

The Cultural Evolution of Social Hierarchy: Dominance, Prestige, Social Learning

Volume 1 of 1

Submitted by **Ángel Victor Jiménez Infante** to the University of Exeter as a thesis for
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ABSTRACT

In this thesis, I focus on two broad research questions derived from a theory proposed by Henrich and Gil-White: (i) the use of prestige cues for social learning (**Chapters 2-4**) and (ii) dominance and prestige as two strategies to acquire high social rank and social influence in human groups (**Chapters 5-6**). In **Chapter 2**, I review the literature on the adaptive value and actual use of prestige-biased social learning, finding mixed support. **Chapter 3** tests whether information provided by high prestige sources of information is better transmitted than information provided by a low prestige source using a transmission chain experiment, finding no evidence to support this prediction. **Chapter 4** presents another transmission chain experiment testing whether dominance and prestige cues are better transmitted than medium social rank cues. I find better transmission of dominance and prestige cues than medium social rank cues, but no reliable differences in the transmission of dominance and prestige cues. **Chapter 5** reviews the literature on the dominance-prestige distinction and related areas of research. It proposes an integrated model to accommodate conflicting findings and extend its application to large-scale societies/groups with formal hierarchies. In **Chapter 6**, I find that economic uncertainty and intergroup conflict both predict preferences for both dominant and prestigious leaders using data from the World Values Survey. I also find that liberal ideology is positively related to perceptions of Donald Trump as dominant and Hillary Clinton as prestigious and negatively related to perceptions of Hillary Clinton as dominant and Donald Trump as prestigious, using survey data collected prior the 2016 US Presidential Election. Finally, Chapter 7 presents an overview of the thesis, discuss its implications for further research on prestige-biased social learning and social hierarchy and outlines new avenues for research.

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CHAPTER 1:

Introductory Remarks

1.1.- Introduction

Disciplines as varied as sociology, political sciences, anthropology, psychology, archaeology, biology and economics have for a long time recognised the importance of social hierarchies in configuring human social life. This academic interest is understandable given that social hierarchies are ubiquitous in human groups (Von Rueden, 2014) and that the rank that an individual occupies within social hierarchies is positively related to important outcomes such as greater reproductive success (e.g., Hill, 1984; von Rueden & Jaeggi, 2016), greater access to contested resources (Henrich & Gil-White, 2001) and better subjective wellbeing, self-esteem and health (Anderson, Hildreth, & Howland, 2015).

One of the theories of social hierarchy that has generated extensive research in the last two decades within the evolutionary human sciences and adjacent fields is Henrich and Gil-White's (2001) theory of the evolution of prestige. According to these authors, there exist two independent strategies that humans use to attain high social rank and social influence, which they labelled 'dominance' and 'prestige'. The *dominance strategy* entails the use of force and intimidation to elicit *fear* in other individuals. The *prestige strategy* entails the display of competence within socially appreciated domains to elicit *admiration* in other individuals. For Henrich and Gil-White, while the dominance strategy is common in social animals, the prestige strategy is exclusive to humans and it evolved as a way to select models from whom to acquire valuable knowledge/skills through social learning.

In this thesis, I focus on two broad research questions derived from Henrich and Gil-White's theory: (i) the use of prestige cues for social learning (**Chapters 2-4**) and (ii) dominance and prestige as two strategies to acquire high social rank and social influence in human groups (**Chapters 5-6**).

1.2.- Overview of the Thesis

To address the question about the use of prestige cues for social learning, I review the literature on prestige-biased social learning in **Chapter 2**. I focus on three key aspects of Henrich and Gil-White's theory. First, I discuss whether using prestige cues to select models from whom to socially learn is adaptive or not. To this end, I analyse whether there is a positive association between being prestigious and being competent within a valued domain and between being prestigious and being older. Second, I discuss two different types of prestige cues that people use to infer competence: first-order and second-order prestige cues. *First-order prestige cues* are cues related to characteristics of the target individual that can be assessed directly by the observer to infer competence. Examples of first-order prestige cues are being older or being generous. *Second-order prestige cues* are cues related to the behaviour of other individuals towards the target individual, which is a more indirect assessment of competence. Examples of second-order prestige cues are the amount of sustained attention and voluntary deference that individuals receive by others. Third, I explore the evidence for and against the actual use of prestige-biased social learning. In this review, I find mixed support for the adaptive value and use of prestige-biased social learning, provide a refinement of research predictions on prestige-biased social learning and present new avenues for research.

In **Chapter 2**, I find that one of Henrich and Gil-White's predictions, i.e., the greater memorability of information provided by high prestige than low prestige individuals, has been completely unexplored. Consequently, I test in **Chapter 3** this prediction using a transmission chain experimental paradigm (Bartlett, 1932; Mesoudi, 2007), which has the advantage of permitting the study of the effects of this predicted recall bias over multiple transmission events. I use two sets of arguments in favour of and against the replacement of computer tablets in primary schools as experimental materials to transmit across the chains. Prestige is manipulated by associating each set of arguments to a different source using a first-order prestige cue: job titles. These sources vary in the amount of prestige and relevance for the topic of the replacements of textbooks by computer tablets: the Head of the Department of Education of a leading university (high prestige, high relevance), an airline pilot (high prestige, low relevance) and a cleaner (low prestige, low relevance). The results do not support the prediction: information provided by high prestige sources is not better transmitted than information provided by low prestige sources.

Whereas **Chapter 3** focuses on the transmission of information provided by high prestige and low prestige sources, **Chapter 4** focuses on the transmission of social rank cues related to prestige and dominance. As experimental materials, I use descriptions of three football players, who are described as either high prestige, high dominance or medium social rank using different social rank cues (e.g., being admired, being feared, and not arousing strong emotions, respectively). I predict that both high prestige cues and high dominance cues are better transmitted than medium social rank cues, while high dominance cues are better transmitted than high prestige cues. This second prediction is derived from the assumption that avoiding the costs inflicted by dominant individuals is more

important than obtaining the social learning and material benefits provided by prestigious individuals. The results of the study support the first prediction: high prestige and high dominance cues are better transmitted than medium social rank cues. However, the results did not support the predicted superior transmission of dominance cues over prestige cues, which did not differ in transmission fidelity.

To address the question about dominance and prestige as two strategies to acquire high social rank and social influence, I review the relevant literature on this topic in **Chapter 5**. I distinguish between three relevant levels of analysis: (i) strategies to acquire high social rank and influence, (ii) dimensions of social rank and (iii) consequences of the dimensions of social rank. First, I discuss whether there are indeed two strategies to acquire high social rank and social influence (dominance or prestige) as proposed by Henrich and Gil-White, only one (competence; Chapais, 2015; Ridgeway & Diekema, 1989), three (dominance, competence and altruism/morality; Bai, 2016) or multiple strategies to acquire coercively imposed social rank (physical dominance and leverage; Lewis, 2002) and multiple strategies or components of the same strategy to acquire voluntarily conferred social rank (competence, generosity and social connectedness; Anderson & Kilduff, 2009). Second, I analyse dominance and prestige as two different dimensions of social rank within small face-to-face groups without formal hierarchies and compare this with social psychologists' distinction between power and status. Third, I analyse the similar and differential consequences of dominance and prestige dimensions on social influence, attention, deference, social learning and fitness. Lastly, I outline a model, which integrates research on the dominance-prestige distinction with research on social psychology and related fields.

One of the problems identified in **Chapter 5** with the dominance-prestige distinction is its application to large-scale societies with formal positions of leadership (e.g., Prime Minister, President) and complex ingroup vs outgroup social dynamics. In **Chapter 6**, I elaborate further my critique of current applications of the model to this type of societies and, more specifically, to the use of this distinction to explain the recent rise of right-wing populist leaders such as Donald Trump (Kakkar & Sivanathan, 2017; McAdams, 2017). I also analyse data from the World Values Survey to test whether preferences for dominant and prestigious leaders could be predicted by economic uncertainty, perceived lack of control and intergroup conflict. I find that both economic uncertainty and intergroup conflict predict preferences for both dominant and prestigious types of political leaders, while perceived lack of control is not a reliable predictor of preferences for these types of leaders. Similarly, I re-analyse data collected by Kakkar and Sivanathan (2017) to test whether political ideology influences the perceptions of the political leaders Donald Trump and Hillary Clinton as dominant or prestigious. I find that, rather than leaders being universally perceived as either dominant or prestigious, these perceptions are influenced by the ideology of the perceiver: liberal ideology is positively related to perceptions of Donald Trump as dominant and Hillary Clinton as prestigious and negatively related to perceptions of Hillary Clinton as dominant and Donald Trump as prestigious. I also compare the strength of political ideology and economic uncertainty in predicting preference for Donald Trump. Contrary to previous claims (Kakkar & Sivanathan, 2017), the results show that political ideology is a much stronger predictor of preference for Trump than economic uncertainty.

In **Chapter 7**, I summarize all of the thesis findings, integrate the different pieces of empirical evidence, and suggest new avenues for research on prestige-biased social learning and social hierarchy.

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CHAPTER 2:

Prestige-biased Social Learning: Current Evidence and Outstanding Questions

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This chapter was conceptualised by Alex Mesoudi and me. Original draft was written by me. It was reviewed and edited by Alex Mesoudi and me.

2.0.- Abstract

Cultural evolution theory posits that a major factor in human ecological success is our high-fidelity and selective social learning, which permits the accumulation of adaptive knowledge and skills over successive generations. One way to acquire adaptive social information is by preferentially copying competent individuals within a valuable domain (*success bias*). However, competence within a domain is often difficult or impossible to directly assess. Almost 20 years ago, Henrich and Gil-White (H&GW) suggested that people use indirect cues of success (e.g., differential levels of attention paid to models by other social learners) as adaptive short-cuts to select models from whom to learn. They called this use of indirect markers of success *prestige bias*. In this review, I re-visit H&GW's proposal, examining the evidence amassed since for the adaptiveness and use of prestige bias in humans. First, I briefly outline H&GW's theory. Second, I analyse whether prestige is associated with competence within valuable domains, which is a crucial assumption underlying the adaptiveness of prestige bias. Third, I discuss prestige cues that people use to infer success (e.g., the amount of voluntary deference and attention received by models). Fourth, I examine the evidence for and against the use of prestige bias in human adults and children. Finally, I point out limitations in the current literature and present new avenues for research on prestige bias.

2.1.- Introduction

Cultural evolution theory posits that a major factor in human ecological success is our high-fidelity and selective social learning, which permits the accumulation of valuable knowledge and skills over successive generations. One of the most cited types of selective social learning in the cultural evolution literature is to copy the behaviours of individuals highly respected and admired in a social group (i.e., prestigious individuals), known as *prestige bias*. Almost 20 years ago, Henrich and Gil-White (henceforth H&GW) developed a theory of the evolution of prestige. The distinctive features of this theory were the consideration of prestige as an alternative route to dominance to attain and maintain high social rank in humans and the relevance attributed to social learning in the evolution of prestige (Henrich & Gil-White, 2001). In this article, I focus on a crucial aspect of H&GW's theory: the adaptive value and actual use of prestige-biased social learning in humans. In the following, I first outline H&GW's theory. Second, I analyse whether prestige is associated with competence within valuable domains and older age. Third, I discuss which types of first-order (e.g., age) and second-order (e.g., the distribution of freely conferred deference) cues of prestige people use to infer competence within a valued domain. Fourth, I examine the evidence for and against the use of prestige bias in human adults and children. Finally, I point out limitations in the current literature and present new avenues for research on prestige bias.

2.2.- Social Learning and the Evolution of Prestige

Following H&GW, *social rank*¹ is defined as a hierarchy of rewards and/or displays in which individuals at the top enjoy privileges (e.g., preferential access to resources usually without resistance from other in-group members), are influential, and receive deference (i.e., manifestations of respect and submission to their wishes). High social rank is generally desirable and is positively associated with reproductive success in many societies (Betzig, 1988; Chagnon, 1988; J. Hill, 1984; Mealey, 1985; von Rueden, Gurven, & Kaplan, 2010; von Rueden & Jaeggi, 2016).

According to H&GW, people use, not necessarily consciously, two distinct strategies to acquire and maintain high social rank: dominance and prestige (see also Cheng & Tracy, 2014; Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013). The *dominance strategy* involves causing, or threatening to induce, costs to other individuals. If the use of this strategy is successful, this elicits *fear* in the other individuals, who defer and submit to the wishes of the dominant individual to avoid the potential costs. In contrast, the *prestige strategy* involves displaying more competence than others in valued domains. If the use of this strategy is successful, this elicits *admiration* in other individuals, who defer and submit to the wishes of the prestigious individual in order to gain access to, and thus socially learn from, this individual, and to acquire other benefits such as private and public goods (Anderson & Kilduff, 2009a; Cheng & Tracy, 2014; Henrich, 2016; Price & Van Vugt, 2014; Von Rueden, Gurven, & Kaplan, 2008). Although the successful use of both strategies leads to receiving deference from other individuals, the key

¹ In reality, H&GW use the word “status”. I prefer the word “social rank” as there is an emerging consensus in the literature to use social status and prestige as synonyms (e.g. Anderson, Hildreth, & Howland, 2015; Cheng & Tracy, 2014) or as closely related terms (e.g. Blader & Chen, 2014)

distinction between them is that dominant individuals receive *coerced deference*, while prestigious individuals receive *voluntary (or 'freely-conferred') deference*.

H&GW argue that the dominance strategy is phylogenetically ancestral to our species. Humans share this strategy with non-human primates (e.g., de Waal, 2000) and other social animals. In contrast, H&GW believe that the prestige strategy is probably unique to humans (but see Chapais, 2015; Garfield, von Rueden, & Hagen, 2018; Horner, Proctor, Bonnie, Whiten, & de Waal, 2010; Kendal et al., 2015 for evidence of prestige in non-human animals). This is because they assume that the evolution of prestige required high-fidelity social learning, which is arguably much more developed in humans than in other animals (Herrmann, Call, Hernandez-Lloreda, Hare, & Tomasello, 2007; Tennie, Call, & Tomasello, 2009). According to H&GW, the selective pressure that drove the evolution of prestige was the need to identify individuals within a group (i.e., not only kin) with “better-than-average” knowledge/skill from whom to learn (but see Barkow, 1989, 2014; Chapais, 2015 for alternative explanations for the evolution of prestige). Copying these individuals within domains such as medicinal plant knowledge or hunting techniques would have led to the acquisition of fitness enhancing knowledge/skills. However, directly inferring superior knowledge/skill is often difficult or costly. For instance, accurately assessing hunting skill is difficult when hunting highly dispersed large-size game in fluctuating environments, in which the variation in caloric returns does not depend exclusively on hunting skill (K. Hill & Kintigh, 2009). Under these circumstances, the use of less direct but more readily available proxies for identifying knowledgeable/skilful individuals may be often adaptive. Such proxies include the amount of copying, attention and deference (i.e., costs paid in exchange for access to the model) that individuals *freely receive*. These prestige

cues act as indirect cues of success to select models from whom to learn (Henrich, 2016).

H&GW also formulated a number of predictions derived from their theory of the evolution of prestige, and their theory has inspired a number of related predictions (Table 1, see also Table 2 for a full list of predictions derived from the present review).

Predictions about prestige, success, age and generosity.

- i) Skilled/knowledgeable individuals are prestigious¹
- ii) Older individuals tend to be more prestigious than younger ones ¹
- iii) Generous individuals tend to be prestigious ²

Predictions about behaviours towards knowledgeable/skilful/prestigious individuals

- iv) Knowledgeable/skilful/prestigious individuals receive freely conferred deference¹
- v) Knowledgeable/skilful/prestigious individuals are paid more attention to ¹
- vi) People seek proximity to knowledgeable/skilful/prestigious individuals ¹
- vii) People preferentially copy knowledgeable/skilful individuals ^{1 3}

Predictions about prestige and social learning.

- viii) People preferentially copy prestigious over non-prestigious individuals ¹
- ix) When success information is absent or difficult to assess, people preferentially copy prestigious individuals ⁴
- x) The use of prestige-biased social learning is more frequent in younger people or people with lack of experience in a given domain⁵
- xi) Prestigious individuals are influential/copied, even beyond their domain of expertise ¹

Table 1. Predictions about Prestige Bias Derived from the Existig Literature.

¹ (Henrich & Gil-White, 2001); ² (Henrich, 2016); ³ (Boyd & Richerson, 1985); ⁴ (Atkisson, O'Brien, & Mesoudi, 2012); ⁵ (Little, Caldwell, Jones, & DeBruine, 2015).

Predictions about prestige and success (Section 2.3)

- i) Prestigious individuals tend to be successful either in currently important domains for a social group or in domains which were valued in the recent past.
- ii) Prestigious individuals only achieve social influence when their domain of prestige is currently valued for a social group
- iii) The positive association between perceived success within a domain and prestige will be higher than the positive association between actual success within the same domain and prestige

Predictions about prestige and age (Section 2.3)

- iv) The association between age and prestige is stronger for domains in which there is no clear evidence of success
- v) Older individuals tend to be prestigious in stable environments, while younger individuals tend to be prestigious in rapidly changing environments
- vi) A positive relationship between age and prestige only holds for ages prior reaching the peak on skill. Beyond that point the age-prestige relationship will either plateau or decrease depending on the importance of the domain for a social group

Predictions about prestige and social learning (Section 2.5)

- vii) The more positively correlated are prestige and success, the more people will use prestige-biased social learning. (2.5.1)
- viii) People will use more prestige-biased social learning when the task is relevant and difficult than when the task is irrelevant and easy for them(2.5.5)
- ix) Prestigious individuals will be copied more when the variation in knowledge/skill within a group is large than when this variation is small (2.5.2)
- x) Cross-domain prestige bias should occur more when cues are noisy within the tested domain than when these cues are clear (2.5.4)
- xi) Cross-domain prestige bias should occur when there are domain-general traits like IQ that make people successful across domains (2.5.4)

Table 2. Predictions about Prestige Bias Derived from the Present Review

2.3.- Prestige, Competence and Age

H&GW predict that knowledgeable/skilful individuals tend to acquire prestige (prediction i in Table 1). This prediction is based on their assumption that people defer to knowledgeable/skilful individuals to obtain preferential access to them, and consequently increase valuable social learning opportunities. H&GW

support their prediction with ethnographies that show that prestige is associated with skill/knowledge in valued domains such as hunting (e.g., Holmberg, 1969, pp. 144-145; Lee, 1979, pp. 343-344), supernatural knowledge (e.g., Lee, 1979, pp. 343-344) or combat (e.g., Patton, 2000) in many foraging societies. More formally, this association between prestige and knowledge/skill has been supported by a recent study looking at more than 1000 ethnographical texts on leadership pertaining to 60 cultures contained in the Human Relations Area Files (HRAF) (Garfield, Hubbard, & Hagen, 2019). Moreover, H&GW assumed that prestige and skill/knowledge in valued domains is also positively correlated in modern post-industrial societies as for the case of male adolescents conferring prestige to peers with high athletic skills (Coleman, 1961, pp. 130-135). Similarly, H&GW predict that older individuals have higher prestige than younger ones, as older individuals have more experience in life and have had time to accumulate greater knowledge and refined skills (prediction ii in Table 1). They support this prediction with ethnographic evidence (Maxwell & Silverman, 1970; Simmons, 1945/1970). However, they do not mention modern post-industrial societies, which makes it difficult to know whether they assume that this correlation also holds in such societies.

Reyes-Garcia et al. (2008) tested these predictions with the Tsimane, an indigenous population from the Bolivian Amazon. Participants were asked to list all the important men in the village and say why they were important. Most of the nominations went to people with formal high rank positions (72%), with the remaining nominations given due to the nominees' personal attributes (12.5%), including being knowledgeable (2.5%). The initial measure of prestige was the number of nominations due to personal attributes. The measure of knowledge was ethnobotanical plant knowledge derived using cultural consensus analysis,

i.e., the most common response to whether each of 15 plants had medicinal properties was considered the correct answer. The results did not support either of the two predictions: neither ethnobotanical medicinal knowledge nor age were significantly associated with their measure of prestige.

However, there are several potential explanations for this null finding. When prestige was measured by the raw number of nominations instead of only the nominations due to personal attributes, prestige was positively and significantly associated with having a formal position the previous year and with being born in the 1970s. This latter result might be due to the recent increase in life expectancy in this society, which may have disrupted the predicted association between prestige and age. Alternatively, Reyes-Garcia et al. suggest that the training provided by missionaries to young men to become competent bilinguals (Spanish/Tsimane) and spread the biblical message gave men born in the 1970s the skills to “navigate between the two worlds” (p.280). This might explain their current higher prestige, as opposed to older men with superior ethnobotanical knowledge.

In the same population, Von Rueden et al. (2008) found a strong positive association between hunting ability and respect, i.e., the extent that a person is considered worthy of being admired, which can be seen as equivalent to H&GW’s prestige. This supports H&GW’s prediction of a positive correlation between knowledge/skill and prestige. Nevertheless, hunting is losing its importance in the studied village due to acculturation and has no effect on community-wide influence, measured as the influence of an individual in the resolution of a dispute during a community-wide meeting. Von Rueden et al. (2008) believe that the social transformation experienced by the Tsimane society might explain why

hunting skill is correlated with respect but not with community-wide influence. Conferring respect to people with highly relevant skills in the past might be a residue of “old-fashioned” values, but these values do not predict community-wide influence because these skills are no longer useful. In contrast, currently relevant skills (e.g., formal education and Spanish fluency) within this society were significant predictors of community-wide influence (see predictions i-ii in Table 2). These authors also found an inverted-U-shaped relationship between age and each of four measures of high rank (success in a physical confrontation, getting one’s way in the group, community-wide influence and respect).

Henrich and Henrich (2010) found that, as predicted, prestige (being nominated as a *yalewa vuku* or ‘wise woman’) was positively associated with medicinal plant knowledge and age, while controlling for years of education in Fijian society. However, medicinal plant knowledge was assessed only indirectly as the number of nominations of women considered to know the most about medicinal plants (perceived knowledge), rather than direct assessments of actual knowledge. In a different study, Henrich and Broesch (2011) tested the same predictions in three Fijian villages, although also indirectly. The outcome variable there was the probability of an individual being selected as a model from whom to learn in each of three domains (fishing, growing yams and medicinal plants). Perceived success in another domain (cross-domain success) was used to measure prestige. The results supported the prediction of the positive association between prestige and knowledge/skill in different domains. Nevertheless, fishing and yam growing success were much better predictors of prestige (cross-domain success) than plant knowledge. Age was a significant predictor of being selected as a model from whom to learn in the domains of growing yams and medicinal plant knowledge in one of the villages and of fishing and medicinal plant

knowledge in the entire sample. Henrich & Broesch reasoned that, because age is an indirect indicator of success, age is a much more relevant cue in domains such as medicinal plant knowledge in which there does not exist clear evidence of success (see prediction iv in Table 2). This potential explanation constitutes an important nuance to the original prediction (prediction ii in Table 1) by H&GW.

In the Hazda, hunter-gatherers in Tanzania, Stibbard-Hawkes, Attenborough, and Marlowe (2018) found that hunting prestige (measured using photo-rankings of hunters) positively predicted three measures of actual hunting success (aim with bow and arrow, pull strength and knowledge of animal vocalizations) but was uncorrelated with a fourth measure (visual acuity). These measures were collected by the researchers by implementing tasks such as an archery contest or using a digital bow pull scale. Similarly to Von Rueden et al. (2008), they found an inverted-U-shaped relationship between age and hunting prestige, and age and hunting success, which might be consequence of the decline of hunting skill after reaching peak skill at 40-55 years of age.

