
line				
(linear)	-0.015	0.040	0.707	0.21
(quadratic)	0.005	0.027	0.839	0.08
prestigePRI	0.002	0.011	0.843	0.04
positionPRI	0.059	0.021	0.004	0.94
reputationPRI	0.000	0.005	0.931	0.01
informationPRI	0.000	0.005	0.924	0.01
social				1.00
(none-basic)	0.852	0.185	< 0.001	
(none-gossip)	0.806	0.302	0.008	
survival	0.644	0.215	0.003	1.00
emotionalPositive	-0.042	0.162	0.798	0.11
emotionalNegative	1.200	0.251	< 0.001	1.00
moral	-0.104	0.262	0.690	0.19
rational	-0.003	0.057	0.954	0.06
counterintuitiveDomain				1.00
(none-biology)	2.086	0.333	< 0.001	
(none-mentality)	-0.219	0.273	0.423	
(none-physicality)	0.581	0.356	0.103	
country (us-uk)	-0.010	0.069	0.880	0.07
gender (female-male)	-0.027	0.117	0.817	0.29
ethnicity				0.04
(white-poc)	-0.007	0.072	0.920	
(white-mixed)	0.014	0.102	0.893	
townChildhoodSize				< 0.01
(linear)	0.000	0.010	0.999	
(quadratic)	0.000	0.011	0.989	
(cubic)	-0.000	0.011	0.993	
townChildhoodLowP (false-true)	0.004	0.075	0.961	0.06
education				0.04
(linear)	-0.005	0.049	0.925	
(quadratic)	0.001	0.040	0.980	
(cubic)	-0.011	0.069	0.870	
occupation				< 0.01
(student-homemaker)	0.002	0.046	0.973	
(student-production)	0.001	0.036	0.979	
(student-trades)	-0.002	0.054	0.977	
(student-sales)	-0.001	0.031	0.979	
(student-service)	-0.001	0.033	0.976	
(student-professional)	-0.001	0.028	0.981	
income				< 0.01
(linear)	-0.000	0.007	0.996	
(quadratic)	0.000	0.009	0.994	
(cubic)	-0.000	0.008	0.994	
memory	0.578	0.099	< 0.001	1.00

As in the full set of models, the results of averaging those models that contained PRI prestige variables were similar to the results of the main study (**Table A4.2**; compare with **Table 4.2**). Prestige, represented by the position variable, had a small but significant effect on proposition recall (position β = 0.059; compared to binary β = 0.145 for the same data set and 0.151 for the main study). Other variables likewise had similar values, except for the participant's gender, which was less influential in the reduced set (RVI of 0.71 in the main study, 0.29 in the current analysis) and moral content, which was slightly more influential (0.14 versus 0.19), though neither variable was statistically significant in either set of models. These differences are likely due to sampling.

In practice, the models containing the binary prestige variable do not perform substantially better than those with PRI prestige variables, and both give comparable results. For example, the best-fitting model for the reduced data set using the binary prestige variable had a marginal R^2_{GLMM} value of 0.11257 and a conditional R^2_{GLMM} value of 0.51998, while the best-fitting position model yielded nearly identical marginal and conditional values of 0.11261 and 0.52020, respectively. The particular model in both cases was the same, save the prestige variable used (see the top model in **Table A4.1**).

A4.3 Discussion

These analyses have demonstrated the robustness of the results found in the main study to perturbations in sampling and to different operational measurements of prestige. The findings were qualitatively and often quantitatively identical between the two data sets and when alternative variables were used to represent prestige, namely the participants' evaluations of the speakers using the PRI scale of individual prestige (Berl et al. [in prep.]). In addition to the respective prestige variable, the same set of additional variables with comparable odds ratios were found to significantly influence the recall of narrative propositions.

An additional finding concerns the applications of the PRI construct itself, in that the position subscale was found to be the most important of the PRI variables. This subscale consists of ratings for the items *wealthy*, *powerful*, and *high social status*, and is the subscale that most closely tracked ratings for a *prestigious* item in the development of the scale (Berl et al. [in prep.]). Even so, it is somewhat surprising

that, although participants consistently perceive prestige as a multidimensional construct composed of these three subscales (shown in Berl et al. [in prep.]), they showed greater recall for speakers that displayed specifically these properties rather than others, such as the *educated* and *intelligent* items of the information subscale, and that it was more predictive of recall than the single integrative value of the scale. This could indicate that—in spite of the general perception of a multidimensional prestige concept—when people are placed in a transmission context they tend to cue in on the importance of an individual's status and relative position in a social hierarchy more than other aspects of prestige, including third-party views on their value (reputation) and their wealth of knowledge (information). This has potentially important implications for cultural evolutionary theory and for future empirical studies that operationalize and evaluate the role of prestige in cultural transmission.

We must also note that the binary prestige variable used in the main study performed better than any of the PRI variables in this reduced data set, but not to a large degree (see discussion of the R^2 values in Methods and Results). As we mentioned previously, this was likely the result of a poorer fit for a noisy continuous variable to a binary outcome than a binary predictor that depicts the same relationship. Using an established scale of individual prestige to break down participants' perceptions beyond a rough high-low distinction allowed us to gain insights into the finer details of the transmission process, such as the importance of the position subscale. Though not as important in terms of statistical fit, these distinctions were clearly important to our participants (at least in terms of their subconscious biases), judging by the influence of the position variable relative to other PRI variables.

In sum, these additional analyses have granted insights into the cultural transmission process and the intricate role that prestige plays in determining the salience of information. Prestige is a multidimensional concept, at least among participants that come from a WEIRD background (Henrich et al. 2010), and we have discovered that an individual's position in society was the most influential dimension when it came to the transmission and recall of artificial creation stories. Further work will be needed to investigate the nuances of prestige-biased transmission, to support or qualify the results found here, and to extend these lines of cultural evolutionary inquiry to other, non-Western societies with diverse perceptions of prestige (Berl and Gavin [in prep.]).