While suggestive, most of these studies do not provide clear evidence to effectively determine whether prestige is positively associated with knowledge/skill and/or age. The most important limitation is that all of the studies (except Stibbard-Hawkes et al, 2018 and von Rouden et al., 2008) used measures of prestige that cannot be easily equated to H&GW's original definition of prestige. The study by Reyes-Garcia et al. (2008) measured the number of nominations of people who were considered "important" within Tsimane villages, which led participants to nominate people with formal leadership positions. Therefore, it confuses power and prestige. Similarly, Henrich and Broesch's (2011) measure of prestige as cross-domain success is also problematic

because prestige was initially considered to be domain-specific (H&GW, p. 170), although with some contradictions (“prestigious individuals are influential even beyond the domain of expertise”, H&GW, p. 184). Another limitation of some of these studies (Henrich & Broesch, 2011; Henrich & Henrich, 2010) is the use of perceived success instead of assessing success directly using objective measures as in the study by Stibbard-Hawkes et al, 2018. Although perceived success and prestige within a domain should be positively correlated given the fact that perceptions of success confer prestige, this does not serve to assess the adaptive role of prestige bias. In order to be adaptive in the first place, prestige should positively correlate with actual success (see prediction iii in Table 2). Using the most common answer as a measure of correct knowledge (Reyes-Garcia et al., 2008) is also problematic, as the most frequent answer might be wrong.

To sum up, it is difficult to convincingly say whether there exists an association between prestige and knowledge/skill, and prestige and age. Future research should use better defined, or more direct and relevant, measures of prestige. However, the reviewed studies are useful for refining the research agenda. For example, the inverted U-shaped relationship between prestige and age found by Von Rueden et al. (2008) and Stibbard-Hawkes et al, 2018 is more plausible than a linear relationship if prestige is correlated with skill and there is a decline in physical and cognitive abilities with older age (see H&GW p. 182 and Supplementary Materials in Henrich and Henrich, 2010, p.4, see prediction vi in Table 2). Moreover, older age might be an inefficient cue of prestige in societies where traditional skills/knowledge have decreased in importance and new skills have become more important for the community (e.g., speaking Spanish to deal with the outside world in Tsimane society, or computer skills in post-industrial

technological society). Consequently, older age is a relevant cue of prestige only when the environment changes at a relatively slow rate, such that the correlation between prestige and knowledge is stable across cultural generations (Henrich, 2016). Rapid environmental change, however, disrupts the positive correlation between valuable knowledge and age as it leads to “a high rate of informational obsolescence” (Maxwell & Silverman, 1970, p. 388), which might even lead to prestige being conferred on to younger individuals (Spisak, Grabo, Arvey, & van Vugt, 2014; see prediction v in Table 2).

2.4.- Prestige Cues

To select the best models from whom to learn, social learners can directly assess the competence of different models within a valued domain. For instance, seeing a model successfully hunting large prey or scoring several goals during a football match leads the social learner to infer that the model is successful within those domains. Of course, their success on one day might not be a reliable indicator of their general, sustained success within a domain, but the social learner can update this information when more information is provided (e.g., the results of the next hunting expedition or football match). Nevertheless, assessing competence through this procedure may be costly and noisy. Instead, social learners can use short-cuts either by making inferences from the appearance, personality, material possessions, etc. of the models, which I call *first-order cues*, or by relying on the behaviours of other social learners towards the models, which I call *second-order cues*. Both types of cues can be cheap ways to acquire valuable information, although they can also lead to useless or maladaptive behaviour.

2.4.1.- First-order Cues

The basis for the usefulness of first-order cues is that these short-cuts are usually positively associated with competence within valuable domains and/or confer prestige due to their close relationship with competence. For instance, the age of a model can be used to infer knowledge and skill as older individuals generally have more experience within a valued domain and, therefore, they can usually provide higher quality information. This cue is especially used and useful for young children as it is less cognitively demanding than other cues such as professed knowledge (Wood, Kendal, & Flynn, 2012). Nevertheless, the usefulness of using age to socially learn depends on the social context and the pace of environmental change (see Section 2.3).

Generosity has also been linked to prestige (prediction iii in Table 1) in experiments (e.g., Flynn, Reagans, Amanatullah, & Ames, 2006; Halevy, Chou, Cohen, & Livingston, 2012; Hardy & Van Vugt, 2006; Willer, 2009) and ethnographic observations (e.g., Konečná & Urlacher, 2017; Price, 2003; Radcliffe-Brown, 1964). Because prestigious individuals tend to be both competent and generous (Cheng & Tracy, 2014; Cheng, Tracy, & Henrich, 2010; Henrich, 2016), at least towards members of their ingroup, generosity can be used as a proxy for competence. According to H&GW, this link is probably due to the fact that providing public goods is an excellent way to signal competence and, therefore, to receive further deference, which might be translated into fitness gains. Nevertheless, wealth is often inherited and, therefore, the relationship between being generous (e.g., providing private and public goods to other people) and being competent does not always hold. Moreover, generosity might

be valued independently to competence (Bai, 2016) due to the direct benefits (e.g., private and public goods) provided to the group.

The self-assessment of one's ability, which if positive can lead to high self-confidence, is often used as a proxy for competence. In fact, assertive and confident individuals tend to be granted higher social rank within groups (Anderson & Kilduff, 2009b). Although confidence is likely to be associated with competence in many circumstances (e.g., people who do not know about a topic cannot usually communicate their knowledge about it effectively), copying or conferring high social rank to overconfident models (i.e., models who overestimate their knowledge) might not be the best strategy, as other models will outperform them in reality. Similarly, pride displays, which generally occur after an achievement, are often proxies for competence and social rank (Tracy, Shariff, Zhao, & Henrich, 2013). Nevertheless, the actual relationship with competence might depend on the type of pride display (i.e., authentic vs hubristic pride, see Cheng et al., 2010). Similarly, job titles within appreciated domains (e.g., doctor) and academic titles conferred by leading universities (e.g., Oxford or Harvard) also act as prestige cues (Burriss, 2004; Dalmaso, Pavan, Castelli, & Galfano, 2012) in post-industrial societies. The same can be said for possessing wealth (Cheng & Tracy, 2013), prestige goods (Plourde, 2008) and wearing particular types of clothing such as suits (Bickman, 1971; DeWall & Maner, 2008; Maner, DeWall, & Gailliot, 2008). Nevertheless, it is necessary to emphasize that the identification of these cues as prestige cues has a subjective component because they depend on the values of the social learners and their social group. For instance, wearing a suit might be an inadequate cue of prestige within the punk rock scene, while having a multicolour Mohawk can be used as a prestige cue within this subculture. Likewise, a successful footballer might not be

considered prestigious within a group of people who do not like football, as football is not a valuable domain for them. Consequently, research using first-order prestige cues should ensure that these cues are relevant for the participants.

In summary, although first-order cues have the clear advantage of being less cognitively demanding than assessing the success of a model directly, they are prone to be unreliable for two reasons. First, the relationship of some of these cues (e.g., age, or job titles) with competence depends on the task, context and/or rate of ecological and social environmental change. Second, some self-generated first-order cues (e.g., confidence) are open to cheating or deception, especially when prestigious individuals receive material or other benefits. Nevertheless, generosity is a self-generated first-order cue which is especially difficult to fake (Barclay, 2013).

2.4.2.- Second-order Cues

According to H&GW, individuals give freely conferred deference, pay more attention, seek proximity to, and copy, competent individuals (predictions iv-vii in Table 1). Consequently, social learners can use the behaviours of other individuals towards the models to select models from whom to learn. These second-order cues have the advantage of being considerably more difficult to fake and of being regularly updated.

The voluntary payment of costs (freely-conferred deference) in exchange for access to prestigious models (prediction iv in Table 1) is a central aspect of H&GW's theory. H&GW argue that prestigious individuals are respected, receive unsolicited help, and are freed from some social obligations because social

learners use these deference displays to try to grant themselves (not necessarily consciously) preferential access to prestigious individuals to gain valuable social learning opportunities. This preferential access to the models is important as many different skills contribute to the success of a model within a valued domain. H&GW gave the example of the potential factors involved in hunting success such as being good at making bows, aiming, tracking and approaching prey as well as more indirect factors such as sleeping well or having an appropriate diet to maintain good eyesight. (Note, however, that if many people show deference to the same individual, the probability of gaining social learning opportunities would be small. Therefore, the adaptive value of paying deference to a highly deferred demonstrator might be minimal.)

Although the study was not conceived to test H&GW's prediction, van der Vegt, Bunderson, and Oosterhof (2006) found that students who self-perceived themselves as having low expertise carrying out a research project within four-person groups were more committed (measured with items like "I am very committed to maintain my relationship with X") and provide more help (measured with items like "I assist X with difficult assignments, even when assistance is not directly requested"; "I help X when s/he is running behind in his/her work activities") to individuals perceived as experts within their group. Consistent with H&GW's prediction, this suggests that deference (helping and commitment) was provided towards perceived experts to incentivise their contribution to the group task and receive help from those experts. Importantly, this reciprocity in the exchange of help and commitment between members with high and low expertise was associated with higher performance in the task. This highlights the adaptive nature of this exchange, which has also been shown theoretically by Panchanathan (2010). Experimental evidence has also shown that high prestige

individuals are paid more attention than low prestige individuals (Cheng et al., 2013; Dalmaso, Galfano, Coricelli, & Castelli, 2014; Dalmaso et al., 2012; DeWall & Maner, 2008; Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010; Gerpott, Lehmann-Willenbrock, Silvis, & Van Vugt; Maner et al., 2008; Ratcliff, Hugenberg, Shriver, & Bernstein, 2011) and that successful individuals tend to be copied (Atkisson, O'Brien, & Mesoudi, 2012; Burdett et al., 2016; McElreath et al., 2008; Mesoudi, 2008; Wood, Kendal, & Flynn, 2013), which provide support for H&GW's predictions about attention (prediction v) and copying (prediction vii in Table 1). This makes deferential, attentional and copying cues reliable cues to infer the prestige of an individual in a social group.

To my knowledge, no research has looked directly at the proximity-management strategies of social learners towards high prestige individuals. However, experimental research with WEIRD (Western, Educated, Industrial, Rich and Democratic, see Henrich, Heine, & Norenzayan, 2010) samples shows that prestige positively predicts being liked (Brand & Mesoudi, 2018; Cheng et al., 2013), and preferred as a holiday companion, business partner, neighbour (Kruger & Fitzgerald, 2011) and long-term mate (Kruger & Fitzgerald, 2011; Snyder, Kirkpatrick, & Barrett, 2008). This provides tentative support for H&GW's prediction on proximity-management towards prestigious individuals (prediction vi in Table 1). However, it is possible that this proximity-management might be motivated by other concerns (e.g., coalitional support) than social learning, which is necessary for supporting H&GW's model. Furthermore, the ethnographical record shows little support for the assumption (prediction viii in Table 1) that underpins all these predictions, that is the preferential copying of what prestigious individuals do (Garfield, Hubbard, et al., 2018). Nevertheless, this absence of

evidence might be motivated by the lack of interest of earlier anthropologists in social learning.

2.5.- Prestige-biased Social Learning

2.5.1.- Prestige and Success Biases

H&GW predict that prestigious individuals are preferentially copied, which is known as *prestige bias* (prediction viii in Table 1). Importantly, this prediction should only hold when both individual learning and the direct assessment of knowledge/skill of a model are costly or difficult. When the acquisition of knowledge/skill through individual learning is relatively cheap, the use of prestige bias (or social learning in general) is less useful. Similarly, when information about the success of individuals is directly available, people should use this information to select models (*success bias*) rather than prestige (prediction ix in Table 1).

Consequently, Atkisson et al. (2012) compared prestige and success biases in the laboratory. Participants played a computer-based task in which they designed virtual arrowheads over a series of trials (see Mesoudi, 2008; Mesoudi & O'Brien, 2008). Participants could improve their arrowhead by either individual or social learning. There were three hunting seasons. Prestige information (time spent by each of the participants looking at the arrowheads designed by each of the four other participants) was provided to participants throughout the experiment. Success information (score of the four different individuals who used different arrowheads) was only provided in season 3. The results supported the prediction about the use of prestige bias: prestige information increased the likelihood of an arrowhead being copied during seasons 1 and 2 compared to the

other arrowheads. In contrast, the results did not support the prediction about the replacement of prestige bias by success bias when both success and prestige information are available: prestige and success cues were used similarly during season 3, even though prestige was not correlated with success in the experiment.

This experiment provides convincing evidence for prestige bias. Nevertheless, it is not clear why participants used prestige and success cues in a similar way in Season 3. Atkisson et al. (2012) argue that participants use prestige cues to socially learn in their everyday life and this extends to their behaviour in the laboratory. It is also possible that success needs to be observed over longer periods of time to replace prestige bias. Alternatively, perhaps participants were over-trained to use prestige cues in Seasons 1-2 and carried this into Season 3. A replication adding a second condition, in which success cues are provided during Seasons 1-2, might clarify this. We might expect participants to learn more easily that success cues are superior to prestige cues in this case. Finally, it would be interesting to systematically manipulate the correlation between prestige and success, to see whether prestige cues are only used when prestige is positively correlated with success (see prediction vii in Table 2).

2.5.2.- Variation in the Use of Prestige Bias with Experience and Age

Exploratory analyses by Atkisson et al. (2012) showed that the use of prestige and success biases was greater when participants performed badly in the previous three trials. Another circumstance that might prompt greater use of these biases is the lack of previous experience within a domain. Consequently, the lower level of experience of younger people compared to older people might

make younger people more prone to copy prestigious/successful individuals (prediction x in Table 1).

Little, Caldwell, Jones, and DeBruine (2015) tested this prediction in the domain of mate choice. In an initial experiment, female participants rated the attractiveness of young, artificially-created male faces paired with female faces with different degrees of prestige, which was manipulated by presenting a numeric score of popularity. As predicted (prediction viii in Table 1), model popularity positively predicted ratings of male face attractiveness. Moreover, older participants were less likely to be influenced by the popularity of the models than younger participants, consistent with the prediction that prestige bias should vary with experience/age. However, a limitation of this experiment is that the male faces being rated were all very young. Given evidence that women are less attracted to men who are considerably younger than themselves than men who are of similar age or older (Buss, 1989; Buunk, Dijkstra, Kenrick, & Warntjes, 2001; Schwarz & Hassebrauck, 2012), this may explain the age effect rather than experience. This was addressed by Little et al. in a subsequent experiment, which used real photographs and in which three age groups were used for both participants (16-25, 26-32, 32-61) and stimuli (18-25, 26-32, 32-40). Again as predicted, model popularity positively predicted the ratings of attractiveness for the younger group (16-25 years old) but not for the older groups of participants (25-32, 32-61). Nevertheless, the problem remained: a considerable number of participants in the oldest group ($M=41.6$, $SD=8.1$) were still rating exclusively much younger male faces than themselves. Consequently, the interpretation of the findings requires similar caution. Moreover, the effect size was more than double for the interaction between age of the face and participants' age ($\eta_p^2=0.10$) than for the interaction between model popularity and participants' age

($\eta_p^2=0.04$). This suggests that rather than experience-dependent prestige bias, Little et al.'s findings can be explained by the congruency between age of faces and age of participants. Further experiments should ensure that the stimuli are maximally relevant for the participants.

Contrary to Little et al.'s prediction, the *two-stage social learning model* (Henrich & Broesch, 2011; Henrich & Henrich, 2010; Kline, Boyd, & Henrich, 2013) predicts a greater use of prestige bias with age/experience. As there exists a trade-off between the access costs to different models and the fitness-enhancing information that can be acquired from the models, social learners should first learn from low access cost models (e.g., relatives, neighbours, friends) and later further improve their knowledge/skill by copying prestigious and/or successful models. This updating process would be more noticeable when there is large variation in knowledge/skill within a given domain so that social learners would benefit more from copying high competence models using success or prestige cues. When the variation is small, most social learners would not copy successful/prestigious models because much of the information they can learn from them is shared by almost everyone in the social group and, therefore, they can learn fitness-enhancing knowledge/skills from low access cost models instead (Henrich & Henrich, 2010; see prediction ix in Table 2). Mathematical models that include a combination of vertical and oblique transmission have shown that, if some members of each generation use model-based biases (e.g., prestige bias, success bias), fitness-enhancing knowledge/skills will spread in a population over generations, leading to the emergence of cultural adaptation (Boyd & Richerson, 1985; Henrich, 2004; Powell, Shennan, & Thomas, 2009). This gives plausibility to the adaptive value of the two-stage social learning model.

This pattern seems to be the case in the transmission of adaptive food taboos related to pregnancy and breastfeeding in Fijian villages. According to Henrich and Henrich (2010), the pattern of transmission is mainly from older (i.e., mothers, grand-mothers, mothers-in-law) to younger (i.e., daughters, granddaughter, daughters-in-law) female relatives. Nevertheless, a substantial minority (almost 25%) of participants in this study reported to have learnt the taboos from the *yalewa vuku* (wise women, who were equated to prestigious individuals), or *the elders* (almost 33%). Although this gives tentative support for the emergence of cultural adaptation through a combination of vertical and oblique transmission, it is not clear whether prestige-biased transmission was greater at an older than a younger age. The acquisition of relevant skills for wild honey collecting among male Jenu Kuruba in South India also seems to follow the two-stage social learning model. According to Demps, Zorondo-Rodríguez, García, and Reyes-García (2012), most honey collecting knowledge/skill is acquired in this population at younger ages: most people reported to learn tree climbing at 6-9, making a smoky torch at 10-15, and cutting honey combs at 16-21. Importantly, most of the knowledge/skills were learnt from relatives (fathers, brothers, and elder kin) but learning from successful individuals and co-workers became more important with age. Nevertheless, the two-stage social learning model is not specific to the use of prestige cues (see Lucas et al., 2016 for further discussion and experimental evidence).

2.5.3.- Prestige Bias and Overimitation

If prestige bias is especially likely to be used when success is difficult to directly assess (see Section 2.2), people should copy irrelevant actions carried out by prestigious individuals when the link between each action and success in

the task is not clear for them. Experiments on overimitation, the tendency to copy irrelevant actions to obtain a reward, have looked at whether younger children overimitate high social rank models. McGuigan (2013) conducted an experiment in which 5 year olds viewed videos with one of four models with high or low social rank performing irrelevant actions (e.g., removing a bolt) and relevant actions (e.g., extracting the sticker with the tool) to obtain a sticker from a transparent box. The high social rank models were the participants' head and class teacher. The low social rank models were a familiar model (a researcher who had carried out research with the children during the previous week) and an unfamiliar model (a totally unacquainted individual for the children). As predicted, children copied irrelevant actions significantly more when they came from the high social rank models than from the low social rank models. Nevertheless, pairwise comparisons only found significant differences between the head teacher and both low rank models. Moreover, the copying of relevant actions was not affected by models' rank. Alternative factors, rather than prestige, might account for the results, as the high rank models were also more familiar to the children and held a position of authority over them.

In contrast, Chudek, Baron, and Birch (2016) obtained findings that cast doubt on importance of model-based biases in overimitation. Children aged 2-7 years viewed videos with two female adult models trying to obtain stickers from a puzzle box. In one condition, the models had low or high prestige, which was manipulated by showing two individuals carefully looking at the actions performed by one model (high prestige) while ignoring the actions of the other model (low prestige). In another condition, the models had high or low success, which was manipulated by the models either saying they obtained five (high success) or zero (low success) stickers. While overimitation generally increased with age, there

was no selectivity at any age: the children were equally likely to overimitate successful and unsuccessful, and prestigious and non-prestigious, models. Importantly, these negative results were found using models who were not familiar to the children and who did not have a position of authority over them, suggesting that these factors might have driven the selective overimitation in McGuigan's (2013) experiment.

2.5.4.- Prestige Bias Beyond the Domain of Prestige

H&GW predict that prestigious individuals are influential beyond their domain of expertise (prediction xi in Table 1). This prediction is based on the following assumption: as it is difficult or costly to identify the factors that make someone successful within a valued domain, natural selection should have favoured a general-copying bias towards the prestigious, in the hope that at least one of the many characteristics that are copied are causally related to success. For instance, many factors might lead to being a successful hunter (tracking skill, ability and materials use to make bows, sleeping well, etc.) and, consequently, a general copying bias of all of these traits associated with the prestigious might be adaptive, at the occasional cost of copying neutral or maladaptive traits (e.g., wearing a magic charm, or being tattooed). This general social learning bias towards prestigious individuals might help to explain why the opinions of prestigious individuals within a given domain (e.g., acting or singing in Western society or hunting in a foraging society) are influential in other domains (e.g., Arnocky, Bozek, Dufort, Rybka, & Hebert, 2018; Jackson & Darrow, 2005; Lee, 1979, p. 343; Radcliffe-Brown, 1964, p. 64; Smith & Bird, 2000). Another possibility not considered by H&GW is that there exist domain-general traits that are likely to lead to success in multiple domains, such as having an inner locus

of control, intrinsic motivation, general intelligence / IQ, or being perseverant and self-disciplined. These domain-general traits might explain *in part* the success of some celebrities such as Will Smith (acting, rapping) or Arnold Schwarzenegger (bodybuilding, acting, politics) across multiple domains (although being famous itself may also have helped them to achieve success in other domains). Nevertheless, a cross-domain social learning bias towards the prestigious might sometimes cause the acquisition of maladaptive information and, consequently, it should be expected that the influence of prestigious individuals is larger within their domain of prestige.

To test this, Chudek, Heller, Birch, and Henrich (2012) conducted two studies with 3-4 years olds. The manipulation of prestige involved varying the degree of attention that two different models received from other individuals. The models then showed a preference for one of two foods, drinks, artefacts or labels for novel objects. Afterwards, children's preferences for the same item pairs were tested. The results for the first study supported prestige-biased social learning (prediction viii in Table 1), as children were more likely to share the preferences of the prestigious model over the non-prestigious model. The second study in which the models displayed preferences only in one of two domains (food or artefacts) also provided support for the prestige-biased social learning hypotheses, but confined within the domain of prestige. That is, children followed the preference of the prestigious model only for the specific domain in which they saw that model exhibit preferences. Consequently, this study did not provide support for H&GW's prediction of cross-domain prestige-biased social learning. Future studies might benefit from studying more directly the two aforementioned mechanisms that favour cross-domain prestige bias, as they make specific and as-yet untested predictions. From the first mechanism (general copying bias) it

follows that cross-domain prestige bias should occur when cues are noisy within the tested domain (see prediction x in Table 2). From the second mechanism (cross-domain general ability) it follows that cross-domain prestige bias should occur when there are domain-general traits like IQ that make people successful across domains (see prediction xi in Table 2).

2.5.5.- Comparisons between Prestige and Content Biases

Although theoretically prestige-biased social learning is generally adaptive, so are other social learning biases, and it is instructive to compare people's use of prestige bias relative to other biases. Acerbi and Tehrani (2018) conducted two studies that compare the strength of content and prestige in cultural transmission. Content biases occur when certain types of material are preferentially transmitted, in contrast to model-based biases such as prestige bias where characteristics of the model are used. Acerbi and Tehrani (2018) chose the topic of quotations because it is a domain in which both content (the message of the quote) and prestige (e.g., frequent misattribution of quotes to famous people) are relevant. First, participants rated a series of unattributed quotes for their likeability, i.e., content. Then, they tested whether quotes associated with famous (i.e., prestigious) individuals (e.g., Vincent Van Gogh) were more liked than the same quotes associated with non-famous individuals invented by the researchers (e.g., Winston Perkins). The results showed no statistical difference in liking ratings between quotes associated with the high and low prestige individuals. Instead, liking was significantly predicted by the original likeability ratings of the quotes when unattributed. This suggests that the content of the quotations is more important than the attributed authorship of the quotation.

Acerbi and Tehrani argue that the lack of evidence for prestige bias in their study might have been because the task did not require any kind of expertise. Furthermore, participants did not obtain higher or lower rewards for preferring some quotations over others. Consequently, the use of prestige bias was not useful here as participants could easily assess the likability of the quotes by themselves without any cost (see prediction viii in Table 2). Alternatively, people might have assumed that the “low prestige” names were “high prestige” too but that they had not heard of them before.

As was argued in Section 2.5.2, the usefulness of prestige bias (and social learning in general) should depend on people’s expertise. When people lack experience within a given domain, they should benefit more from using prestige cues to select models from whom to learn (prediction ix in Table 1). However, Verpooten and Dewitte (2017) predicted and found support for the opposite prediction for the appreciation of modern art. i.e., Like Acerbi and Tehrani, they used a subjective task in which there was no objectively correct or incorrect answer. Laypeople and art experts were shown portraits of female faces, which varied in attractiveness (moderate vs high attractiveness). In one condition, participants were shown these pictures without any additional information. In another condition, participants were told that the pictures belonged to a collection of a prestigious museum in New York (MoMA). As predicted, laypeople’s appreciation was guided by the content of the pictures, showing more appreciation for the highly attractive faces than the moderately attractive faces with little influence of the prestige manipulation. As was also predicted, experts showed more appreciation for the pictures associated with the prestigious museum. This relationship was mediated by admiration towards the artists, which is consistent with H&GW’s theory (see Section 2.2). Surprisingly, they also found

that experts appreciated more the moderately attractive faces than the highly attractive faces. In another study, Verpooten (2018) used real artworks from MoMA, which depicted animate (e.g., pig) or inanimate (e.g., chair) objects. According to evolutionary psychologists (New, Cosmides, & Tooby, 2007), people have an evolved preference for animate over inanimate objects, which the authors predicted would guide the behaviour of non-experts. Consistent with this, there was an overall preference for animate over inanimate objects. Again, however, this was moderated by expertise. The greater the expertise of the participants, the less the participants appreciated the animate over the inanimate artworks, to the extent the preferences reversed in the top experts. Verpooten and Dewitte (2017), inspired by previous work (Boyd & Richerson, 1985; Prum, 2013), argue that the experts' deviations in artwork preferences from evolved aesthetic preferences might be due to a runaway process analogous to a runaway sexual selection in which the trait (here, artworks) coevolves with preferences within a population of art experts.

The contradiction between prediction ix in Table 1, which predicts a greater use of prestige bias by non-experts, and the results of the studies by Verpooten, which found a greater use of prestige bias by experts than non-experts, is likely due to a combination of two factors. First, the appreciation of art is a more relevant task for experts than for non-experts. Second, the assessment of quality of art is a difficult task, which requires to take into account many variables. Consequently, the greater relevance of the art domain for experts than for non-experts plus the difficulty of the task might make experts to rely on prestige cues to assess the value of different pieces of art. Although the research covered in this section is interesting with respect to the general phenomenon of prestige, it is not clear how the likability of quotes or artworks is related to social learning. Although a

greater appreciation of a cultural item probably leads to the greater transmissibility of that item, this may not always be the case. Disgust-inducing information, for instance, is not particularly liked, yet several studies have shown that it has a transmission advantage (Eriksson & Coultas, 2014; Heath, Bell, & Sternberg, 2001; Miton, Claidiere, & Mercier, 2015), at least, in WEIRD samples (Eriksson, Coultas, & de Barra, 2016). For instance, an offensive comment on Twitter (e.g., one that is overtly racist) or Marcel Duchamp's *Fountain* might be disgusting and be disliked by many people, but this in itself could contribute to these items' greater transmission by commenting on them or drawing attention to them. Future studies should test the differential effects of the content of the information and the prestige associated to the source by designing experiments that measure transmission in a more direct way using, for instance, experimental paradigms such as transmission chains (Bartlett, 1932; Mesoudi, 2007) and choose-to-transmit (Eriksson & Coultas, 2014; Heath et al., 2001; Stubbersfield, Tehrani, & Flynn, 2014) and choose-to-receive (Eriksson & Coultas, 2014; Stubbersfield et al., 2014) methods.

2.6.- Final Remarks and Future Directions

In this article, I have reviewed the evidence amassed for the adaptiveness and use of prestige bias in human adults and children since the publication of H&GW's influential paper and suggested new predictions and research questions (see Table 2). Although H&GW predicted that prestige is positively correlated with both skill/knowledge within valued domains and age (predictions i-ii in Table 1), the specific tests of these claims inspired by H&GW's theory suggest a more complex picture. Above all, the positive association between prestige and both knowledge/skill and age heavily depends on the stability of the social and

ecological environment. When there is rapid social change, the skills/knowledge that were important and valuable in the past might not be any longer. Nevertheless, people might still confer prestige according to old-fashioned values, which would disrupt the predicted positive correlation between prestige and knowledge/skill. Alternatively, people might confer prestige according to new values that confer importance to the skills that are relevant nowadays. In this case, if the researchers measure the correlation between prestige and a particular domain of knowledge/skill that has lost its importance within a society, the predicted positive association between prestige and knowledge/skill would be disrupted (see predictions i-iii in Table 2). The same can be said about the predicted positive correlation between prestige and age. Age is a good cue of knowledge/skill when the social and ecological environment is relatively stable and life expectancy does not go much beyond an age at which the degradation of cognitive and physical skills starts. When there is rapid environmental change, older age might be an inadequate cue to select models from whom to learn and sometimes even younger models might be preferred. Moreover, the degradation of cognitive and physical skills with age might moderate the positive association between age and knowledge/skill and favour a plateau or a decline at older age. Future research should explore how social and ecological change and the age-dependency in skill/knowledge within different domains affects the association between prestige, knowledge/skill and age (see predictions v-vi in Table 2).

The evidence reviewed in this article provides mixed support for the use of prestige-biased social learning in both human adults and children. However, few studies have examined this and further research is needed to clarify which factors lead to variation in the use of prestige-biased social learning. The difficulty of the task, the relevance of the domain for the individuals and the benefits and

costs associated with the task seem to be important factors influencing the use of prestige-biased social learning (see prediction viii in Table 2). In general, easy tasks, tasks that are not relevant for participants and tasks that do not provide incentives to perform well or avoid costs (e.g., monetary rewards or costs) seem not to stimulate the use of prestige-biased social learning (Acerbi & Tehrani, 2018). Other factors taken into account in the literature, such as experience and age (Little et al., 2015) seem to be important when they affect task difficulty, the relevance of the domain for the participants and potential gains or costs of the task for the participants. For instance, expertise leads to a greater use of prestige-biased social learning when the task is more relevant for the experts but the task is still difficult for them (Verpooten & Dewitte, 2017). Similarly, younger individuals use more prestige-biased social learning than older individuals when the task is more relevant for them (Little et al., 2015). Moreover, when there is little variation in knowledge/skill in a group, it is more adaptive to learn from low access cost models than from costly prestigious models (Henrich & Henrich, 2010; see prediction ix in Table 2).

Another factor that influences the use of prestige-biased social learning is the availability of alternative social learning biases, e.g., success or content biases. When success information is provided, this information should be preferentially used over prestige information (prediction ix in Table 1). However, this was not found in the sole experiment comparing prestige with success bias (Atkisson et al., 2012), although this is a single study. Both direct and conceptual replications are needed to gain confidence in this result. Content bias was stronger than prestige bias in another study (Acerbi & Tehrani, 2018), but this might depend on the domain and the factors mentioned above (i.e., task difficulty, relevance for the individual, and benefits and costs associated with the task).

Variation in some of these factors (e.g., the relevance for the participants) might lead some participants (e.g., non-experts) to make use of content biases, while other participants (e.g., experts) to employ prestige-biased social learning (Verpooten & Dewitte, 2017).

It is also possible that prestige biased social learning has different effects on different measures of influence, e.g., recall, likability, behavioural influence, willingness to transmit and receive information. To the extent these measures of influence affect task difficulty, relevance for the participants or the benefits/costs associated with tasks, it seems plausible that the different measures would be a source of variation in the use of prestige and other social learning biases. For instance, although one recent study found that anti-vaccination messages are not better transmitted per se, exploratory analyses showed that when anti-vaccination messages are provided by doctors (i.e., a prestigious source within a relevant domain) these types of messages are especially powerful in influencing people's vaccination-related decisions (Jiménez, Stubbersfield, & Tehrani, 2018). Similarly, although people might be able to appreciate the content of certain pieces of information (e.g., quotes, news, artworks, etc.) independent of the prestige of the source of the information, they might be more influenced by prestige cues when they want to achieve influence over other people's behaviour (e.g., by quoting a prestigious source of information), get personal or social benefits (e.g., choosing artworks to be displayed in their own town) or they have to decide whether to learn more about a topic or transmit the information about the topic to other people. Therefore, research on prestige-biased social learning might benefit from comparing the influence of prestige cues on different types of outcomes.

Although H&GW predicted that prestige-biased social learning is cross-domain such that prestige in one domain bleeds across to other domains (prediction xi in Table 1), the only experiment testing this hypothesis found that prestige-biased social learning is stronger within domains (Chudek et al., 2012). Nevertheless, anecdotal evidence (e.g., the influence of the opinions of celebrities in domains in which they are not experts) suggests that cross-domain prestige-biased social learning occurs to some extent. In small-scale societies, it is likely that prestigious individuals are relatively skilful/knowledgeable across multiple domains and, consequently, a cross-domain prestige bias would be adaptive (Acerbi, 2016), albeit leading to the occasional acquisition of irrelevant or even maladaptive information. However, the risks of cross-domain prestige-biased social learning seem considerably higher in the digital era in which, for example, young people in developing countries might be more influenced by American pop singers, Hollywood celebrities or leaders of terrorist groups than by the nearby adults who have relevant skills for their environment (Barkow, O'Gorman, & Rendell, 2012). Consequently, studying to what extent the digital media have subverted the adaptive role of prestige-biased social learning seems a productive new avenue for research on prestige and social learning (Acerbi, 2016; Barkow et al., 2012).

H&GW predicted that information provided by prestigious individuals is more memorable. However, this question has not been studied yet. If H&GW are correct and prestige-based hierarchies evolved to select fitness-enhancing models from whom to learn, prestige-biased social learning should strongly affect human memory. However, it is possible that the effects of prestige on memory are just the consequence of the preferential attention that prestigious individuals receive (see Section 2.4.2). Therefore, studies exploring how prestige cues affect

memory should look at how differential attention towards prestigious and non-prestigious individuals affects memorability (e.g., by using eye-tracking).

In conclusion, H&GW's theory of the evolution of prestige has generated a great deal of research and this research has stimulated new research questions and predictions. Although the evidence reviewed here suggest that prestige-bias social learning is employed in at least some contexts, further research will need to determine the precise circumstances in which people use prestige cues to learn socially, and when the use of these cues is adaptive.

2.7.- References

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CHAPTER 3:

Prestige Does Not Affect the Cultural Transmission of Novel Controversial Arguments in an Online Transmission Chain Experiment

This chapter has been adapted with minor revisions from Jiménez, Á. V., & Mesoudi, A. (2019, July 10). *Prestige does not affect the cultural transmission of novel controversial arguments in an online transmission chain experiment*.

Preprint at: <https://psyarxiv.com/3u9wh>. This chapter has been accepted for publication in the *Journal of Cognition and Culture* and it is currently in press.

Contributions:

This chapter was conceptualised by Alex Mesoudi and me. Experimental design, preparation of the materials, programming of the experiment with Qualtrics, data collection, data analysis and interpretation was all conducted by myself. Original draft was written by me. It was reviewed and edited by Alex Mesoudi and me.

3.0.- Abstract

Cultural evolutionary theories define *prestige* as social rank that is freely conferred on individuals possessing superior knowledge or skill, in order to gain opportunities to learn from such individuals. Consequently, information provided by prestigious individuals should be more memorable, and hence more likely to be culturally transmitted, than information from non-prestigious sources, particularly for novel, controversial arguments about which pre-existing opinions are absent or weak. It has also been argued that this effect extends beyond the prestigious individual's relevant domain of expertise. I tested whether the prestige and relevance of the sources of novel, controversial arguments affected the transmission of those arguments, independently of their content. In a four-generation linear transmission chain experiment, British participants ($N=192$) recruited online read two conflicting arguments in favour of or against the replacement of textbooks by computer tablets in schools. Each of the two conflicting arguments was associated with one of three sources with different levels of prestige and relevance (high prestige, high relevance; high prestige, low relevance; low prestige, low relevance). Participants recalled the pro-tablets and anti-tablets arguments associated with each source and their recall was then passed to the next participant within their chain. Contrary to my predictions, I did not find a reliable effect of either the prestige or relevance of the sources of information on transmission fidelity. I discuss whether the lack of a reliable effect of prestige on recall might be a consequence of differences between how prestige operates in this experiment and in everyday life.

3.1.- Introduction

The diffusion of knowledge, skills, attitudes, norms and other forms of information within societies via cultural transmission (or social learning) depends not only on the content of that information, but also on the characteristics of the source of the information. For example, when Hollywood actor Angelina Jolie wrote a newspaper article about her decision to undergo a preventive double mastectomy due to testing positive for a gene associated with breast cancer (Jolie, 2013), there followed an increase in online searches for information about breast cancer (Juthe, Zaharchuk, & Wang, 2015), increased demand for genetic screening of this disease (Desai & Jena, 2016), and an increase in the number of referrals to undergo similar preventive operations (Evans et al., 2015). While the content of Jolie's article surely played some role, it seems plausible that her prominence and success as an actor also influenced the subsequent spread of knowledge regarding breast cancer screening.

This distinction between the content and the source of culturally transmitted information has received much attention in the field of cultural evolution, which seeks to provide general explanations for cultural change that are rooted in both psychology and evolutionary theory (Henrich, 2015; Mesoudi, 2011). My focus here is on the sources of culturally transmitted information. Cultural evolution researchers call this *model-based transmission bias* (Henrich & McElreath, 2003; Wood, Kendal, & Flynn, 2013), referring to the transmission advantage of information provided by models with specific characteristics such as being successful, older, genetically related, or prestigious. Such biases are typically evolutionarily adaptive. For example, learning from models who are successful (e.g., knowledgeable or skilful) within a valued domain generally leads

to the acquisition of fitness-enhancing knowledge/skills. Therefore, preferentially copying successful models (*success bias*) is typically an adaptive strategy when the knowledge or skill cannot easily be acquired on one's own, via a social learning.

However, assessing the knowledge or skill of potential models within a domain is often difficult. The learner may not have enough expertise to correctly infer the quality of others' information. Even if they do, this inference may be costly, for example requiring lengthy observation of the model to ensure their success is not due to luck. To reduce these costs, Henrich and Gil-White (2001) suggested that social learners use short-cuts to infer the success of models from whom to learn. These shortcuts might involve using fixed characteristics of models such as job titles (*first-order cues*) or behaviours displayed by other individuals towards the model, such as the amount of attention paid by others to the model (*second-order cues*) (Jiménez & Mesoudi, 2019). The use of these shortcuts is known as *prestige bias* or *prestige-biased social learning* (Henrich & Gil-White, 2001; Jiménez & Mesoudi, 2019). Prestige bias is adaptive (Henrich & Gil-White, 2001; Jiménez & Mesoudi, 2019) because prestige (e.g., amount of attention received by a model) is associated with high knowledge or skill within valued domains (Garfield, Hubbard, & Hagen, 2019; Henrich & Gil-White, 2001; Stibbard-Hawkes, Attenborough, & Marlowe, 2018; Von Rueden, 2014), although see Reyes-Garcia et al. (2008).

If there is a positive relationship between the success and prestige of a model, then using prestige cues to select models from whom to learn (prestige bias) is a cheaper way to acquire mostly valuable knowledge/skills than assessing directly the competence of the model (success bias).

My aim in this study is to experimentally test whether information attributed to prestigious sources is culturally transmitted with greater fidelity than information attributed to non-prestigious sources, as predicted by Henrich and Gil-White (2001). I use the transmission chain design (Bartlett, 1932; Mesoudi, 2007) in which participants are asked to recall written information, and the resulting recall is passed to the next participant to read and recall and so on down the chain. This can reveal cumulative effects of hypothesised transmission biases. The information transmitted along the chains consists of opposing arguments about a novel and controversial issue: the replacement of textbooks by computer tablets at primary school. I was not interested in the issue itself (i.e., the content), only in the effects of prestige on its transmission (i.e., the source). I chose this issue because, although it engenders some debate (e.g., Kleeman, 2014; Rowan, 2014), it is an issue that is not widely discussed and about which people lack polarized attitudes or detailed prior knowledge. Therefore, people's attitudes towards tablets are unlikely to strongly affect the transmission of these arguments, minimising the influence of both content biases and individual judgement.

Previous research provides some evidence that prestige affects both recall in a single individual, and cultural transmission from one individual to another. Holtgraves, Srull, and Socall (1989) had participants read conversations between two people. One group of participants were told that one of the speakers was higher status than the other. Another group were told that the two speakers had equal status. As predicted, statements were more likely to be recalled when they were thought to come from a high status speaker, compared to the same remarks made in the equal status condition. However, this effect only occurred when the status information was provided before reading the conversations; no effect was

found when status information was provided afterwards. There was also no effect of status when the conversations were acted out, rather than read. Ratcliff, Hugenberg, Shriver, and Bernstein (2011), meanwhile, found that participants were better at recognising faces associated with prestigious professions (e.g., CEOs or doctors) than faces associated with non-prestigious professions (e.g., mechanics or plumbers). However, this study did not address whether information provided by prestigious individuals was more memorable or how prestige affected the cultural transmission of information.

Other studies have found evidence for prestige-biased cultural transmission. Atkisson, O'Brien, and Mesoudi (2012) found that participants preferentially copied virtual artifact designs that purported to come from models who received more attention from other participants. These prestige cues were even used as equally often as direct success information. Chudek, Heller, Birch, and Henrich (2012) similarly found that children preferentially copied the choice of toy or food from an adult model to whom others had attended to, compared to models who were ignored by others. While suggestive, these studies did not examine the long-term effect of prestige along chains of participants, as afforded by the transmission chain method, nor did they examine the transmission of controversial arguments, as I did here. The latter is particularly important because of cases such as Angelina Jolie's endorsement of breast cancer screening, or (more troublingly) the endorsement of anti-vaccination arguments by celebrities such as Jenny McCarthy, where prestigious individuals appear to influence the adoption of controversial or unfamiliar arguments.

This leads to our secondary aim, which is to explore whether the effect of prestige on cultural transmission extends beyond the domain of expertise of the

information source. This seems to occur when, for example, an actor has an effect in a medical domain like breast screening or vaccination. Although prestige bias should be more beneficial within the domain of expertise of the prestigious model (*within-domain prestige bias*), the theory (Henrich & Gil-White, 2001; Jiménez & Mesoudi, 2019) assumes that people should copy prestigious individuals beyond their domain of expertise (*cross-domain prestige bias*): (i) when success information in the domain of interest is unavailable and asocial learning in that domain is costly or difficult (general copying bias) and (ii) when there is a positive correlation in skill between domains due to general characteristics such as IQ or perseverance that lead the model to be successful across multiple domains (cross-domain general ability). The first of these, at least, would apply to controversial arguments for which people have little pre-existing knowledge.

However, the evidence regarding cross-domain prestige bias is mixed. In the aforementioned study by Chudek et al. (2012), the effect of prestige did not extend beyond the domain within which the model expressed a choice. For example, a prestigious model's choice of food did not affect whether their choice of toy was also copied. Cases such as the 'Angelina Jolie effect' remain anecdotal and ambiguous, given the difficulty of using observational data to determine cause-effect relationships. When Jolie wrote her article, there was already growing interest in genetic screening for cancer, and guidelines about detecting breast cancer had just been published by public health organisations (Acerbi, 2019). Moreover, it is difficult to separate the effect of the content of the information she provided from the effect of her prestige. Given this ambiguous but limited evidence, there is a need for more experimental tests of the domain generality of prestige.

Consequently, I sought to test whether the influence of prestige on cultural transmission only occurs in the relevant domain of expertise of the prestigious model, or whether it extends beyond the relevant domain. I therefore used three sources that varied in prestige and relevance: a relevant high prestige source (Head of the Department of Education of a leading university), an irrelevant high prestige source (aircraft pilot), and an irrelevant low prestige source (cleaner). Prestige was manipulated using job titles (a first-order cue), following previous non-transmission chain experiments (Dalmaso, Galfano, Coricelli, & Castelli, 2014; Dalmaso, Pavan, Castelli, & Galfano, 2012; Ratcliff et al., 2011). This contrasts with typical manipulations of prestige in the cultural evolution literature, which usually entails a second-order cue: the amount of attention displayed by other individuals to the model (Atkisson et al., 2012; Chudek, Baron, & Birch, 2016; Chudek et al., 2012). Nevertheless, both types of cues should be positively correlated given that individuals with prestigious job titles (e.g., doctors) tend to be paid more attention by others (Dalmaso et al., 2014; Dalmaso et al., 2012; Ratcliff et al., 2011), due to both cues being used as proxies for competence.

In light of the above theory and evidence, I preregistered (<https://osf.io/pk2rz/>, see SM1a) the following two hypotheses:

H1: The arguments provided by high prestige sources will be better recalled over generations than arguments provided by low prestige sources.

H2: The arguments provided by high relevance sources will be better recalled over generations than the arguments provided by low relevance sources.

3.2.- Methods

3.2.1.- Ethical Statement

The study was approved by the Biosciences Ethical Committee at the University of Exeter Cornwall Campus on the 6th June 2017 (Ref 2017/1963).

3.2.2.- Participants

Participants were recruited online through Prolific (www.prolific.ac) (Peer, Samat, Brandimarte, & Acquisti, 2016) following the procedure stated in the preregistration (<https://osf.io/pk2rz/>, see SM1a). I used pre-screening filters to select participants who had not previously participated in any of our studies on Prolific, had an approval rating of 90% or above, were aged 18-60 years, spoke English as a first language and had British nationality. The data was collected at four different times (one for each “cultural generation”), with 48 participants per generation across 48 separate, parallel chains. 48 chains were necessary to provide two replications of each of the 24 counterbalanced versions of the experimental materials (see Section 2.4). Participants were paid at a rate of £5.25/hour for an estimated time of completion of 20 minutes for generations 1 and 2 and 15 minutes for generations 3 and 4.

I excluded from the dataset participants who (i) failed the attentional check (“If you are carefully reading the questions, select ‘Green’”), or (ii) failed the manipulation check to identify the professions (i.e., manipulation of prestige) of the sources of the information, or (iii) read both sets of arguments (pro- and anti-tablets) in less than 10 seconds (148 words/minute). The latter exclusion criterion was changed compared to the preregistered protocol, which originally specified a cutoff of 27 seconds (400 words/minute). After seeing the data for the first wave

of participants it became apparent that the original cutoff was too strict and unnecessarily excluded large numbers of participants who had provided valid data. The new cutoff was derived from inspection of the data: three participants who read the material in less than 10 seconds (1080 words/minute) were unable to recall anything, while amongst the remaining participants there was no relationship between time spent reading the materials and the number of propositions correctly recalled (Bayesian multilevel Poisson logistic model predicting the number of propositions correctly recalled by the time spent reading each of the materials associated with each source and intercepts varying by participant: $B=0.001$, $SE=0.003$, 89% CI [-0.003, 0.005])², confirming that these participants provided valid data.

Excluded participants were replaced by new participants. Overall, I collected responses from 288 participants (203 females, 85 males) aged 18-61³ ($M=34.57$, $SD=10.12$), with 192 of these participants (143 females, 49 males) aged 18-61 ($M=35.10$, $SD=10.11$) being included in the study.

3.2.3.- Materials

To select the sources of information, I asked an independent sample of 10 Prolific participants (5 females, 5 males) aged 19-42 ($M=28.8$, $SD=7.16$) to rate 24 professions on their prestige within society and their relevance for the debate over whether tablets should replace books in schools. Ratings were given on a

² Throughout the thesis, I am using 89% credible intervals, instead the conventional 95% credible intervals, as McElreath (2015) recommends to avoid readers thinking in terms of significance tests. There is no statistical reason to prefer one over the other. 89% is chosen because it is a prime number, 95% is chosen because is a convention.

³ Although in the pre-screening I selected an age range of 18-60, 1 participant was 61 years old in the experiment. This was probably a natural consequence of the pass of time, since participants reported their age for the pre-screening prior the participation in the study.

7-point Likert scale from “not prestigious at all” or “extremely irrelevant” (-3) to “extremely prestigious” or “extremely relevant” (+3), respectively. I selected three sources who differed in their level of prestige and relevance: the Head of Education of a leading university (high prestige: $M=1.6$, $SD=1.1$; high relevance: $M=2.4$, $SD=0.8$), an aircraft pilot (high prestige: $M=1.5$, $SD=1.2$; low relevance: $M=-2.1$, $SD=1.3$) and a cleaner (low prestige: $M=-2.6$, $SD=1$; and low relevance: $M=-2.2$, $SD=1.2$). See Appendix A.2. for a full list of professions and their associated ratings⁴.

In the experimental materials, the sources of information were associated with one of two sets of arguments in favour of and against the replacement of textbooks by computer tablets at primary school. Two different names (“William Healey”⁵ and “Daniel Bryanson”) were used for the sources, as each participant read the information about two sources and their associated arguments. Their names and the order of presentation were fully counterbalanced. The sources were described as follows:

Head of Education of a leading university (high prestige, high relevance)

William Healey [Daniel Bryanson] is the Head of the Department of Education of a leading university. Outside of his job, he [also] volunteers for the

4 This procedure to select professions to use in the experiment on the basis of the means of ratings on a Likert scale is a standard practice in psychology. However, this practice contradicts what students are taught about ordinal variables in statistical courses. Ordinal variables are categorical variables that are ordered but the distances between adjacent categories might be different. Consequently, this precludes carrying out mathematical operations such as addition, subtraction, multiplication and divisions with them to obtain means and standard deviations. As I became more aware of the consequences of treating ordinal variables as continuous (Liddell & Kruschke, 2018) after data collection, I report descriptive statistics in SM1B that are more adequate for ordinal variables, such as medians.

5 In the preregistration, I used the name “William Yellowfield”. When I was piloting the experiment, a colleague commented that this name was obviously made-up. Therefore, I decided to change it to William Healey for the experiment.

Australian Learning Trust. As a volunteer, Professor Healey [Bryanson] visits schools once a fortnight and teaches the children the importance of his job for society. He firmly supports the replacement of textbooks by computer tablets at primary schools for the following reasons: [He is firmly against the replacement of textbooks by computer tablets at primary school for the following reasons:]

Aircraft pilot (high prestige, low relevance)

William Healey [Daniel Bryanson] is a commercial Aircraft pilot who regularly flies between Auckland and Madrid, Paris, Amsterdam and other European destinations. Outside of his job, he [also] volunteers for the Australian Learning Trust. As a volunteer, Mr Healey [Bryanson] visits schools once a fortnight and teaches the children the importance of his job for society. He firmly supports the replacement of textbooks by computer tablets at primary schools for the following reasons: [He is firmly against the replacement of textbooks by computer tablets at primary school for the following reasons:]

Cleaner (low prestige, low relevance)

William Healey [Daniel Bryanson] works as a cleaner in a telemarketing company. Outside of his job, he volunteers for the Australian Learning Trust. As a volunteer, Mr. Healey [Mr Bryanson] visits schools once a fortnight and teaches the children about the importance of his job for society. He firmly supports the replacement of textbooks by computer tablets at primary school for the following reasons: [He is firmly against the replacement of textbooks by computer tablets at primary school for the following reasons:]

Table 3 shows the full list of arguments in favour of ('pro-tablets') and against ('anti-tablets') the replacement of textbooks by computer tablets at

primary school. 'Pro-tablets' arguments pointed out both the advantages of tablets (e.g., "Computer tablets permit the storage of hundreds of books and the instant access to those books from everywhere") and the disadvantages of books (e.g., "The continuous carrying of textbooks from home to school gives long-term back pain to our children"). 'Anti-tablets' arguments pointed out both the advantages of books (e.g., "Textbooks can last hundreds of years and they don't require electricity or batteries to work") and the disadvantages of tablets (e.g., "The continuous use of devices with screens such as computer tablets gives long-term vision problems to our children"). Both sets of arguments were created with the explicit intention of being balanced and covering similar topics. Both sets included arguments about the impact of computer tablets and textbooks on health, the environment, children's learning, student distraction, control by the teacher, parental support and technical aspects such as storage, accessibility, durability and battery life. Both sets of arguments were inspired by the pros and cons arguments compiled by ProCon.org (<https://tablets-textbooks.procon.org/>).

'Pro-tablets' arguments	'Anti-tablets' arguments
<i>The continuous carrying of textbooks from home to school gives long-term back pain to our children.</i>	<i>The continuous use of devices with screens such as computer tablets gives long-term vision problems to our children.</i>
<i>Children using computer tablets learn much better as they are more engaged and understand the material better.</i>	<i>Children using textbooks learn much better as they are more engaged and understand the material better.</i>
<i>Teachers have less control over children's learning when using textbooks because they cannot effectively manage what children are doing during the class.</i>	<i>Children are more easily distracted when using computer tablets because they can play games instead of attending to the lesson.</i>
<i>The production of textbooks for our schools requires the consumption of tons of paper each year, which contributes to the problem of deforestation.</i>	<i>The production of computer tablets requires the emission of a considerable amount of pollutants to the air, which contributes to the problem of the greenhouse effect.</i>
<i>Children need less support from their parents when they use computer tablets than when they use textbooks because tablets offer personalized lessons.</i>	<i>Children receive more support from their parents when they use textbooks than when they use computer tablets because parents offer personalized help.</i>
<i>Computer tablets permit the storage of hundreds of books and the instant access to those books from everywhere.</i>	<i>Textbooks can last hundreds of years and they don't require electricity or batteries to work.</i>

Table 3. Arguments in favour ('pro-tablets') and against ('anti-tablets') the replacement of textbooks by computer tablets at primary schools used as materials to transmit along the transmission chains

3.2.4.- Design

A 3 (pair of sources: Cleaner vs Head of the Department of Education, Cleaner vs Aircraft Pilot, Head of the Department of Education vs Aircraft Pilot) X 2 (opinions associated with sources: 'pro-tablets' vs 'antitables', 'antitables vs protables') factorial design was used for this experiment. The order of presentation and the names associated with the sources ('William Healey' and 'Daniel Bryanson') were fully counterbalanced, which resulted in 24 different versions of the experimental materials. As I was only interested in the influence of the sources of the information on transmission, I analyse three experimental conditions: Condition 1 (Head of the Department of Education vs Cleaner), Condition 2 (Aircraft Pilot vs Cleaner) and Condition 3 (Head of the Department of Education vs Aircraft Pilot).

I used the transmission chain method (Bartlett, 1932; Mesoudi, 2007) to experimentally simulate this controversy. This method is similar to the children's game "Chinese Whispers" or "Broken Telephone". A first "generation" of participants read the original materials given above in Section 3.2.3. They then recalled this material from memory. Their recall is then transmitted to the next participant in their chain (second generation). This procedure is repeated for four generations in total, and across 48 separate, parallel chains to provide independent replications of transmission effects. This method has typically been used to study *content transmission biases*, which entail a transmission advantage to certain types of information due to their intrinsic characteristics (Henrich & McElreath, 2003) such as having a more emotional (Eriksson & Coultas, 2014; Stubbersfield, Tehrani, & Flynn, 2017), social (Mesoudi, Whiten, & Dunbar, 2006; Stubbersfield, Tehrani, & Flynn, 2014), negative (Bebbington, MacLeod, Ellison, & Fay, 2017) or stereotypical (Bangerter, 2000; Kashima, 2000) content. The novelty of the present study is to use this method to study a model-based transmission bias: prestige bias. Transmission chain experiments permit the study of the consequences of experimental conditions over multiple transmission events. Single-generation experiments sometimes cannot detect certain transmission biases, as the effects of the experimental conditions are only revealed after multiple transmission events (e.g., Jiménez, Stubbersfield, & Tehrani, 2018), or they are detected in the first generation and then reversed in latter generations (e.g., Kashima, 2000).

In my experiment, I kept the description of the sources of information (i.e., names and job titles) constant along the chains, i.e., these were not subject to participant recall. This ensured that my manipulation was applied across all generations and all chains, and simulated the fact that prestigious individuals tend

to be acknowledged and recognised by most members of a society or social group. The content of the information (the arguments in favour of and against the replacement of textbooks by computer tablets at primary school) was allowed to vary as the information provided to participants in generations 2-4 was the information recalled by the participant in the previous generation within their chain.

3.2.5.- Procedure

Prior to the presentation of the experimental materials, participants were asked their opinion about the replacement of textbooks by computer tablets at primary school ('pre-test' opinion) by rating their agreement with the statement "If the decision were in my hands, I would replace all the textbooks with computer tablets in primary schools" on a 7-point Likert scale from "totally disagree" (-3) to "totally agree" (+3). They were also asked about their familiarity with computer tablets using a 7-point Likert scale from "very unfamiliar" (-3) to "very familiar" (+3).

Participants were then randomly assigned to one of 48 transmission chains and provided the following instructions: "*In many schools across the world, computer tablets have started to replace traditional textbooks. This recent change has given rise to a heated debate about the benefits and risks of computer tablets and textbooks for children's education. We have asked a number of volunteers at schools in Australia about their views on this issue. In the following, you will learn about two of these volunteers and about their opinions about the use of textbooks and computer tablets at primary school. It is very important that you read the information at a pace that allows you full comprehension as you will be asked some questions about this information later*". Participants then read

information about one of the sources (e.g., cleaner) and one set of arguments (e.g., 'pro-tablets') and, immediately afterwards, information about another source (e.g., Head of the Department of Education) and the other set of arguments (e.g., 'anti-tablets'). Participants in generation 1 read the original arguments created by us. Participants in generations 2-4 read the arguments as they were recalled by the participant in the previous generation within their chain. Spelling and grammar mistakes were corrected before transmitting the information from one participant to the next.

Participants were then asked to identify the source professions they had read from a list of six professions (Head of the Department of Infectious Diseases of a leading university, cleaner, Head of the Department of Education of a leading university, writer, warehouseman, aircraft pilot and taxi driver) and to rate the prestige within society of the two sources they had read about on a 5-point Likert scale from "not prestigious at all" (1) to "incredibly prestigious" (5) and their relevance for the debate about the benefits and risks of tablets and books at schools on a 7-point Likert scale from "very irrelevant" (-3) to "very relevant" (+3).

There was then a surprise free recall test in which participants had to recall the arguments provided by each source. I originally intended to force participants to do this for each source for at least 2.5 minutes and no more than 5 minutes. However, a technical problem disabled the feature that forced participants to stay on the task at least 2.5 minutes. Therefore, participants submitted their responses when they considered they had finished, which is the standard procedure for transmission chain experiments. The feature that prevented participants to complete the recall task beyond 5 minutes worked correctly.

Finally, participants provided demographic details (age, gender, nationality, first language, nearest city and profession) and were asked again about their opinion about whether computer tablets should replace books at primary schools by rating their agreement with the statement “If I were an education policy maker I would replace textbooks by computer tablets all over the country” on a 7-point Likert scale from “totally disagree” (-3) to “totally agree” (+3). They were also asked to provide reasons to support one or the other side by writing their own opinion within a textbox. At the end, participants were informed about the goal of the experiment and my hypotheses.

3.2.6.- Coding and Data Analyses

Participants’ recall accuracy was assessed by comparing their correct recall with a preregistered table (<https://osf.io/6d5ga/>, see Appendix A.4) containing twelve central propositions, i.e., verbs, adjectives or other relational terms followed by complementary nouns, which capture the core meaning of the sentence (Kintsch, 1974). For instance, the core meaning of “the continuous carrying of textbooks from home to school gives long-term back pain to our children” is “textbooks give back pain (to children)”. This table specified which elements were important (central propositions) to recall within each sentence. The recall was coded by me. A second coder, who was blind to the hypothesis, coded 12.5% of the chains (6 chains). We found a high inter-coder reliability between both coders (Cohen’s Kappa = 0.84).

All statistical analyses were conducted with Bayesian package *brms* (Bürkner, 2017) in R 3.5.3 (R Core Team, 2019). This was a change from the preregistered script (<https://osf.io/dt2uq/>, see SM1c.), in which I did the analyses with dummy data with the package *lme4* (Bates, Maechler, Bolker, & Walker,

2015). The change was due to the advantage of *brms* in handling ordinal predictors (Bürkner & Charpentier, 2018). This change did not affect the qualitative conclusions derived from the results (see SM2a and SM2b).

3.3.- Results

3.3.1.- Manipulation Checks: Prestige and Relevance of the Sources

As the ratings of prestige and relevance were measured in an ordinal scale, I used the median, range and frequency of each rating to describe the central tendency and the distribution of the ratings for each source (Figures 1 and 2 and SM2c). For the same reason, I conducted Bayesian multilevel ordinal logistic models with source as a predictor. Because each participant rated the prestige and relevance of two sources of information, the intercepts were allowed to vary by participant. For these analyses, I used the default priors in *brms* (Bürkner, 2017).

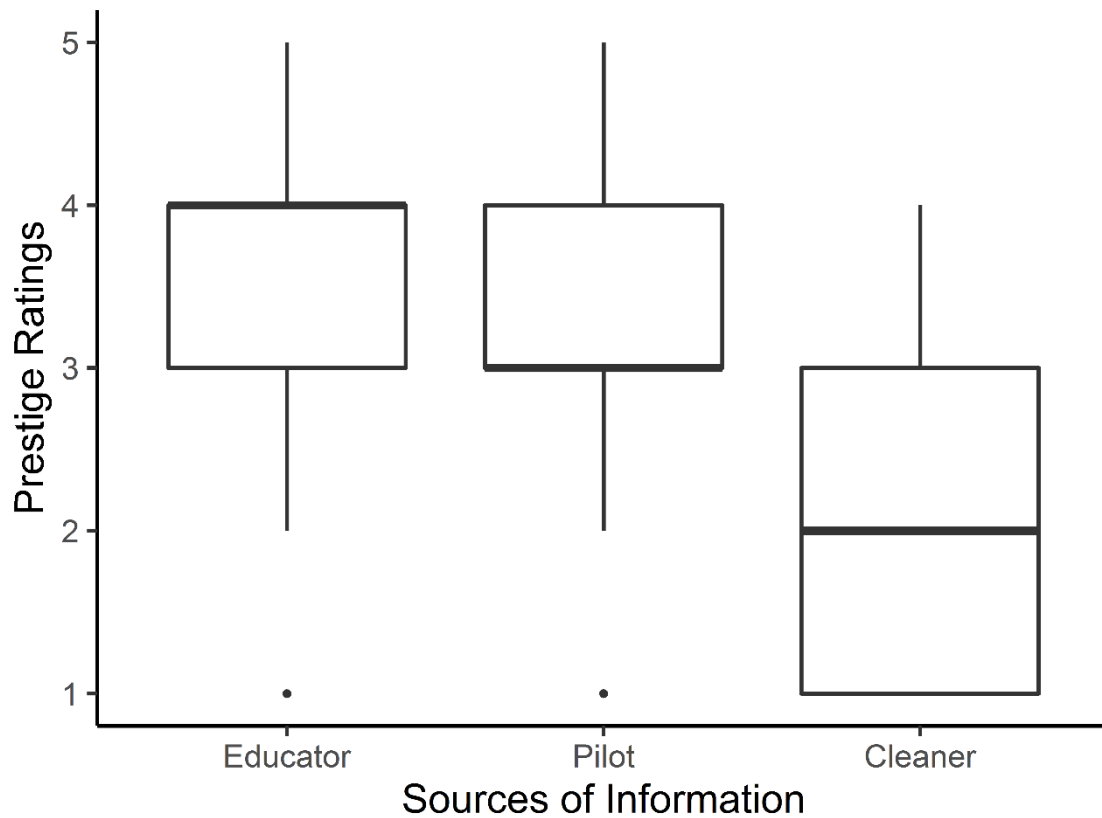


Figure 1. The distribution of ratings of prestige for the three sources of information: Head of the Department of Education (“educator”), pilot and cleaner. Prestige was measured on a 5-point scale from “Not prestigious at all” (1) to “incredibly prestigious” (5). Thick lines represent the median, the box the middle 50% of ratings or inter-quantile range, the lower whisker ranges from the 25th percentile to the smallest value no smaller than 1.5 times the inter-quantile range and outliers are ratings outside 1.5 times the inter-quantile range.

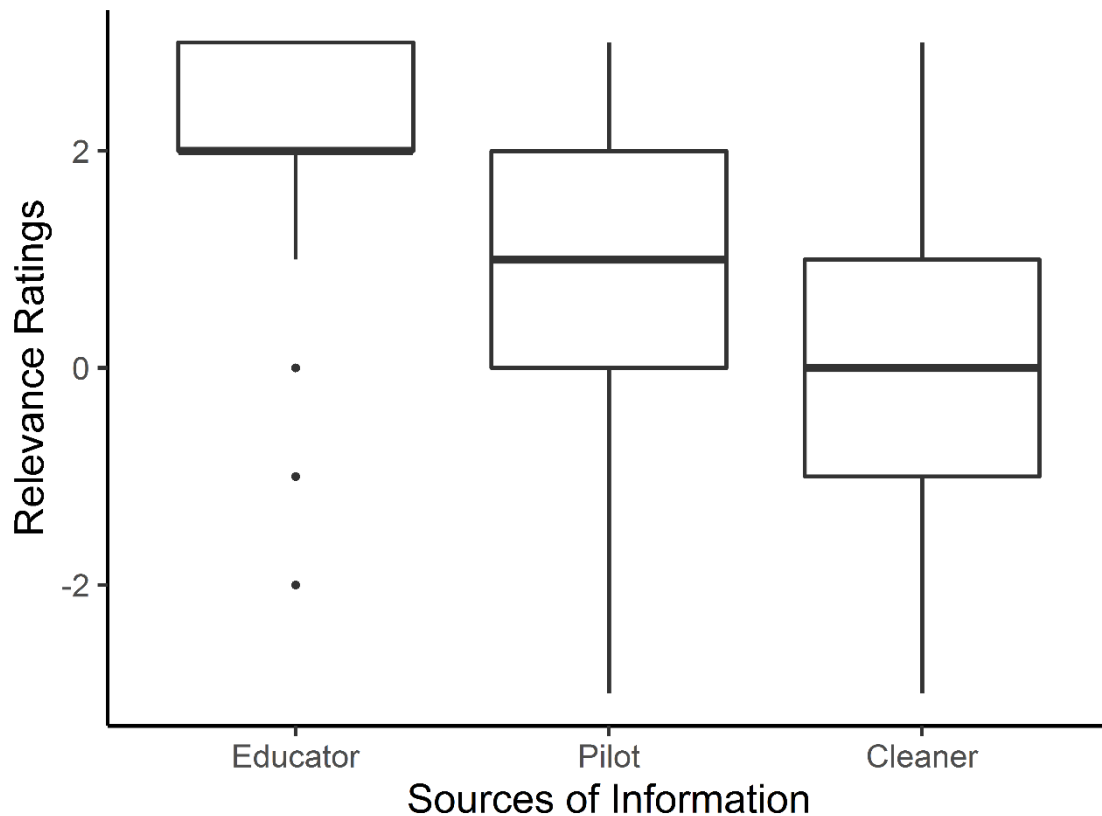


Figure 2. The distribution of ratings of relevance for the three sources of information: Head of the Department of Education (“educator”), pilot and cleaner. Relevance was measured on a 7-point Likert scale from “very irrelevant” (-3) to “very relevant” (+3). The thick line represents the median, the box the middle 50% of ratings or inter-quantile range, the lower whisker ranges from the 25th percentile to the smallest value no smaller than 1.5 times the inter-quantile range and outliers are ratings outside 1.5 times the inter-quantile range.

I expected that the Head of the Department of Education (henceforth ‘educator’) and the pilot would be rated similarly prestigious, and both rated more prestigious than the cleaner. Prestige were rated on a 5-point Likert scale from “not prestigious at all” (1) to “incredibly prestigious” (5). The educator was considered the most prestigious (Median=4), being mostly rated as “(4) very prestigious” (50%), followed by “(3) somewhat prestigious” (37%). The pilot was seen as less prestigious than the educator (Median=3), being mostly rated as “(3) somewhat prestigious” (58%) followed by “(4) very prestigious” (32%). The cleaner was seen as the least prestigious (Median=2), being rated mostly as “(2) hardly prestigious” (40%), followed by “(3) somewhat prestigious” (30%) and “(1)

not prestigious at all" (27%). As expected, the regression model confirmed that the educator ($B=5.26$, $SE=0.51$, 89% CI: [4.46, 6.11]) and the pilot ($B=3.95$, $SE=0.42$, 89% CI:[3.29, 4.62]) were rated as more prestigious than the cleaner. Contrary to expectations, however, the educator was rated as more prestigious than the pilot ($B=1.31$, $SE=0.32$, 89% CI: [0.81, 1.82]), although the magnitude of this difference was much smaller than that between the educator and cleaner, and between pilot and cleaner.

I also expected that the educator would be rated more relevant to the issue of tablets in schools than both the pilot and cleaner, who would be rated similarly (non) relevant. Relevance was rated on a 7-point Likert scale from "very irrelevant" (-3) to "very relevant" (+3). The educator was considered most relevant (Median=2), being mainly rated as +3 (46%). The pilot was considered the next most relevant (Median=1), being mostly rated as +1 (33%). The cleaner was considered least relevant (Median=0), being mainly rated as +1 (30%). As expected, the regression model confirmed that the pilot ($B=-3.08$, $SE=0.36$, 89% CI: [-3.65, -2.51]) and the cleaner ($B=-3.40$, $SE=0.35$, -89% CI: [-3.96, - 2.85]) were considered less relevant sources of information than the educator, while there was little difference between the pilot and the cleaner ($B=0.31$, $SE=0.25$, 89% CI:[-0.08, 0.71]).

3.3.2.- Cumulative Recall

Figure 3 shows the recall of correct central propositions across cultural generations by opinion ('pro-tablets' vs 'anti-tablets', Figure 3A) and source of the information (educator, pilot and cleaner, Figure 3B). As in similar transmission chain experiments, Figure 3 shows that recall decreased over cultural generations, with a larger decrease from generation 1 to generation 2 than for

subsequent generations. Unexpectedly, the ‘anti-tablets’ opinion seems to have been better transmitted than the ‘pro-tablets’ opinion (Figure 3A). Contrary to my hypotheses, Figure 3B suggests little difference in cumulative recall between the three sources of information.

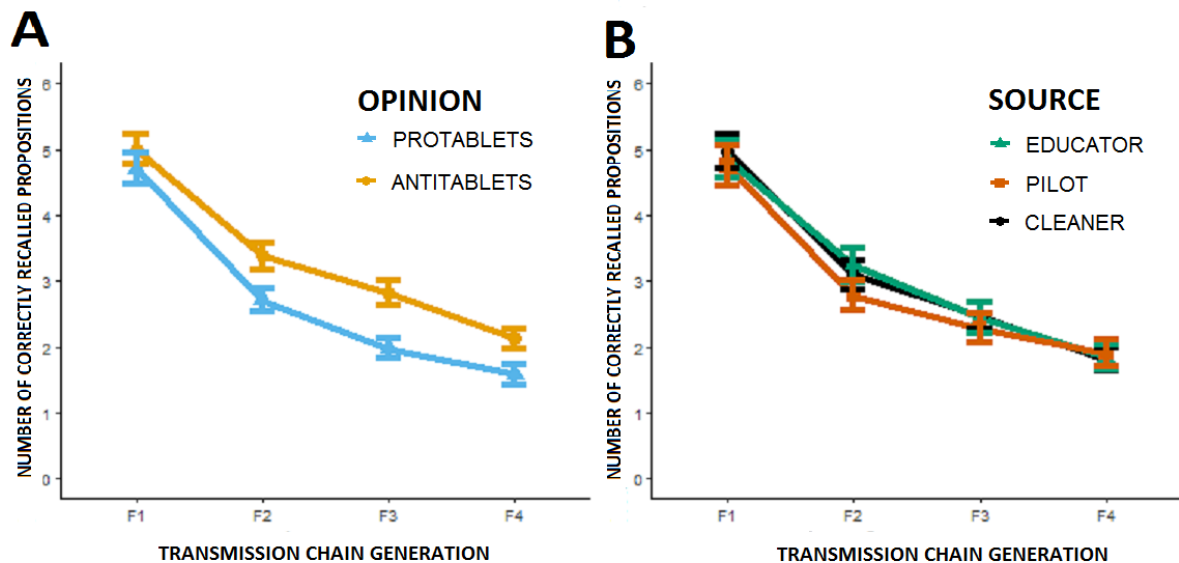


Figure 3. Raw means for the recall of information with 1.60 standard error bars (corresponding to 89% CI as given in the text) plotted against generation. A: the ‘anti-tablets’ arguments were better transmitted than the ‘pro-tablets’ arguments. B: contrary to H1 and H2, the information provided by the three sources (Head of the Department of Education, Pilot and Cleaner) was transmitted with similar fidelity.

To statistically analyse these trends, we produced several Bayesian multilevel Poisson regression models with intercepts varying by chain and compared their model fit (Table 4). Model fit was compared using leave-one-out cross validation information criterion (LOOIC; Vehtari, Gelman, & Gabry, 2017), which can be interpreted similarly to Akaike information criterion (AIC) or Watanabe-Akaike information criterion (WAIC): a lower LOOIC indicates better fit to the data.

I first ran a generation model with generation (one to four) as the sole predictor of recall (number of correctly recalled propositions). Generation was treated as a monotonic variable (Bürkner & Charpentier, 2018) as recall tends to decrease across generations but the amount of the decrease varies between adjacent generations. This model was compared with an opinion model, which included opinion ('pro-tablets' vs 'anti-tablets') and generation as predictors. As the opinion model (LOOIC=1301.2, SE=14.4) had a better fit to the data than the generation model (LOOIC=1311.1, SE=14.3), the opinion model was selected as the control model to compare against subsequent models. (Allowing an interaction between generation and opinion did not improve the model fit by much, LOOIC=1298.5, SE=14.3. Including participants' degree of agreement with the statement "I would replace all the textbooks with computer tablets in primary schools" prior to being exposed to the experimental materials also did not improve the model fit. See SM2b for details).

Unstandardized Coefficients	Main Regression Models					
	Generation	Opinion	Source	Prestige	Relevance	Prestige-Relevance
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Intercept	1.56 (0.06)	1.65 (0.06)	1.60 (0.08)	1.62 (0.09)	1.63 (0.12)	1.61 (0.12)
mo(Generation)	-0.95 (0.09)	-0.95 (0.09)	-0.95 (0.09)	-0.95 (0.09)	-0.95 (0.09)	-0.95 (0.09)
Opinion [Pro-tablets]		-0.19 (0.06)	-0.19 (0.06)	-0.19 (0.06)	-0.19 (0.06)	-0.19 (0.06)
Source [Educator]			0.06 (0.08)			
Source [Pilot]			0.06 (0.08)			
mo(Prestige)				0.05 (0.14)		0.05 (0.15)
mo(Relevance)					0.03 (0.13)	0.01 (0.13)
LOOIC	1311.1	1301.2	1302.5	1302.2	1302.6	1303.8
model weights	0.002	0.329	0.208	0.205	0.167	0.089

Table 4. Unstandardized Coefficients (B) and their standard errors (in brackets) for each of the main regression models. Square brackets indicate the reference categories for categorical predictors. Ordinal predictors were modelled as monotonic effects and they are labelled mo(variable). More regression models and further details can be found in SM2b. LOOIC = leave-one-out cross validation information criterion (lower values indicate better fit to the data; see text for details). Model weights were calculated using pseudo-Bayesian model average weights with Bayesian bootstrap (Vehtari & Gabry, 2019; Yao, Vehtari, Simpson, & Gelman, 2018) with the loo package (Vehtari, Gabry, & Gelman, 2019).

To test H1, which stated that the information provided by high prestige sources of information (educator and pilot) would be better recalled than the information provided by the low prestige source (cleaner), I ran a model ('source model') which included source of information as a predictor of recall (with cleaner as reference category) in addition to generation and opinion. Consistent with hypothesis H1, the information provided by the prestigious sources, the educator ($M=3.09$, $SD=1.70$, $B=0.06$, $SE=0.08$, 89% CI [-0.07, 0.18]) and the pilot ($M=3.09$, $SD=1.77$, $B=0.06$, $SE=0.08$, 89% CI[-0.06, 0.19]), were better recalled than the less prestigious cleaner ($M=2.93$, $SD=1.75$). However, the credible intervals for both comparisons include 0, indicating an unreliable effect of source of

information on recall. Furthermore, the fit of the source model (LOOIC=1302.5, SE=14.5) was worse than the fit of the control model (LOOIC=1301.2, SE=14.4). Allowing an interaction between source and generation did not improve model fit (LOOIC=1305.5, SE=14.5). Consequently, the results did not support H1.

To test H2, which stated that the information provided by the high relevance source (educator) would be better recalled than the information provided by the low relevance sources (pilot and cleaner), I refitted the source model with educator as the reference category. Contrary to H2, the information provided by the educator was not better recalled than the information provided by the pilot ($B=0.01$, $SE=0.07$, 89% CI [-0.11, 0.12]) and the cleaner ($B=-0.06$, $SE=0.08$, 89% CI [-0.18, 0.07]). Consequently, the results did not support H2.

An alternative way to test H1 and H2 is to use the participants' own ratings of prestige and relevance as predictors of recall, instead of assuming based on the independent raters' judgements (see Section 3.2.3) that both the pilot and the educator are high prestige sources (with the educator also being a relevant high prestige source) and the cleaner a low prestige source. As prestige and relevance were ordinal measures, we modelled them as monotonic variables (Bürkner & Charpentier, 2018): the effects of prestige and relevance on recall should increase or decrease with higher ratings but the effect might vary between adjacent ratings. In addition to generation and opinion, these models included ratings of prestige (prestige model: LOOIC=1302.2, SE=14.5), ratings of relevance (relevance model: LOOIC=1302.6, SE=14.5) or ratings of both prestige and relevance (prestige-relevance model: LOOIC=1303.8, SE=14.5). Marginal effects of the latter prestige-relevance model are shown in Figure 4. In these models, the effects of prestige and relevance were in the expected direction:

prestige (prestige model: $B=0.05$, $SE=0.14$, 89% CI [-0.17, 0.27]) and relevance (relevance model: $B=0.03$, $SE=0.13$, 89% CI [-0.17, 0.24]) both positively predicted recall in the prestige model and relevance model respectively, while for the prestige-relevance model, the effect of relevance $B=0.01$, $SE=0.13$, 89% CI [-0.19, 0.23]) diminished after accounting for prestige ($B=0.05$, $SE=0.15$, 89% CI [-0.17, 0.28]). However, the credible intervals for both variables in all models include 0 indicating unreliable effects of prestige and relevance ratings on recall. Furthermore, none of these models had better fit than the control model (LOOIC=1301.2). Consequently, these alternative analyses did not provide support for either H1 or H2.

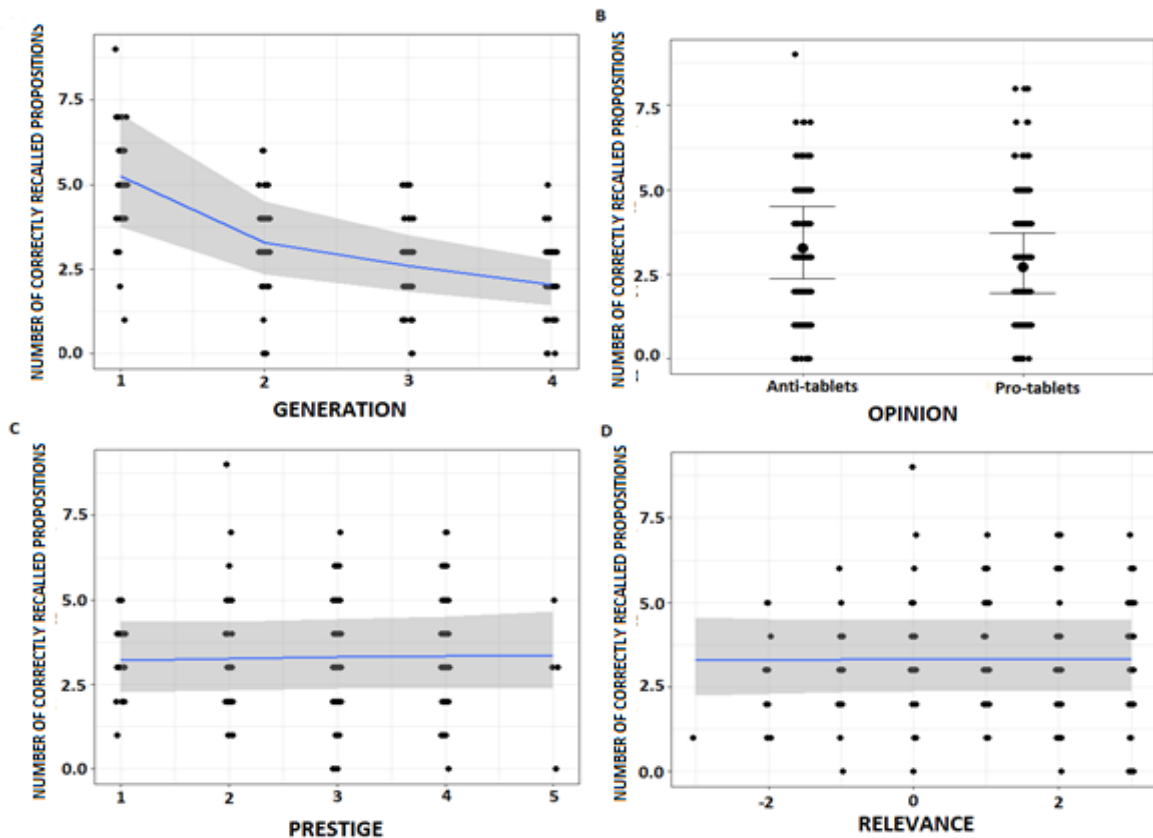


Figure 4. Marginal effects plots of the prestige-relevance model. A: The number of correctly recalled propositions decreased monotonically with generation ($B=-0.95$, $SE=0.09$, 89% CI $[-1.09, -0.81]$), the greatest decrease being between generation 1 to generation 2. B: The pro-tablets propositions were transmitted worse than the anti-tablets propositions ($B=-0.19$, $SE=0.06$, 89% CI $[-0.29, -0.10]$). C: Prestige is positively related to the number of correctly recalled propositions but this effect is very weak and the wide standard error shows that it is unreliable ($B=0.05$, $SE=0.15$, 89% CI $[-0.19, 0.28]$). D: Relevance is positively related to the number of correctly recalled propositions but this effect is very weak and the wide standard error shows that is unreliable ($B=0.01$, $SE=0.13$, 89% CI $[-0.19, 0.23]$).

3.4.- Discussion

In this experiment, I studied whether the prestige and the relevance of sources of information affect the transmission of arguments in favour (“pro-tablets”) and against (“anti-tablets”) the replacement of textbooks with computer tablets in schools. Contrary to my predictions, I failed to find a reliable advantage of the prestige (H1) or relevance (H2) of the sources of information on the transmission of their arguments using two different analytical procedures: (i) assuming that the sources differ in prestige and relevance in a similar way for all participants in our sample (Head of the Department of Education: high prestige,

high relevance; airline pilot: high prestige, low relevance; cleaner: low prestige, low relevance) and (ii) using the participants' own ratings of prestige and relevance of the sources as predictors of recall.

Although the effect of prestige on recall was statistically unreliable, it was in the expected direction. This suggests that either prestige has a weak effect on the recall of information or the results in the expected direction were due to chance. If the effects of prestige on recall are too small to have multi-generational effects in my experiment, this might indicate that the prestige of the source is not important in reality, where information is transmitted repeatedly from person to person. This would mean that, contrary to Henrich and Gil-White's (2001) hypothesis, there is no intrinsic memory bias to recall better what prestigious individuals say or argue. It would also mean that purported cases of prestige bias in real life (e.g., the 'Angelina Jolie effect', see Introduction) are exaggerated or spurious.

Alternatively, people might recall better what prestigious individuals say due to *repeated* or *redundant transmission* (Morin, 2016). That is, outside the experimental setting, people are exposed to the opinions of prestigious individuals multiple times (e.g., on TV, radio and conversations) and this multiple exposure is what makes them more memorable. Future transmission chain studies could manipulate both the prestige of the sources and the number of exposures or number of sources per argument within each generation (e.g., Eriksson & Coultas, 2012; Kempe & Mesoudi, 2014), rather just one source per argument, to test this alternative.

Another possibility is that my manipulation of prestige (i.e., ascribing opinions to fictitious sources of information with different levels of prestige) does

not adequately capture the way prestige works in everyday life. In large scale societies, especially in the digital era, people encounter individuals who are prestigious at different societal levels. *Prestigious individuals at the group level* are people who are admired and respected within a face-to-face group united by a common task or activity (e.g., a basketball team or a student class). Here, prestigious individuals and the people who admire them know each other and interact. *Prestigious individuals at the society level* (e.g., Hollywood actors/actresses, pop singers and professional footballers) do not normally know personally their admirers. Rather, their admirers have the illusion of familiarity and personally knowing the prestigious individuals, giving rise to a type of relationship known as *para-social interaction* (Horton & Wohl, 1956). At both levels, social learners already know and admire the prestigious individual, while participants in my study were for the first time exposed to the (fictional) sources. It is possible that, if participants already knew and admired the sources of information, the effects of prestige on recall might have been stronger. For example, if fans of a famous singer such as Beyoncé listens to her arguing in favour or against the replacement of computer tablets at school, these fans might recall better these arguments than similar arguments provided by other sources that they know but they do not admire. Nevertheless, similar manipulations to the one used in our study have been effective in demonstrating a positive effect of prestige on attention (Dalmaso et al., 2014; Dalmaso et al., 2012; Ratcliff et al., 2011). This suggests that prestige-biased social learning might have different effects on different measures of influence such as recall of information, attention towards the sources, opinion formation, etc. (Jiménez & Mesoudi, 2019). Future research will need to determine whether prestige-biased social learning only

occurs at certain levels (e.g., decision-making under uncertainty, attention towards sources) but not others (e.g., memory).

The recall advantage of the “anti-tablets” arguments over the “pro-tablets” arguments was unexpected. It is possible that the anti-tablets advantage was caused by a *confirmation bias effect*, i.e., better recall of information that is congruent with pre-existing attitudes (Frost et al., 2015). Supporting this, the full sample of participants was initially slightly against the replacement of textbooks by computer tablets at schools (Median=-1). However, participants’ attitudes towards tablets did not predict recall, which contradicts the confirmation bias explanation (see also Jiménez, Mesoudi, & Tehrani, 2018).

In conclusion, this experiment does not provide evidence in support of a prestige bias in the recall of information. To my knowledge, this is the first experiment studying this question. Therefore, it is difficult to know whether the prestige of the source of information genuinely does not affect recall, or whether my study suffers from methodological limitations (e.g., my manipulations of prestige). Given the potentially important consequences of prestige-driven information diffusion, such as the spread of attitudes towards breast screening or vaccination, I encourage further tests of whether information attributed to prestigious sources is preferentially recalled and transmitted through society.

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CHAPTER 4:

An Experimental Simulation of the Cultural Transmission of Dominance and Prestige Social Rank Cues

This chapter has been adapted with minor revisions from Jiménez, Á. V., & Mesoudi, A. (2019, December 28). *An experimental simulation of the cultural transmission of prestige and dominance social rank cues*. Preprint at: <https://psyarxiv.com/tc6w4/>

Contributions:

This chapter was conceptualised by Alex Mesoudi and me. Experimental design, preparation of the materials, programming of the experiment with Qualtrics, data collection, data analysis and interpretation was all conducted by myself. Original draft was written by me. It was reviewed and edited by Alex Mesoudi and me.

4.0.- Abstract

Informal social hierarchies within small human groups are argued to be based on prestige, dominance, or a combination of these two (Henrich & Gil-White, 2001). Prestige-based hierarchies entail the ordering of individuals by the level of admiration and respect they receive from others due to their competence within valued domains. This type of hierarchy provides benefits for subordinates such as high-quality social learning opportunities and both private and public goods. In contrast, dominance-based hierarchies entail the ordering of individuals by their capacity to win fights, coerce and intimidate others. This type of hierarchy produces costs in subordinates due to its aggressive and intimidating nature. Given the benefits and costs associated with these types of social hierarchies for subordinates, I hypothesized that prestige and dominance cues are better recalled and transmitted than social rank cues that do not elicit high prestige or dominance associations (here medium social rank cues). Assuming that for the majority of the population who are not already at the top of the social hierarchy it is more important to avoid the costs of dominance-based hierarchies than to obtain the benefits of prestige-based hierarchies, I hypothesized that dominance cues are better transmitted than prestige cues. I conducted a recall-based transmission chain experiment with 30 chains of four generations each (N=120). Participants read and recalled three descriptions of prestigious, dominant and medium social rank footballers, and their recall was then passed to the next participant within their chain. As predicted, I found that both prestige cues and dominance cues were better transmitted than medium social rank cues. However, I did not find support for my prediction of the better transmission of dominance cues over prestige cues. I discuss whether the results might be explain by a specific social-rank content transmission bias or by a more general emotional content transmission bias.

4.1.- Introduction

Social hierarchies are a universal phenomenon in our species (Von Rueden, 2014), emerging rapidly and spontaneously during social interactions (Anderson & Kilduff, 2009; Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013; Smith & Foti, 1998). Being at the top of the hierarchy in a human social group is associated with positive fitness outcomes such as greater access to resources, mating opportunities and greater number of surviving offspring (Betzig, 1988; Chagnon, 1988; Hill, 1984; Mealey, 1985; Savin-Williams, 1979; Snyder, Kirkpatrick, & Barrett, 2008; Von Rueden, 2014; von Rueden, Gurven, & Kaplan, 2010; von Rueden & Jaeggi, 2016). People at the top usually act as leaders of groups, which helps to solve group problems such as collective decision-making and within-group coordination (Anderson & Willer, 2014). Consequently, social hierarchy is not only beneficial for the individuals at the top but also, potentially, for groups and their members. Nevertheless, hierarchies also produce costs for groups and their members as they can lead to abuse of lower social rank individuals, which diminishes group morale and lowers group performance (Anderson & Willer, 2014).

The *dual evolutionary model of social hierarchy* (Cheng, 2019; Cheng & Tracy, 2014; Cheng et al., 2013; Henrich & Gil-White, 2001; Jiménez & Mesoudi, 2019, December 27; Redhead, Cheng, & O’Gorman, 2018a) might help to explain this contrast between the benefits and costs of social hierarchy. According to this model, informal social hierarchies within small human groups can be based on prestige, dominance, or a combination of the two. *Prestige-based hierarchies* entail the ordering of members of a social group by their prestige (sometimes referred to as ‘status’), which is defined as the respect, esteem and admiration

that they receive by other members of the group (Anderson, Hildreth, & Howland, 2015). Prestige is given by others (Blader & Chen, 2014; de Waal-Andrews, Gregg, & Lammers, 2015), usually due to being competent in domains that are appreciated by a group (Henrich & Gil-White, 2001). For example, frequently scoring goals is an indicator of competence in football, which is highly regarded by people who play/like football. As such, top goal scorers tend to attain prestige within football teams. However, competence in itself might often not be enough to be granted prestige. Competence needs to be acknowledged by others (e.g., by having many social connections) and these others have to expect to benefit from that competence somehow. In my example of football players, it would be difficult for an excellent football player to be conferred prestige if he/she is never seen playing or if he/she plays well but he/she plays in a rival team or does not share tips about his/her football skills. Therefore, prestige-biased hierarchies are not only meritocratic, but also beneficial for less knowledgeable/skilful individuals as being close to prestigious individuals gives opportunities to social learners to acquire valuable knowledge/skills (Henrich & Gil-White, 2001) and being provided with private (Pinker, 1998, p. 499) and public (Price & Van Vugt, 2014) goods.

In contrast, *dominance-based hierarchies* entail the ordering of individuals in the capacity to win fights, coerce and intimidate others (Redhead, Cheng, & O’Gorman, 2018b). Dominance is a form of informal social rank that is imposed upon others (de Waal-Andrews et al., 2015; Henrich & Gil-White, 2001), sometimes with the help of coalitional alliances. Consequently, the top of dominance-based hierarchies are usually occupied by individuals who possess physical and material characteristics that are useful to win fights and intimidate others, such as having greater strength, higher fighting skills, greater coalitional

support, and the possession of more and/or better weapons or other resources that could be used to inflict costs. Therefore, dominance-based hierarchies are mainly beneficial for the dominant individuals and their allies. Therefore, people who do not have a dominant position tend to dislike this type of hierarchy (Brand & Mesoudi, 2019; Ridgeway & Diekema, 1989) and, if possible, try to escape the influence of dominant individuals and rebel against them (Boehm et al., 1993; Cheng, 2019; Ridgeway & Diekema, 1989).

4.1.1.- Social Rank Cues

Because prestige-based and dominance-based hierarchies are associated with beneficial and detrimental fitness consequences respectively in subordinates, it is important for subordinates to identify who is prestigious and who is dominant within a social group. To this end, people use *social rank cues* or signals that convey information on the level of prestige and dominance of an individual. I classify social rank cues into first-order and second-order cues (Jiménez & Mesoudi, 2019). *First-order cues* are cues related to the behaviour, appearance, personality, material possessions, etc. of an individual. These can be assessed directly by the observer. *Second-order cues* are cues related to the behaviour of other people towards an individual and imply, therefore, a more indirect assessment of the individual by the observer.

Prestige cues are cues that people use to infer the competence of an individual within a value domain and the willingness of an individual to provide benefits for the group. Examples of *first-order prestige cues* are being knowledgeable/skilful (Henrich & Gil-White, 2001), humble (Cheng, Tracy, & Henrich, 2010) and showing altruistic behaviour towards the in-group (Halevy, Chou, Cohen, & Livingston, 2012). Examples of *second-order prestige cues* are being paid

sustained attention with prolonged eye contact, being copied, being popular, and receiving generalised voluntary deference (Henrich & Gil-White, 2001).

Dominance cues are cues that people use to infer the fighting skill of an individual and their willingness to use force and intimidation to attain their goals. Examples of *first-order dominant cues* are being aggressive/intimidating (Henrich & Gil-White, 2001), arrogant/narcissist and self-centred (Cheng et al., 2010). Examples of *second-order dominance cues* are being paid attention but without receiving prolonged eye contact, being obeyed, being disliked/unpopular and receiving generalised coerced deference (Henrich & Gil-White, 2001).

Medium social rank cues are cues that people use to infer that an individual is not particularly prestigious or dominant but is not at the bottom of either hierarchy. Examples of *first-order medium social rank cues* are having average knowledge/skill, being modest and regarding highly the contribution of others. Examples of *second-order medium social rank cues* are not being paid a lot of attention, not being very influential within a group and receiving deference by only a small group of close friends and relatives.

4.1.2.- Hypotheses

According to Henrich and Gil-White (2001), prestige-based hierarchies evolved as a way to identify individuals with better-than-average fitness-enhancing knowledge/skills from whom to learn. Based on their theory, they predicted that high prestige individuals are more likely to be copied by others than low prestige individuals. This prediction has found some support (Atkisson, O'Brien & Mesoudi, 2011; Brand, Heap, Morgan & Mesoudi, 2019; Chudek, Heller, Birch & Henrich, 2012), although with limitations (see Jiménez & Mesoudi, 2019). However, a key piece in the puzzle of how people learn from prestigious individuals is missing in the literature. That is, there is a lack of studies investigating the cultural transmission of prestige cues themselves. This is an important question because it is necessary to identify prestigious individuals to be able to preferentially copy them.

If people select individuals with better-than-average knowledge/skills from whom to learn through the identification of indirect cues that convey high prestige, as Henrich and Gil-White's state, then it is likely that natural selection (or potentially cultural selection, Heyes, 2018) has shaped human cognition to be more attentive to, and process and recall better high prestige social rank cues than social rank cues conveying lower prestige. If so, descriptions of individuals displaying high prestige social rank cues would be transmitted with greater fidelity during social interactions than descriptions of individuals displaying lower prestige social rank cues.

The identification of individuals who are more likely to impose costs upon others through physical aggression or other types of intimidation might also have been important in human evolution. Natural selection (or cultural selection) might therefore have shaped human cognition to be more attentive, and process and

recall better high dominance social rank cues than social rank cues conveying lower dominance. If this is true, then descriptions of individuals displaying high dominance social rank cues would be transmitted with greater fidelity during social interactions than descriptions of individuals displaying lower dominance. Consequently, I predict that both high prestige and high dominance social rank cues are better transmitted than medium social rank cues.

Another important question is whether high dominance cues are better transmitted than high prestige social rank cues, high prestige cues better transmitted than high dominance cues, or both types of high social rank cues are similarly well transmitted. Previous research suggested that people tend to be more attentive, recall better and choose to transmit more information conveying negative and threat-related information than neutral or positive information (Bebbington et al., 2017; Blaine and Pascal, 2018) and that people are loss averse, i.e., they prefer not to lose certain amount of money than to gain the same amount of money with the same probability (Kahneman & Amos, 1979; but see Mukherjee et al., 2017). These pieces of evidence suggest that avoiding costs might have been more important in human evolution than attaining benefits. If so, it is likely that people are more attentive, process and recall better high dominant social rank cues, which signal the capacity and disposition of an individual to impose costs over others, than high prestige social rank cues, which displays the capacity to provide benefits to others, being injured is likely to have important negative fitness consequences such as impeding physical mobility and difficulties attaining resources. Therefore, high dominance cues, which convey the capacity and willingness to inflict costs upon others should be easily identified and remembered. In contrast, lacking access to the knowledge/skill of a prestigious individual might be less detrimental given the fact that others

individuals of the group (e.g., kin) are likely to possess and be willing to share knowledge/skills, which, although less valuable than the knowledge/skills of the prestigious individual, are still likely to be fitness-enhancing. Consequently, I predict that high dominance cues are better transmitted than high prestige cues.

In this experiment, I created fictional descriptions of three footballers playing in three different local football teams, who were described as prestigious, dominant or medium social rank. I use a transmission chain experimental design (Bartlett, 1932; Mesoudi, 2007) in which participants were organised in linear chains of four participants ('cultural generations') in order to test the accumulated effect of memory biases beyond a single individual's recall. Participants in the initial group receive and recall the original descriptions, while the remaining participants receive the information recalled by participants in the previous generation of their chain. I preregistered my hypotheses on the Open Science Framework (OSF) website (<https://osf.io/68vcs>, see SM3a.), which were that:

H1: Both high prestige and high dominance cues are more accurately transmitted over experimental cultural generations than medium social rank cues.

H2: High dominance cues are more accurately transmitted over experimental cultural generations than prestige cues.

4.2.- Methods

4.2.1.- Ethical Statement

The study was approved by the Biosciences Ethical Committee at the University of Exeter Cornwall Campus on the 4th November 2019 (Ref eCORN002174 v3.3).

4.2.2.- Participants

Following the procedure stated in the preregistration (<https://osf.io/68vcs>, see SM3a), I recruited online participants through Prolific (www.prolific.ac) (Peer, Samat, Brandimarte, & Acquisti, 2016). Using pre-screening filters, I selected participants who were aged 18-60 years, were English native speakers, had British Nationality, had an approval rating on previous Prolific studies of 90% or above, and had not participated in any of our previous studies through this website.

The data was collected at four different times (one for each “cultural generation”), between the 12th and 19th November 2019. Each time I recruited 30 participants to complete one generation. 30 chains were necessary to provide five replications of each of the six counterbalanced versions of the experimental materials (see Section 4.2.4). Participants were paid at a rate of £6/hour for an estimated time of completion of 15 minutes for Generations 1 and 2 (£1.5) and 10 minutes for Generations 3 and 4 (£1).

Following the exclusion criteria stated in the preregistration, I excluded from the dataset the data of two participants who read at least one of the footballers’ descriptions at a rate greater than 1080 words/minute. I derived this

cut-off point from a previous transmission chain experiment (Jiménez & Mesoudi, 2019, July 10), in which participants who read the materials faster than this pace were unable to recall anything from the materials. These two excluded participants were replaced by new participants. We also excluded two other participants who occupied the same generation in a chain for which we had already collected a response. As stated in the preregistration, the responses for participants who completed the study first were retained.

Overall, I recruited 124 participants (84 females, 40 males) aged 18-60 ($M=37.25$, $SD=10.27$), with 120 of these participants (82 females, 38 males) aged 18-60 ($M=37.44$, $SD=10.25$) included in the analysis.

4.2.3.- Materials

Fictional descriptions of three different local footballers (John, Bill and James) who play in different local teams (also fictional) were created as materials to transmit along the chains. These descriptions were created with the intention of describing a prestigious (John), a dominant (Bill) and a medium social rank (James) footballer respectively. The materials were based on the dominance-prestige distinction put forward by Henrich and Gil-White (2001) and Cheng et al. (2010). Following this account, John, the prestigious footballer, was described as a competent footballer who was admired by his teammates. In contrast, Bill, the dominant footballer, was described as a violent footballer who was feared by his teammates. James, the medium social rank footballer, was described as having average football skill without evoking strong emotions. I decided to use medium social rank rather than low social rank because low social ranked individuals were likely to elicit strong emotions of pity and sympathy. Medium social rank is both lacking in such emotions, and in prestige and dominance cues.

The exact descriptions of the three footballers are as follows:

Prestigious footballer (John)

Everybody in the football team admires John. He is so skilful as a football player that last year he scored the most goals in the local league. Consequently, this year members of the team unanimously voted to make him captain of the team. They also tend to copy whatever he does. At team meetings, the other members always pay careful attention to what he is saying with their eyes fixed on him. Nevertheless, he is modest about his football skills and he always takes other team members' wishes into consideration. Outside of the football team, he is also very popular. People often invite him to parties because they want to spend time with him.

Dominant footballer (Bill)

Everybody in the football team is afraid of Bill. He is so violent as a football player that last month he injured two teammates during training. This year he self-appointed himself captain without the support of any team member. Other teammates tend to obey him. At team meetings, the other members always pay careful attention to what he is saying, though usually without making eye contact with him. He thinks he is the best player and he never takes other team members' wishes into consideration. Outside of the football team, people also dislike him, but people invite him to parties because they don't want to make him angry.

Medium social rank footballer (James)

People in the football team don't have strong emotions towards James. He is an average football player in the team, scoring only a few goals last year. This

year he wanted to be the captain of the team, but he only received two votes. He isn't very influential among his teammates. At team meetings, the other members of the team often don't listen to him very carefully and don't tend to fix their eyes on him for long. He is modest about his football skills, and consequently takes other teammates' perspectives in high regards. Outside the team, he is not particularly popular but he does get invited to parties held by his closest friends because they like to hang out with him.

4.2.4.- Design

A within-chain transmission chain design with four generations per chain was used. Participants in the first generation were asked to read and then recall the original descriptions of all three footballers (prestigious, dominant and medium social rank) given above in Section 4.2.3, although without the labels denoting prestige, dominance or medium social rank. The product of their recall was then transmitted to the next participant in their chain (second generation), who also recalled the material. This procedure was repeated until reaching the fourth generation and across 30 separate, parallel transmission chains to provide independent replications of transmission effects. The order of presentation of the three descriptions was fully counterbalanced, which resulted in six different versions of the experimental materials (5 replications for each version).

4.2.5.- Procedure

Participants were first randomly assigned to one of the 30 transmission chains and provided with the following instructions: *“In the following you will read three descriptions of three football players who play in different local football teams in the UK. We would like you to read these descriptions very carefully as*

you will be asked some questions about each of the football players later. It is very important that you read the information at a pace that allows you full comprehension as you will be asked some questions about this information later.”

Second, they read the three descriptions of the prestigious, dominant and medium social rank footballer. Third, they were asked to provide their basic demographic information (i.e., gender, age, first language, nationality, profession and nearest city from where they live). This served as a distractor task. Fourth, they were asked to recall the descriptions of the three footballers one by one. They were given between a minimum of 1 minute and a maximum of 3 minutes to recall the description of each footballer. Lastly, participants were thanked for their participation and informed about the goal of the experiment and our hypotheses.

4.2.5.- Coding and Data Analyses

Participants' recall accuracy was assessed by comparing their correct recall with a preregistered table (<https://osf.io/b4nqu/>, see Appendix B.3)⁶ containing twelve social rank cues for each description. Examples of prestige cues are to be skilful, admired and copied. Examples of dominance cues are to be violent, feared and obeyed. Examples of medium social rank cues are to have average skill, not to evoke strong emotions and not to be very influential. After data collection, I realised that two cues contained two cues each. For instance, “being chosen as captain”, which in the original table was considered a unique prestige cue could be divided into having the position of captain (being captain)

⁶ The registration form was submitted on 11th November 2019. The data was collected between the 12th and 19th November. During data collection, I realised that the supplementary materials for the preregistration (i.e., experimental materials, table for coding recall and R script) were not attached to the preregistration form and uploaded again on 15th November 2019.

and the process of attainment of the captainship (being chosen/voted). The same was applicable for the equivalent dominance cue (“being self-appointed captain” = being captain + attaining the captainship through self-appointment) and medium social rank cue (“not enough votes for being captain” = not being captain + receiving few votes). The other proposition (“being invited to parties” for both the prestigious and dominant individuals, and “being invited to parties of closest friends” for the medium social rank individual), were considered unfair for the medium social rank individual as it contained more information to remember. Consequently, I changed the recall coding system to accept “being invited to parties” as one cue for the three individuals. An additional proposition specified the people who invited them (i.e., only their friends for the medium social rank individual and the team or people in general for both the prestigious and dominant individual). See Table 6. Both coding systems (the preregistered and the new) yielded qualitatively similar results and, consequently, I only report here the results derived from the new, improved coding system. A second coder, who was blind to the hypothesis, coded 10% of the chains (3 chains) using this improved coding system. A high inter-coding reliability between both coders (Cohen’s Kappa = 0.86) was found.

PROPOSITIONS	PRESTIGIOUS (John)	DOMINANT (Bill)	MEDIUM SOCIAL RANK (James)
P1	Is admired	Is feared	Doesn't arouse strong emotions
P2	Skilful	Violent	Average skill
P3	Highest goal score	Injured teammates	Few goals
P4A + P4B	A: Being captain	A: Being captain	A: Not being captain
	B: Being chosen/voted	B: Being self-appointed	B: Not having many votes
P5	Is copied	Is obeyed	Isn't very influential
P6	Is paid attention to / Is listened to	Is paid attention to / is listened to	Is not paid (a lot of) attention to / Is not listened to (very carefully)
P7	Received eye contact	People avoid eye contact	Rarely prolonged eye contact
P8	Is modest	He thinks he is the best (arrogant/narcissist)	Is modest
P9	Takes others into consideration	Doesn't take others into consideration	Take others' perspectives in high regard (Takes others into consideration)
P10	Is popular / liked	Is unpopular/disliked	isn't particularly popular
P11A + P11B	A: is invited to parties	A: is invited to parties	A: is invited to parties
	B: by the team/people	B: by the team/people	B: by closest friends
P12	People want to spend more time with him	People don't want to make him angry	Closest friends like to hang out with him

Table 5. Recall coding template. Propositions 4 and 11 were splitted into propositions 4A and 4B, and 11A and 11B respectively after data collection. See main text for details.

All statistical analyses were conducted with Bayesian package *brms* (Bürkner, 2017) in R 3.5.3 (R Core Team, 2019) following the preregistered R script (see SM3c). As in my previous transmission chain experiments (Jiménez & Mesoudi, 2019, July 2010; Jiménez, Stubbersfield, & Tehrani, 2018), all the regression models were multilevel with intercepts varying by chain. I treated generation as a monotonic variable (Bürkner & Charpentier, 2018) as recall decreases over generations but the amount of the decrease varies between adjacent generations (Jiménez & Mesoudi, 2019, July 10). I adopted a model comparison approach, comparing a control model that included generation as the

sole predictor of recall to a model that, in addition to generation, included the type of social rank cue (prestige, dominance, medium social rank) as a predictor. I use leave-one-out cross validation information criterion (LOOIC) (Vehtari, Gabry, & Gelman, 2019), as a measure of relative model fit. LOOIC can be interpreted similarly to Akaike information criterion (AIC) or Watanabe-Akaike information criterion (WAIC), such that a lower LOOIC indicates better fit to the data.

4.3.- Results

4.3.1.- Cumulative Recall

Figure 5 shows the number of correctly recalled social rank cues across cultural generations for the description of each footballer (prestigious, dominant and medium rank). As in similar transmission chain experiments, the number of correctly recalled social rank cues decreases over cultural generations. As predicted by H1, the figure clearly shows that the prestige and dominance cues were better transmitted than the medium social rank cues. This effect is present from the first generation, and in each subsequent generation. Contrary to H2, the figure does not show any clear differences in the transmission of prestige and dominance cues over generations.

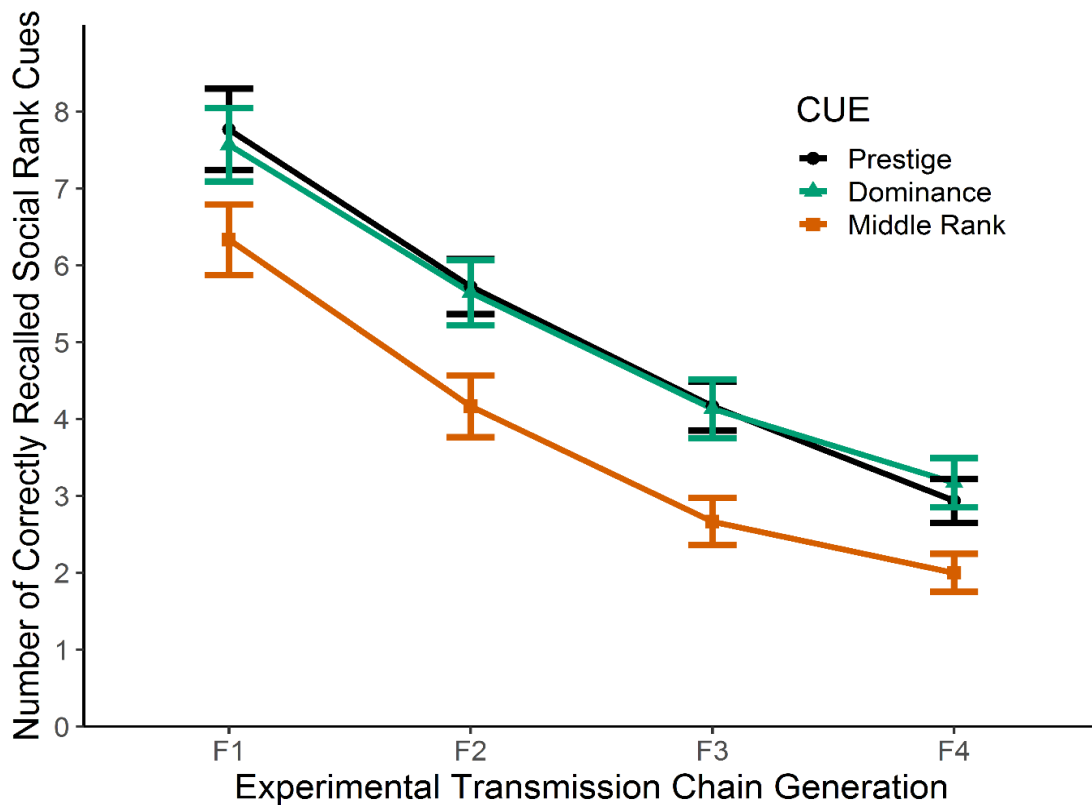


Figure 5. Raw means for the recall of information with 1.60 standard error bars (corresponding to 89% CI as given in the text) plotted against generation. As predicted by H1, both prestige cues and dominance cues were better transmitted than medium social rank cues. Contrary to H2, there were no clear differences in the transmission of prestige cues and dominance cues over generations.

To statistically analyse these trends, I produced several Bayesian multilevel Poisson regression models (See Table 7). I first ran a generation-only model that included generation as the sole predictor of recall, which was used as our control model (LOOIC=1431.3, SE=17.4). I compared this model with my two a priori models. The first was a social rank model, which included the three types of social rank cues (prestige, dominance and medium social rank cues) together with generation as predictors of recall (LOOIC=1400.4, SE=17.5). The second was an interaction model, which included the main effects of the social rank cues and generation together with their interaction (LOOIC=1400.9, SE=17.5). Both a priori models had a better fit than the control generation model, with the social rank model being slightly better than the interaction model. As predicted by H1, both dominance cues (M=5.15, SD=2.75, B=0.30, SE=0.06, 89% CI [0.20, 0.40])

and prestige cues (M=5.12, SD=2.76, B=0.31, SE=0.06, 89% CI [0.21, 0.41]) were better recalled than medium social rank cues (M=3.79, SD=2.58). Contrary to H2, the dominance cues were not better recalled than the prestige cues (B=-0.01, SE=0.06, 89% CI [-0.10, 0.09]).

Unstandardized Coefficients	Main Regression Models		
	Generation	Cues	Cues * Generation
	B (SE)	B (SE)	B (SE)
Intercept	1.92 (0.08)	1.70 (0.09)	1.76 (0.10)
mo(Generation)	-0.97 (0.07)	-0.97 (0.07)	-1.12 (0.13)
Cue [Dominance]		0.30 (0.06)	0.21 (0.09)
Cue [Prestige]		0.31 (0.06)	0.25 (0.08)
Cue[Dominance]:Generation			0.24 (0.17)
Cue[Prestige]:Generation			0.16 (0.17)
LOOIC	1431.3	1400.4	1400.9
model weights	0.000	0.562	0.438

Table 6. Unstandardized Coefficients (B) and their standard errors (in brackets) for each of the main regression models. Square brackets indicate the reference categories for the categorical predictors. Ordinal predictors were modelled as monotonic effects and are labelled mo(variable). More regression models and further details can be found in the Supplementary Materials. LOOIC = leave-one-out cross validation information criterion (lower values indicate better fit to the data; see text for details). Model weights were calculated using pseudo-Bayesian model average weights with Bayesian bootstrap (Vehtari & Gabry, 2019; Yao, Vehtari, Simpson, & Gelman, 2018) with the loo package (Vehtari, Gabry, & Gelman, 2019).

Exploratory analyses were conducted to study the possible effects of gender, age and interest in football on the transmission of social rank cues. The addition of these three variables together or separately to the social rank model did not improve its model fit (see SM4a).

4.3.2.- Narrative Evolution

To study the narrative evolution, I analysed which social rank cues were well conserved in generation 4 for the description of the prestigious, dominant and medium social rank individuals. I also identified participants' inferences at

any generation within the chains and assessed their congruency with the dominance-prestige-medium social rank distinction. These analyses were not included in the preregistration and are exploratory.

For the prestigious individual, the cue that was best conserved in Generation 4 was being popular (67%), which was followed by being invited to parties (47%), being the team captain (40%), being skilful playing football (30%) and being voted for the captain position (33%). Participants' inferences mainly referred to his good social skills (e.g., "nice", "friendly", "kind", "open"), confidence, competence (e.g., "all round", "golden boy") and the wish of people to be like him. These inferences are all congruent with the notion of a prestigious individual as it was described in the introduction, i.e., as a competent, generous and respected individual.

For the dominant individual, the cue that was best conserved was being feared (60%), which was followed by being team captain (43%), being invited to parties (37%), being aggressive (33%), having self-appointed himself the captain position (30%), being obeyed (30%) and being unpopular (30%). Participants' inferences refer to him as an "angry", "mean", "nasty", "unpleasant", "direct", "forceful", "hostile", "loud" "bully" who "shouts a lot", "is not a good listener" and "people don't enjoy his company". These inferences are congruent with the notion of a dominant individual as described in the introduction, i.e., an aggressive individual who is feared by people.

For the medium social rank individual, the cue that was best conserved was having average football skill (57%), followed by being invited to parties (43%). Participants' inferences refer to him as a "good person" (also "nice", "pleasant", who "could be trusted in times of need") with an introverted personality

(e.g., “quiet”, “shy”, “reserved” person who “may lack confidence in larger groups”). These characteristics are compatible with the notion of medium social rank. However, opposite characteristics, i.e., being a bad person with an extroverted personality, would also be compatible with the notion of medium social rank.

4.4.- Discussion

In this study, I have tested (H1) whether high social rank cues (both prestige and dominance cues) are better transmitted than medium social rank cues and (H2) whether dominance cues are better transmitted than prestige cues. To test these two hypotheses, I conducted a transmission chain experiment with four cultural generations. Supporting H1, I found that both prestige and dominance cues were better transmitted than medium social rank cues. The recall advantage of both high social rank cues was evident in the first generation, which suggests that this effect might be strong enough to be detected in single-generation experiments, although also carried through to all subsequent generations, indicating its long-term stability over repeated transmission episodes. This result is consistent with the evolutionary importance of both prestige-based and dominance-based social hierarchies in human social groups (Henrich & Gil-White, 2001).

Contrary to H2, dominance cues were no better transmitted than prestige cues. I predicted a transmission advantage of dominance cues over prestige cues because I assumed that avoiding the potential costs produced by dominant individuals (e.g., physical injuries) were more important than the potential benefits provided by prestigious individuals (e.g., high quality information to socially learn). My experiment does not test directly this assumption, but the lack of

statistical differences between the cumulative recall of prestige and dominance cues suggest that identifying both prestigious and dominant individuals might have been equally important in our evolutionary history.

Recall-based transmission chain experiments are generally used to study content transmission biases, i.e., a transmission advantage of information with particular intrinsic characteristics. These studies have identified different content biases such as social (Mesoudi, Whiten, & Dunbar, 2006; Stubbersfield, Tehrani, & Flynn, 2014), emotional (Eriksson & Coultas, 2014; Stubbersfield, Tehrani, & Flynn, 2017), negative (Bebbington, MacLeod, Ellison, & Fay, 2017), and stereotypical (Kashima, 2000; Lyons & Kashima, 2006) content transmission biases. My results suggest another content transmission bias to add to this list: a *social rank content transmission bias*. However, the results might also be explained, not by a specific content bias referring to social rank, but by a previously identified content bias: the emotional content bias. Stubbersfield et al. (2017) showed that narratives with high emotional content are better transmitted than narratives with low emotional content. This effect occurred independent of the valence of the emotion (positive as in amusement vs negative as in disgust). It is plausible that our descriptions of both the prestigious individual and the dominant individual have elicited a higher level of emotionality than our description of our medium social rank individual. The description of a prestigious football player might have elicited positive emotions like admiration, while the description of the dominant football player might have elicited negative emotions like fear. This possibility would be congruent with Henrich and Gil-White's dual evolutionary model of social hierarchy, which states that the emotions of admiration and fear elicited in others are the mechanisms by which prestigious and dominant individuals respectively acquired high social rank and influence. As

emotions are a proximate mechanism, emotional and social rank content biases are not necessarily alternative explanations. Emotions such as admiration and fear could be the proximate mechanism by which the ultimate-level social rank bias operates. Future studies should use procedures to balance the emotional content across experimental conditions to test whether the elicitation of emotions is the mechanism by which social rank bias operates at a proximate level.

Another possibility is that the experimental materials for both prestige and dominance cues were easier to remember (i.e., less cognitively demanding) than the medium social rank cues due to their higher level of concreteness (Heath & Heath, 2008). Being at the top of a social hierarchy, being feared or admired, being popular or disliked is more concrete and, consequently, easier to remember, than being in the medium of a social hierarchy, not eliciting strong emotions, or not being particularly popular. Future studies might use a description of an individual at the bottom of both dominance and prestige hierarchies to avoid the problem of different levels of concreteness between high social rank and lower social rank. A description of an individual at the bottom of a social hierarchy could also elicit higher level of emotions (e.g., compassion, pity) than the medium social rank description, which might help to alleviate the problem of different levels of emotional content.

In conclusion, I have found evidence to support the higher fidelity transmission of high social rank cues, referring to both prestige and dominance, than medium social rank cues. I found no evidence that supports a transmission advantage of either type of high social rank cue. However, the mechanism that explains these results are not clear. It could be the consequence of a specific content transmission bias referring to high social rank (social rank content

transmission bias) or it could be a more general feature of the information such as a higher level of emotional content or concreteness of the experimental materials for both the prestigious and dominant individual than for the medium social rank individual. Given that this is the first experiment studying the cultural transmission of social rank cues, I encourage both direct and conceptual replications of this study to further explore the transmission advantage of social rank cues.

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CHAPTER 5:

The Integrated Dual Evolutionary Model of Social Hierarchy

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Contributions:

This chapter was conceptualised by Alex Mesoudi and me. Original draft was written by me. It was reviewed and edited by Alex Mesoudi and me.

5.0- Abstract

Almost 20 years ago, Henrich and Gil-White (2001) developed the *dual evolutionary model of social hierarchy*, which distinguishes between dominance and prestige as two different strategies to attain, maintain and increase social rank and social influence. This model has stimulated research in a variety of fields such as psychology, anthropology and management science; has proved to be useful to explain contradictory findings in the literature and has prompted new avenues for research. However, the current application of this model faces two main problems: (i) it is not clear whether a two-strategy model is the best way to conceptualise the strategies that people use to attain social rank, and (ii) it is challenging to apply this model, which was initially developed to explain the attainment of high social rank within small groups without formal hierarchies, to large-scale societies with formal hierarchies. In this article, I address these two problems. To this end, I first outline Henrich and Gil-White's dual evolutionary model of social hierarchy. Second, I describe the evidence for and against the different aspects of this model and discuss the ways that it could be integrated with research conducted in adjacent fields. Lastly, I outline an integrated model that addresses the two problems pointed out above and encourage the study of how contextual factors affect the strategies that people use to acquire, maintain and increase social rank and social influence.

5.1.- Introduction

In a scene of the popular TV series *Game of Thrones*, Lord Petyr 'Littlefinger' Baelish threatens the Queen-Regent Cersei Lannister with compromising information that, if publicly revealed, could negatively affect her. In his view, threatening Cersei in this way would make him more socially influential.

“Knowledge is power” he bluntly states. As a way to teach ‘Littlefinger’ a lesson, Cersei orders her guards to seize him and cut his throat, but then she orders the guards to stop. She says: “power is power”. This scene illustrates well how people use coercion as a way to compete for social rank and social influence. Yet, people also compete for social rank and social influence through the display of valued knowledge/skills. This is the way scientists, artists and athletes compete for social rank and social influence within their area of specialism.

Henrich and Gil-White (2001) labelled these two different strategies for competing for social rank ‘dominance’ and ‘prestige’, respectively. This distinction between dominance and prestige has stimulated research in cultural evolution (e.g., Brand & Mesoudi, 2019; Offord, Gill, & Kendal, 2019), social psychology (e.g., Halevy, Chou, Cohen, & Livingston, 2012; Maner & Case, 2016), evolutionary psychology (e.g., Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013; Conlon, 2019; Snyder, Kirkpatrick, & Barrett, 2008), anthropology (e.g., Henrich & Broesch, 2011; Reyes-Garcia et al., 2008; Von Rueden, Gurven, & Kaplan, 2010), and management science (McClanahan, 2019; Ronay, Maddux, & von Hippel, 2018); has proved to be extraordinarily useful to explain contradictory findings in the literature (e.g., Cheng & Tracy, 2014; Kakkar, Sivanathan, & Gobel, 2017); and has prompted new avenues for research (e.g., Cheng, Tracy, & Henrich, 2010).

However, the current application of the dominance-prestige distinction faces two main problems. First, it is not clear whether a two-strategy model is the best way to conceptualise the pathways to high social rank in humans. For some authors, competence is the only way to the top (e.g., Chapais, 2015). For others, morality is an independent third way to the top (Bai, 2016). Moreover, there have

been proposals to distinguish between different strategies to obtain coerced social influence (Lewis, 2002), as well as to distinguish between different strategies for attaining voluntary social influence (Anderson & Kilduff, 2009a).

Second, dominance and prestige were initially just two different strategies to acquire high social rank and influence within small groups without formal hierarchies. However, the distinction is now being applied to large-scale societies and groups with formal hierarchies (e.g., Kakkar & Sivanathan, 2017) without explicitly acknowledging the different dynamics of social rank allocation in groups of different size and in hierarchies with different levels of formality. The distinction between power and status (e.g., Magee & Galinsky, 2008) in social psychology is potentially more suitable for large-scale societies with formal hierarchies than the dominance-prestige distinction.

In this article, I address these two problems. To this end, I first outline Henrich and Gil-White's *Dual Evolutionary Model of Social Hierarchy* (henceforth Standard Dual Model or SDM). Second, I describe the evidence for and against the different aspects of the SDM and discuss the ways that it could be integrated with research conducted in adjacent fields. Lastly, I outline an integrated model that addresses the two problems pointed out in this introduction and I encourage the study how contextual factors affect the strategies that people use to acquire, maintain and increase social rank and social influence.

5.2.- The Standard Dual Evolutionary Model of Social Hierarchy (SDM)

Figure 6 depicts the SDM (Cheng & Tracy, 2014; Cheng, Tracy, Foulsham, et al., 2013; Henrich, 2016; Henrich & Gil-White, 2001; Redhead, Cheng, Driver, Foulsham, & O'Gorman, 2018). I distinguish three levels of analysis: strategies to

acquire high social rank (dominance strategy vs prestige strategy), dimensions of social rank (dominance dimension vs prestige dimension) and consequences of social rank (being influential, receiving attention, receiving deference, and having higher fitness for both the dominance dimension and the prestige dimension, and being copied only for the prestige dimension).

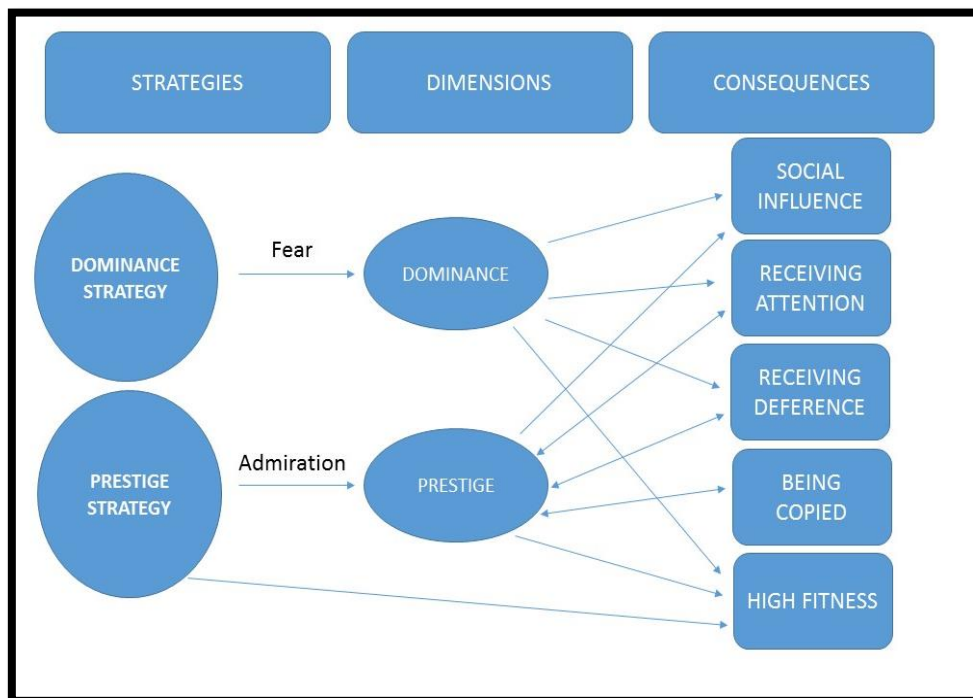


Figure 6. The Standard Dual Evolutionary Model of Social Hierarchy (SDM). Based on Henrich and Gil-White (2001)

According to the SDM, dominance and prestige are two strategies that people use (consciously or unconsciously) to acquire, maintain and/or increase their social rank and social influence within a social group. The *dominance strategy* entails the display of aggressive and coercive behaviours to induce *fear* in other individuals. In contrast, the *prestige strategy* entails the display of knowledge/skill within valued domains to induce *admiration* in other individuals.

Although this is not always explicit (e.g., Cheng, Tracy, Foulsham, et al., 2013), there are not only two ways (strategies) to the top (high social rank) in the SDM. There are also two different tops (dimensions on Figure 6), with each one only being reachable by one strategy, which receives the same name as the dimension (see arrows connecting the dominance strategy to dominance dimension and the prestige strategy to prestige dimension in Figure 6). The key difference between both dimensions is whether the social rank is coercively imposed (dominance dimension) or voluntarily conferred (prestige dimension) (Cheng, 2019; Redhead, Cheng, & O’Gorman, 2018a). Consequently, the boundaries between the dominance strategy and the dominance dimension and between the prestige strategy and the prestige dimension are not clearly marked in the SDM.

In the SDM, having a position of high dominance or high prestige within a social group confers social and biological benefits. Both dominant and prestigious individuals are socially influential, receive preferential attention and deference and tend to have higher biological fitness (see arrows connecting both dominance and prestige dimensions with social influence, receiving attention, receiving deference and higher fitness in Figure 6). Nevertheless, these similar consequences of dominance and prestige are the result of the distinct emotions they elicit in subordinates: fear vs admiration respectively. Whereas dominant individuals received deference due to fear of the potential costs of failing to do so (*coerced deference*), prestigious individuals receive deference due to the desire of other people to have access to their knowledge/skills (*voluntary deference*). Similarly, dominant individuals are paid attention as a way to monitor their potentially threatening behaviour, while prestigious individuals are paid attention due to the admiration towards their knowledge/skills. The same mechanism

indicates that dominant individuals are socially influential through *obedience*, while prestigious individuals are influential through *persuasion*.

A clear difference between the consequences of dominance and prestige is that prestige leads to being copied by other individuals, while this is not the case for dominance (see arrow connecting the prestige dimension with being copied but the lack of arrow connecting the dominance dimension with being copied in Figure 6). According to Henrich and Gil-White (2001), prestige evolved in our lineage as a way to select knowledgeable/skilful models from whom to learn within valuable domains (e.g., hunting skill for a hunter-gatherer society). This would have led to gaining superior knowledge/skills to increase fitness. Some of these cues are *first-order cues*, i.e., characteristics of the target individual such as their age and level of confidence, which can be assessed directly by the observer to infer competence (Jiménez & Mesoudi, 2019). However, these cues could be unreliable. This would have favoured the use of *second-order cues* such as the amount of sustained attention, voluntary deference and copying that individuals receive as a way to infer who has superior knowledge/skills by observing the behaviour of other individuals displayed towards the target individual (Henrich & Gil-White, 2001; Jiménez & Mesoudi, 2019). In this sense, the relationship between prestige and being copied, being paid attention and receiving deference is bidirectional (see bidirectional arrows prestige to being copied, receiving attention and receiving deference in Figure 6) because prestige leads to being copied and receiving attention and deference occurs at the same time as being copied, and this attention and deference serves to reinforce an individual's prestige. First-order (e.g., physical formidability) and second-order cues (e.g., fear displayed towards the target individual) are also used for identifying who is dominant. The use of these cues is adaptive as it helps to

prevent potential costs by individually and socially learning who is more likely to cause those costs without having to directly suffer themselves the dominant behaviour (Jiménez & Mesoudi, 2019, December 28).

5.3.- Key Predictions, Empirical Evidence and Limitations of the SDM

In this section, I discuss the key predictions derived from the SDM (Table 1), their associated empirical evidence and its limitations. I also propose to integrate the SDM with research about social hierarchy in adjacent fields, mainly social psychology.

Predictions about dominance and prestige strategies	
(i)	Dominance and prestige strategies are independent from each other ^{1 2}
(ii)	Both dominance and prestige strategies lead to acquiring high social rank and social influence ^{1 2}
(iii)	Dominance and prestige strategies use different means (fear vs admiration) ^{1 2}
Predictions about the dynamics of dominance and prestige dimensions	
(iv)	The strength of the social influence attained by people high in dominance diminishes over time ³
(v)	The strength of the social influence attained by people high in prestige strengthens over time ³
Predictions about the consequences of dominance and prestige dimensions	
(vi)	Both dominant and prestigious individuals received more attention than low social rank individuals ^{1 2}
(vii)	Prestigious individuals receive more sustained attention than dominant individuals ¹
(viii)	Dominant individuals receive more furtive glances than prestigious individuals ¹
(ix)	Both dominant and prestigious individuals received more deference than low social rank individuals ¹
(x)	The deference prestigious individuals receive is voluntarily conferred, while the deference received by dominant individuals is coercively attained ¹
(xi)	Both dominant and prestigious individuals have higher fitness than low social rank individuals ¹
(xii)	Prestigious individuals are preferentially selected as models from whom to socially learn valued knowledge/skills ¹

Table 7. Key predictions of the Standard Dual Evolutionary Model of Social Hierarchy.

¹ (Henrich & Gil-White, 2001), ² (Cheng et al., 2013), ³ (Redhead et al, 2018)

5.3.1.- Strategies to Social Rank and Influence

5.3.1.1.- Two Ways to the Top?

The SDM predicts that dominance and prestige are two strategies, which are independent from each other (prediction (i) in Table 8), and that lead to acquiring high social rank and influence (prediction (ii) in Table 8) through the use of different means (fear and admiration respectively, prediction (iii) in Table 8).

The standard procedure to test whether dominance and prestige are two independent strategies (prediction (i) in Table 8) has been to ask subjects to rate the perceived prestige and the perceived dominance of themselves or other individuals using the validated Dominance-Prestige scales (Cheng, Tracy, & Henrich, 2010) to see to what extent prestige and dominance ratings are correlated. Low correlations are taken as evidence of the independence of the two strategies. The scales include items for dominance like “I (he/she) enjoy(s) having control over others” and “Some people are afraid of me (him/her)”. The scales also include items for prestige like “Members of my (your) group respect and admire me (him/her)” and “Members of my (your) group do not want to be like me (him/her)” (reverse coded). The results of multiple studies using this scale or another similar scale (Buttermore, 2006), have supported the idea that prestige and dominance strategies are independent, as the correlations have tended to be low (between $r=-0.06$ and $r=0.18$). These results have been found in studies that asked participants to rate themselves (Cheng et al., 2010; Conlon, 2019; Monge-López & Álvarez-Solas, 2017); unacquainted peers in a group task conducted in the laboratory (Cheng, Tracy, Foulsham, et al., 2013); peer members of an athletic team (Cheng et al., 2010) or of other naturally occurring groups such as music bands and small businesses (Brand & Mesoudi, 2019);

and the famous footballer Lionel Messi (Kakkar et al., 2017). Furthermore, low correlations between prestige and dominance are maintained over time among undergraduate classmates (Redhead, Cheng, Driver, et al., 2018).

The prediction that both dominance and prestige strategies lead to high social rank and social influence (prediction (ii) in Table 8) has been experimentally tested by Cheng, Tracy, Foulsham, et al. (2013). Students were asked to rank, first individually and later in groups, fifteen pieces of equipment (e.g., box of matches, signal flares, food concentrates) according to their relevance for survival on the Moon (Bottger, 1984; Branch, 1971). Next, participants rated each other by their perceived social influence, dominance, prestige and likability. Two external judges also rated each of the participants for these traits. Behavioural social influence was measured by comparing the individual decisions with the collective decisions in the task. The results showed that both prestige and dominance positively predicted social influence in the three measures (peer ratings, external judges' ratings and the behavioural measure). Similarly, Brand and Mesoudi (2019) showed that both dominance and prestige ratings of other members of naturally occurring small groups were positively associated with influence ratings within those groups.

These two studies also provide tentative evidence that dominance and prestige strategies resulted in social influence through the use of different means: fear vs admiration respectively (prediction (iii) in Table 8). In Cheng et al.'s study, prestige was more strongly associated with liking than was dominance, and in Brand and Mesoudi's study liking was positively related to prestige and negatively related to dominance. These results are congruent with the idea that the prestige strategy elicits admiration and the dominant strategy fear. However, it is possible

for an individual to be liked without being admired (e.g., a friend who is not particularly skilful/knowledgeable in any valued domain) or to be disliked without being feared (e.g., a boring acquaintance). More conclusive evidence was found in an unpublished study by Cheng, Tracy, and Henrich (2013; reviewed in Cheng & Tracy, 2014), which showed that the relationship between dominance and social influence were mediated by fear, while the relationship between prestige and social influence were mediated by contribution to the group.

All in all, the reviewed evidence supports the idea that dominance and prestige are two independent strategies that lead to the acquisition of high social rank and social influence through different means. These studies are high in external validity: they were conducted with naturally occurring groups or they studied the emergence of dominance-based and prestige-based hierarchies in interactions between unacquainted individuals. However, the dominance-related and prestige-related behaviours were measured through self and peer reports instead of being manipulated. Consequently, the nature of the supporting evidence is correlational. As a next step, I encourage experiments in which dominance and prestige are manipulated by the researchers, for instance, by the use of confederates trained to use dominance and prestige cues.

5.3.1.2.- Debate

5.3.1.2.1.- One Way to the Top?

My recommendation of manipulating dominance and prestige with confederates has already been done in a series of studies conducted in the 1980s-90s. Contrary to prediction (ii) in Table 8, these studies only found that prestige-related cues led to the attainment of social influence, while dominance-related cues failed to attain social influence (Carli, LaFleur, & Loeber, 1995;

Copeland, Driskell, & Salas, 1995; Driskell, Olmstead, & Salas, 1993; Ridgeway, 1987; Ridgeway & Diekema, 1989). In the first of these experiments (Ridgeway, 1987), the confederate displayed either dominance (e.g., loud voice, tense posture, staring eye contact), submissiveness (e.g., soft voice, cowering posture, averted eye contact with sneaking glances), high competence (e.g., medium voice, relaxed posture, high eye contact with normal break-offs), or low competence (e.g., soft, slumped voice, slumped posture, low eye contact) non-verbal cues while arguing with a second confederate about the amount of a financial reward in an insurance settlement. The target confederate argued for a low reward, while the other confederate argued for an average reward. Participants had to decide the amount of the financial reward before and after being exposed to the interaction. The difference between these amounts was used as the measure of influence. The results show that the use of high competence cues led to the highest level of influence, while there were no significant differences between the uses of dominance, submissive and low competence cues in predicting influence.

According to Cheng and Tracy (2014), the failure of the dominance strategy to attain influence in these studies was probably due to two reasons. First, the dominant behaviour was not directed towards participants and, consequently, they could not experience fear, which is necessary for the successful use of the dominance strategy. Second, the measure of influence was persuasion, which is contrary to the way dominant individuals achieve social influence, i.e., submission to their wishes via fear and intimidation. Consequently, these studies only show that the dominance strategy is not useful to attain persuasion but they do not provide evidence about whether the use of the

dominance strategy is useful to attain other forms of social influence (e.g., compliance with a request from a dominant individual).

A “one-way to the top” approach has also been put forward by Chapais (2015) who argues that both dominance and prestige require competence and, consequently, competence is the only way to the top. For Chapais, the attainment of high social rank via dominance requires competence in controlling one’s own fear, using weapons, formulating tactics to attack rivals, etc. Moreover, this competence in imposing their will, for Chapais, not only triggers fear but also admiration and, consequently, the dominance-prestige distinction is not so clear-cut.

Although it is true that dominance goes together with competence within domains as the ones mentioned by Chapais, this is not incompatible with the SDM, which focuses on the *causes* of acquiring high social rank and social influence through the elicitation of different emotions in others. A dominant behaviour might elicit both fear and admiration but these will rarely be triggered together at the same time in the same individual. People suffering the dominant behaviour would defer to the dominant individual due to fear. Other individuals might admire the dominant individual for their dominance-related skills when they are used against other individuals (especially members of rival out-groups), not against themselves. Halevy et al. (2012) have shown that behaviours damaging an out-group and benefitting the in-group elicit perceptions of greater prestige and lower dominance in in-group members when there is no other way of benefitting the in-group without damaging the out-group. However, if the dominant behaviour is directed towards the in-group, it seems implausible that this behaviour would elicit the admiration of in-group members or that, if

admiration is elicited somehow, the elicitation of admiration instead of fear would be the pathway to the top. For example, terrorists might acquire social influence among people with similar ideology through the prestige route due to their commitment to their cause or their violence against those who they see as their enemy. However, the only way they are going to acquire social influence among the people they are fighting against is by imposing their will through violence and intimidation. In this light, Chapais' (2015) criticism does not entail a real challenge to the SDM (for further discussion about the in-group vs out-group distinction applied to the SDM, see Jiménez, Flitton, & Mesoudi, 2020, January 7).

5.3.1.2.2.- Three Ways to the Top?

Numerous studies in social psychology (Flynn, 2003; Flynn, Reagans, Amanatullah, & Ames, 2006; Hardy & Van Vugt, 2006; Willer, 2009) have shown that altruism/generosity is associated with the attainment of high social rank and greater influence within a social group. For instance, Hardy and Van Vugt (2006) conducted a study in which participants had to decide how much they contributed to a public fund vs the amount to keep for themselves. They received a bonus for the amount of money in the public fund that was divided equally among participants. The results showed that participants who contributed more to the public fund did economically worse but they were rated as higher in prestige.

However, researchers do not agree whether altruism (or morality in general, which is a broader concept) is an independent way to the top (Bai, 2016) or is part or a modifier of the prestige route (Cheng & Tracy, 2014; Henrich, 2016). Henrich and Gil White (2001, p. 180) argue that individuals who provide public goods at a cost for themselves often acquire prestige but the advantage of defecting (i.e., using the goods without deferring towards the provider) makes it

difficult for prestige to evolve through altruism. Nevertheless, they point out that for skilful/knowledgeable individuals, the provision of public goods might be an excellent way to advertise their competence and, consequently, obtain a greater number of followers who defer to them, which might be translated into fitness gains. Similarly, Cheng and Tracy (2014) see altruism as a form of signalling competence to acquire more followers. They argue that the tendency to copy the prestigious is an incentive for prestigious individuals to behave altruistically, as if they are followed, they would acquire more benefits through the contribution of other individuals to the public good. This close link between being altruistic and being copied has been proposed to explain the evolution of human cooperation (Henrich, 2016, pp. 128-131; Henrich, Chudek, & Boyd, 2015).

In contrast to this subsuming of altruism within competence, Bai (2016) argues that altruism and other forms of moral behaviour are an independent way to acquire high social rank. By morality Bai means “a prescriptive system (...) that focuses on approach motives to do something good” (pp.208-209), which is usually costly for the individual behaving morally. To effectively acquire high social rank, the display of moral behaviour should be tuned to the morality system/s accepted within a specific culture, as the display of competence should be tuned to the domains that the observers regard as important.

According to Bai, competence is not a requirement for the moral route to high social rank as many heroes and heroines often fail to achieve their goals and might be punished for their virtues. Bai gives the example of Malala Yousafzai, a Pakistani school girl who defended the right of girls to attend school against the Taliban and was shot for this. Although she did not succeed in restoring the access to education for girls in Pakistan, she was awarded a Nobel

Prize for her heroism, which led her to becoming a very influential person worldwide.

According to Bai (2016), the psychological mechanism to acquire high social rank through the morality route is the elicitation of admiration for virtue, which leads to positive feelings and expectations of the morally praiseworthy individuals bearing costs to benefit the group or a moral view. Consequently, people accept the influence of virtuous individuals and defer to them because they believe this would benefit themselves. This is very similar to the mechanism of the competence route, which is admiration for competence, which leads to people deferring to the competent individual to attain benefits (e.g., social learning or private/public goods) for themselves (Leary, Jongman-Sereno, & Diebels, 2014). This suggests that displaying competence and/or displaying altruism (or other forms of morality) are ways in which people can acquire prestige and voluntary deference, not to acquire a third different dimension of social rank.

Nevertheless, Bai argues that admiration is an “umbrella term” (p. 211), which refers to similar but different emotions (Schindler, Zink, Windrich, & Menninghaus, 2013). For instance, admiration for morality leads to more intense physical sensations (e.g., warmth in the chest) and higher desire of imitating the model than admiration for skill (Algoe & Haidt, 2009). Similarly, admiration for morality and admiration for skill activate different cortical areas in the brain (Immordino-Yang, McColl, Damasio, & Damasio, 2009). However, this does not change the fact that people admired for their competence or for their virtue are conferred voluntary deference because people expect to benefit from them, which contrast with the coerced deference attained by dominant individuals.

Bai seems to have found cases in which competence is not necessary to acquire prestige. Another case is the possibility of behaving altruistically without being competent by having acquired wealth through inheritance. However, competence and altruism seems to be tightly linked together in many empirical contexts. For example, altruism is positively correlated with prestige (Cheng et al., 2010) and morality with competence-respect in some of Bai's own studies (Bai, Ho, & Yan, 2019). Similarly, competence (e.g., hunting skill and gardening knowledge) and altruistic behaviours (e.g., sharing meat and helping others with work) clustered together in a study in a foraging society using data reduction techniques (Konečná & Urlacher, 2017). Furthermore, competence within a particular domain (e.g., hunting) is normally necessary in order to gain the surplus wealth to be able to act altruistically. For example, sharing turtle meat among the Meriam of Torres Strait (Australia) requires being a skilful hunter, which demands hard work (Smith & Bird, 2000). Moreover, if an individual is very competent in a given domain, they are likely to elicit resentment and jealousy in less competent individuals. However, if this very competent individual acts generously by contributing to a group task or providing advice, he/she can overcome this threat to his/her attainment of voluntarily conferred high social rank (Grant, 2013).

All in all, the reviewed evidence suggests that displaying altruism/generosity (or moral behaviour in general) is a way in which individuals could attain high prestige. However, further research is necessary to understand how altruism/generosity interacts with competence in the attainment of prestige.

5.3.1.2.3.- Multiple Ways to Dominance and Multiple Ways to Prestige?

The concept of dominance in the animal literature has been found problematic. It tends to refer to the use of force or the threat of the use of force, sometimes with the help of coalitional support (Lewis, 2002). This is also the way that dominance is frequently understood in the human literature, which is associated with physical and non-verbal cues that signal the capacity of an individual to inflict costs via physical aggression such as physical formidability, masculine facial characteristics, deeper voice, etc. as well as behavioural displays such as risk-taking behaviour (Hill, Bailey, & Puts, 2017; Redhead, Cheng, & O’Gorman, 2018b). However, this is not the only way humans and other animals can impose costs in other individuals. Lewis (2002) has restricted the concept of dominance to physical dominance and has used the term ‘leverage’ to refer to the way individuals can attain social influence through the possession of resources that cannot be taken by force. For example, female chimpanzees have an advantageous social position when they are in estrus, although the ability to win fights does not change. In humans, expert knowledge/skills and wealth can be used to inflict costs or threaten to inflict costs in others to attain social influence. For example, a shaman can attain influence in others by threatening to withhold his services when they are needed (Chapais, 2015).

Apart from the display of competence and altruism/generosity, other individual behaviours and characteristics such as demographic characteristics (Berger, Cohen, & Zelditch, 1972), assertiveness (Anderson & Kilduff, 2009b), confidence (Anderson, Brion, Moore, & Kennedy, 2012) and social connectedness (Anderson & Shirako, 2008) have been associated with the attainment of prestige. I posit that demographic characteristics, assertiveness

and confidence are first-order cues that people use to infer competence (Jiménez & Mesoudi, 2019). In contrast, social connectedness is a way to *broadcast* competence and/or generosity (Anderson & Kilduff, 2009a).

Anderson and Shirako (2008) demonstrated the importance of social connectedness to acquire prestige through generosity in a study with MBA students enrolled in a negotiation class. The researchers measured through peer reports the level of connectedness of each student prior to the start of the class and the students' reputations after engaging in all the dyadic negotiation exercises. The results clearly show that the reputation for cooperativeness or selfishness for the more connected individuals was more linked to their history of behaviour during negotiations than the reputation of less connected individuals. The same is applicable to the attainment of prestige through competence. For example, scientific publications and scientific prestige culturally evolved to encourage scientists to share their knowledge, so that others could build on it (Hull, 1988/2010). If Darwin had kept his ideas to himself, he would not be celebrated and natural selection would have taken longer to discover.

5.3.1.3.- Needed Integration

Taking all these pieces of evidence together, I proposed to talk about dominance strategies and prestige strategies in the plural, instead of a unique dominance strategy and a unique prestige strategy. In dominance strategies, I include physical dominance and leverage (Lewis, 2002). In prestige strategies, I include displays of (apparent) competence, displays of (apparent) generosity and the development of social connections (Anderson & Kilduff, 2009a).

Future research will need to determine to what extent the different strategies for attaining dominance and prestige are independent from each other. I predict that the two strategies to rank high in the dominance dimension (i.e., physical dominance and leverage) are independent because their induction of fear rest on different mechanisms: the capacity to win fights vs the possession of valued knowledge/skills/resources (prediction (i) in Table 9). In contrast, I predict that the three strategies to rank high in the prestige dimension (i.e., displaying competence, displaying generosity and developing more social connections) are more dependent on each other (prediction (ii) in Table 9).

(i)	Physical dominance and leverage are two independent strategies to induce fear in others and attain/maintain/increase social influence and power
(ii)	Displaying competence, displaying generosity and developing more social connections are not independent strategies to induce admiration and attain/maintain/increase status and power
(iii)	Power can be attained either through dominance strategies, prestige strategies or a mixed of both types of strategies.
(iv)	Status can only be obtained through the use of prestige strategies, never through the use of dominance strategies.

Table 8. Predictions derived from the present review.

5.3.2.- Dimensions of Social Rank

5.3.2.1.- Dominance and Prestige

The literature abounds with examples of dominant and prestigious individuals in large-scale societies who occupy/occupied formal power positions such as Joseph Stalin (Stuppy & Mead, 2016; Suessenbach, Loughnan, Schonbrodt, & Moore, 2018), Kim Jong-un, Baschar al-Assad (Suessenbach,

Loughnan, Schönbrodt, & Moore, 2018), Vladimir Putin (Bai, 2016), Henry Ford II (Cheng, Tracy, Foulsham, et al., 2013), Donald Trump, Narendra Modi and Nigel Farage (Kakkar & Sivanathan, 2017) for dominance and Stephen Hawking (Henrich & Gil-White, 2001; Suessenbach, Loughnan, Schonbrodt, et al., 2018), Warren Buffet (Cheng, Tracy, Foulsham, et al., 2013), Hillary Clinton (Kakkar & Sivanathan, 2017), Abraham Lincoln (Stuppy & Mead, 2016) and Marry Barra (Bai, 2016) for prestige. However, the SDM was initially developed to explain rank differentiation within small groups with informal hierarchies such as a hunter-gatherer band or a group of school peers (Henrich & Gil-White, 2001). In this type of group, in which members know each other and interact face-to-face, the use of either dominance strategies or prestige strategies is effective to attain coercively-imposed social rank (the dominance dimension) or freely-conferred social rank (the prestige dimension, see Section 5.3.1). However, dominance and prestige are likely to have different dynamics over time.

In a longitudinal study with naturally occurring small groups without formal hierarchies, Redhead, Cheng, Driver, et al. (2018) predicted that the social influence attained by people initially rated as high in dominance diminishes over time (prediction (iv) in Table 8), while the social influence attained by people initially rated as high in prestige strengthen over time (prediction (v) in Table 8). Dominance, prestige and social influence were measured through peer ratings using the previously validated scales (Cheng, Tracy, Foulsham, et al., 2013; Cheng et al., 2010) described in Section 5.3.1.1. The authors found support for this prediction. Dominance strategies are likely less effective over time than prestige strategies because people dislike attacks on their autonomy and being coerced (Boehm et al., 1993; Price & Van Vugt, 2014). Consequently, less dominant individuals might fight back against dominant individuals by forming

coalitions (e.g., Ridgeway & Diekema, 1989) and, in doing so, resist or diminish their influence. In contrast, some of the consequences of prestige such as being copied and receiving deference make the prestige of an individual and, with it, their social influence, increase over time due to their bidirectional relationship (see Section 5.2, Figure 6, and Cheng, 2019 for a review).

5.3.2.2-. Power and Status

In parallel to the dominance-prestige distinction of the SDM, social psychologists have distinguished between power and status as two different dimensions of social rank (Fragale, Overbeck, & Neale, 2011; Hays, 2013; Hays & Bendersky, 2015; Magee & Galinsky, 2008). In this area of research, power is defined as the “asymmetrical control over valued resources in social relations” (Magee & Galinsky, 2008), while status is defined as the respect, esteem and admiration received by individuals from others (Magee & Galinsky, 2008).

The key distinction between both dimensions of social rank is that status is more subjective than power (Blader & Chen, 2014). That is, status entirely depends on the admiration professed by observers to some of the target’s attributes. Power or the control over resources is more an objective property of the individual (Blader & Chen, 2014): he/she controls or does not control the resources. Furthermore, power does not necessarily reflect the consensus over the value of the attributes of one individual because power can be taken by the use of dominance strategies, be inherited (e.g., the crown) or be awarded by one or a few individuals (e.g., being hired as a policeperson). In many cases, nevertheless, there is a certain level of consensus in a group about who deserves to have power (e.g., electing a Prime Minister through elections).

Another distinction between power and status within social psychology is that power is more formal in nature (e.g., having the role of Prime Minister, Head Teacher, policeperson or CEO), while status is more informal. Nevertheless, power and status often interact. Having a position of high power (e.g., being the line manager within a company) is frequently associated with having high status (e.g., being admired and respected) for two reasons. First, a position of high power leads to having perceived instrumental value because powerful people have control of resources that other individuals want to benefit from. Second, individuals who have high status are frequently chosen for positions of power as individuals expect that high status individuals are good leaders.

However, power and status does not necessarily go together. An individual with a powerful position (e.g., a line manager) might have influence and be deferred to by subordinates within a group, not because they admire him/her but because they fear the consequences of not doing so (e.g., being fired). Similarly, an individual without power within a group (e.g., an assembly-line worker) might have status among his/her peers due to some of his/her attributes (e.g., knowledge about football) and consequently attain influence in the group.

5.3.2.3.- *Needed Integration*

The social psychologists distinction between power and status has certain similarities with the SDM's distinction between dominance and prestige. However, while I consider the terms prestige and status synonymous and interchangeably, the term dominance cannot be equated to power. The concept of power (i.e., the asymmetrical control over valued resources) is agnostic about the way it is exercised (e.g., in a gentle or coercive manner) or obtained (e.g., through a democratic process, coercion or inheritance). In contrast, the concept

of dominance always goes together with the coercion of others. Moreover, power tends to have a formal nature, but dominance, as well as status/prestige, always has an informal nature. Consequently, I consider the term dominance a valid concept for referring to a dimension of social rank within small groups in which social influence is exercised informally through coercion. However, the concept of dominance as a dimension of social rank is not applicable to large groups and/or groups with formal hierarchies. In these contexts, dominance refers exclusively to strategies to acquire, maintain or increase power and social influence through coercion. Power can also be obtained through the use of prestige strategies, when people voluntarily confer a powerful position to some individual (prediction (iii) in Table 9). However, status can only be attained through the use of prestige strategies, never through the use of dominance strategies as status entirely depends on the subjective appreciation of the value of an individual (prediction (iv) in Table 9).

The distinction between power and status has the advantage that it is applicable at both the group level (i.e., small groups without formal hierarchies in which all the members know each other and interact directly) and the society level (i.e., large groups in which members know and directly interact with a tiny proportion of members who have formal hierarchies). It can also help to understand how the prestige route to social rank might confer opportunities to display behaviours that are associated with the other strategy (e.g., threats to maintain high social rank). Henrich and Gil-White (2001) give the example of Stephen Hawking. Although he attained prestige within the scientific community and society in general through his scientific contributions to the field of astrophysics, his prestige led him to attain institutional power. This gave him the opportunity to potentially inflict costs on students (e.g., giving them low grades)

without being physically dominant. This could have not been possible in a social group without formal hierarchies.

5.3.3.- Consequences of Social Rank

According to the SDM, attaining a dominant or prestigious social rank leads to being socially influential (prediction (ii) in Table 8), receiving attention (prediction (vi) in Table 8) and deference (prediction (ix) in Table 8) and having higher fitness (prediction (xi) in Table 8). Nevertheless, these similar consequences of dominance and prestige are achieved through different means, i.e., the induction of fear (dominance) vs admiration (prestige) in subordinates.

5.3.3.1.- Attention

Although the SDM predicts that both dominant and prestigious individuals receive preferential attention from subordinates (prediction (vi) in Table 8), it also predicts that the type of attention they receive is different. That is, prestigious individuals are expected to receive sustained attention, which is assumed to facilitate acquiring high quality knowledge/skills through social learning from competent individuals (prediction (vii) in Table 8) (Henrich & Gil-White, 2001); while dominant individuals are expected to receive furtive glances, which is the consequence of the need to monitor the behaviour of the dominant individual to prevent potential costs (prediction (viii) in Table 8) (Henrich & Gil-White, 2001).

While the evidence showing that high social rank individuals are paid more attention is robust, (Dalmaso, Pavan, Castelli, & Galfano, 2012; DeWall & Maner, 2008; Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010; Gerpott, Lehmann-Willenbrock, Silvis, & Van Vugt, 2017; Jones et al., 2010), few studies have distinguished between dominant and prestigious individuals. One exception is a

recent study conducted by Roberts, Palermo, and Visser (2019). These researchers manipulated dominance and prestige through the use of first-order cues (Jiménez & Mesoudi, 2019; Jiménez & Mesoudi, 2019, December 28): faces rated as high or low in dominance and CVs considered to be high (e.g., succeeding in a career in medicine) or low (e.g., having dropped from university) in prestige. The attentional blink (AB) task was used in this study, which entails the rapid visualisation of a series of stimuli including two targets and a number of distractors (scrambled human faces and dog faces). This task is used to study biases affecting the allocation of attentional resources to competing stimuli. In this study, the way participants identified the faces was by answering positively to the question “did you see an unscrambled face”? Contrary to prediction (vi) in Table 8, there were no significant differences between the high and low prestige stimuli, and the accuracy was higher for low dominance stimuli than for high dominance stimuli. It is not clear why the low dominance faces were more accurately identified but a possibility suggested by the authors is that the low dominance faces did not meet the stereotypical expectations of how male faces look like. Nevertheless, the procedure used involved 10 milliseconds to process each stimuli with an interval of 80 milliseconds between stimuli. These is very different from the way people interact with dominant and prestigious individuals and it is difficult to compare with other attention experiments using more realistic experimental materials.

Another exception is the study by Cheng, Tracy, Foulsham, et al. (2013) reviewed in Section 5.2.1. After collecting the data for the emergence of dominance and prestige-based hierarchies in groups of unacquainted individuals completing together the *Moon Task*, external participants who wore fixed eye-trackers viewed clips of these interactions. These external participants rated the

individuals in the clips for dominance and prestige. In support of prediction (vi) in Table 8, the dominance and prestige ratings received by the individuals in the clips were positively related to the amount of attention they received by these external participants to the group interactions.

Cheng et al. did not directly test whether the type of attention that dominant and prestigious individuals received was different. However, they took two different measures of attention: total fixation duration and proportion of fixations. These measures can be used as proxies for sustained attention and furtive glances respectively. According to the standardized coefficients, dominance ratings ($\beta=0.56$) positively predict sustained attention to a greater extent than prestigious ratings ($\beta=0.23$), which contradicts the prediction of a greater sustained attention towards prestigious individuals over dominant individuals (prediction (vii) in Table 8). Similarly, dominance ratings ($\beta = 0.56$) also positively predict furtive glances to a greater extent than prestigious ratings ($\beta = 0.24$) do, which supports the prediction of a greater number of furtive glances towards dominant individuals than towards prestigious individuals (prediction (viii) in Table 8).

Although there was no comparison between dominance and prestige, another relevant study was conducted by Holland, Wolf, Looser, and Cuddy (2017). The authors used static images of one man and one woman displaying either dominant poses (e.g., greater occupation of the space and open limbs) or submissive poses (e.g., smaller occupation of the space and closed limbs), while participants' attention was recorded with eye-tracking devices. As the authors predicted, people fixated less and spent less time looking at dominant posers than at submissive posers, fixated less and spent less time looking at the faces

and upper bodies and more at the lower bodies of dominant posers than submissive posers. This is congruent with the assumption that dominant individuals are feared and monitored. The authors conclude their article emphasizing the importance of distinguishing between prestige and dominance to assess attention in line with Henrich and Gil-White's predictions. They point out that, while experiments using prestige through manipulations of targets' clothing (DeWall & Maner, 2008; Maner, DeWall, & Gailliot, 2008) or CV (Dalmaso et al., 2014; Dalmaso et al., 2012) indicate that people payed sustained attention to high prestige individuals, their manipulations of the target's dominance through non-verbal displays indicate that people avert their gaze from high dominance individuals.

In the light of the examined evidence, it is not clear whether both prestigious and dominant individuals received similar or different types of attention. The study by Cheng et al. (2013) indicates that both prestigious and dominant individuals received similar types of attention and that dominance has a stronger effect than prestige in predicting attention. However, Holland et al. (2017) showed that people avert their gaze from people displaying dominance poses, which suggest that people do show different types of attention towards dominant individuals. Unfortunately, this study did not compare dominance with prestige. Moreover, these eye-tracking experiments have the serious limitation in that they measure the attention paid to individuals differing in social rank by external observers to the group interactions. In line with the theory, dominant individuals should only encourage furtive glances when they can react to the observer. Similarly, prestigious individuals should only encourage sustained attention when it is possible to learn something valuable (e.g., knowledge, skill) from them. Neither of these were possible in these experiments. The introduction

of expectations about encountering these high social rank individuals or being watched by them later (e.g., Gobel, Kim, & Richardson, 2015) might help to clarify this question. Moreover, the development of eye-tracking devices that allow the measurement of attentional biases of participants interacting together is promising. Future studies using mobile eye-trackers in group interactions might help to tell apart the effects of prestige and dominance on social attention.

5.3.3.2.- Deference

The SDM predicts that both dominant and prestigious individuals receive more deference than low social rank individuals (prediction (ix) in Table 8). It also predicts that the deference received by dominant individuals is coercively attained due to the fear of potential costs (e.g., psychical aggression) of failing to do so in subordinates; while the deference received by prestigious individuals is voluntarily conferred due to the wish of subordinates to benefit from the prestigious individual's knowledge/skill (prediction (x) in Table 8). Unfortunately, to my knowledge, there are no studies comparing the deference received by dominant and prestigious individuals.

The deference towards dominant men has been shown in an experiment about mate competition (Gambacorta & Ketelaar, 2013). In the experiment, participants were made to believe that they were competing with another male for a date with an attractive female. The manipulation of dominance was a photo of a shirtless man who was either physically strong (high dominance) or weak (low dominance). Participants were prompted to tell stories and jokes to the attractive female. Gambacorta and Ketelaar assumed that dominant men have used violence to prevent other men mate through human evolutionary history. Consequently, they hypothesized that men competing for mates with a dominant

man would inhibit creative displays to avoid the potential costs inflicted by dominant individuals. In the experiment, men competing with the high dominance man told fewer stories and jokes than the men competing with the low dominance man. Moreover, the quality of the stories and jokes of the men who told them was lower when competing with the high dominance man than when competing with the low dominance man.

Deference towards prestigious individuals has been shown by van der Vegt, Bunderson, and Oosterhof (2006), who found that participants with low expertise in a group task show more deference (i.e., were more committed and help more) towards experts than towards less competent individuals. This could be interpreted as a way to incentive experts' contribution and receiving advice and help from those experts (Jiménez & Mesoudi, 2019).

5.3.3.3.- Fitness

The SDM predicts that both dominant and prestigious individuals have higher fitness than lower social rank individuals (prediction (ix) in Table 8). Von Rueden et al. (2010) studied whether this prediction holds for Tsimane men. The ability to win a dyadic physical confrontation was used as a proxy for dominance, while community-wide influence was used as a proxy for prestige. In this study, both dominance and prestige were positively related to number of in-pair surviving offspring and extra-marital affairs. Both correlations were stronger for prestige. Dominance was positively related to marrying younger women and prestige to having wives with earlier age of birth. The relationship between determinants of social rank (physical formidability, political influence and hunting ability) and positive fertility outcomes is robust in the literature about small-scale foraging societies (Von Rueden, 2014). Nevertheless, it is less clear how

dominant and prestigious individuals attain higher fertility. Von Rueden (2014) suggests that it could be through having more access to mates and/or higher quality mates, as well as receiving more support from allies and deference from others. It is also possible that the characteristics that lead to attaining high social rank within these societies (e.g., hunting ability) are the important factors in determining offspring survivorship (Von Rueden, 2014). Moreover, it could also be the case that having more offspring is what leads to attaining higher social rank and not the other way round (Von Rueden, 2014).

Sexual preferences for dominant and prestigious men have also been found in studies with WEIRD (acronym for Western, Educated, Industrialized, Rich and Democratic; Henrich, Heine, & Norenzayan, 2010) samples. Snyder et al. (2008) argue that high dominance men could cause costs to their partners if they behave aggressively towards them. Consequently, they hypothesized that women generally prefer prestigious men over dominant men. They independently manipulated dominance (high vs low) and prestige (high vs low) in a 2 x 2 between-subjects design using descriptions of individuals competing for leadership within a student fraternity. They found support for their hypothesis: high prestige individuals were rated as more attractive and desirable as short-term and long-term partners than low prestige individuals. Low dominance individuals were also more desirable as long-term partners than high dominance individuals. In a subsequent study using the context of an athletic competition, high dominance men were considered more attractive and desirable as both short-term and long-term partners than low dominance men. A potential explanation for this finding is that using the dominance strategy in athletic male to male competition is socially sanctioned (Snyder et al., 2008) and, therefore, it could be difficult to disentangle from the prestige strategy of displaying high

competence. Unfortunately, there was no comparison between prestige and dominance in the athletic context in this study.

5.3.3.4.- Social learning

A clear difference between the consequences of dominance and prestige is that prestige leads to being preferentially selected as a model from whom to socially acquire valuable knowledge/skills (prediction (xii)). This is not the case for dominance except when the knowledge/skill that the social learning involves acquiring the dominance strategy itself. This prediction is derived from Henrich and Gil-White's (2001) theory of the evolution of prestige, which was reviewed in Section 5.2.

This preferential selection of prestigious individuals as models from whom to socially learn has been demonstrated by laboratory and online experiments (Atkisson, O'Brien, & Mesoudi, 2012; Brand, Heap, Morgan, & Mesoudi, 2019, December 12; Chudek, Heller, Birch, & Henrich, 2012) and by ethnographic studies of small-scale societies (Henrich & Broesch, 2011; Henrich & Henrich, 2010). Although the empirical evidence is in general supportive of the use of prestige-biased social learning, there is little supporting evidence in the ethnographic record (Garfield, Garfield, & Hewlett, 2016; Garfield, Hubbard, & Hagen, 2019). Similarly, Chudek, Baron, and Birch (2016) did not find that children aged 2-7 preferentially copied the high prestige individuals over low prestige individuals. See Jiménez and Mesoudi (2019) for longer review of prestige-biased social learning.

To my knowledge, Chambers and Hammonds (2014) has conducted the sole study comparing social learning from prestigious vs dominant individuals.

They manipulated dominance by showing a demonstrator displaying either high (e.g., speaking loudly and doing authoritative gestures) or low (e.g., speaking timidly and having a very reserved body posture) first-order dominance cues. Instead of manipulating prestige, they manipulated success information: whether the demonstrator was able to solve five anagrams or only one out of five. The study adopted a 2 (dominance: high vs low) x 2 (success: high vs low) between-subjects experimental design. The measure of social learning was the number of anagrams solved by participants after viewing the demonstrators. This is more a motivational type of influence (i.e., vicarious effectiveness or vicarious helplessness) than direct copying. The results yielded a significant main effect of success and an interaction between dominance and success, but the main effect of dominance was not significant. For the dominant demonstrators, when they were successful solving the anagram, participants solved more anagrams than when the dominant demonstrator was unsuccessful. For the non-dominant demonstrators, there were no significant differences between successful and unsuccessful. These results, however, are difficult to interpret because the manipulation checks show that the dominant demonstrators received higher ratings of prestige than dominance and that their prestige was higher than the prestige of the non-dominant successful demonstrator.

5.4.- The Integrated Dual Evolutionary Model of Social Hierarchy (IDM)

Taking all the pieces of evidence reviewed in Section 5.3 together, I proposed an integrated model, which I label the Integrated Dual Evolutionary Model of Social Hierarchy (henceforth IDM). Figure 8 depicts my proposed model, which, like the SDM, distinguishes between two types of social hierarchies

(‘dimensions’ on the figure). I use the terms ‘power’ and ‘prestige’⁷ to refer to these dimensions. The dimension of power entails the ordering of individuals by their degree of control of resources and group decisions, while the dimension of prestige entails the ordering of individuals by the degree of respect, esteem and admiration that they receive from others. Power can be formal or informal, while prestige is always informal.

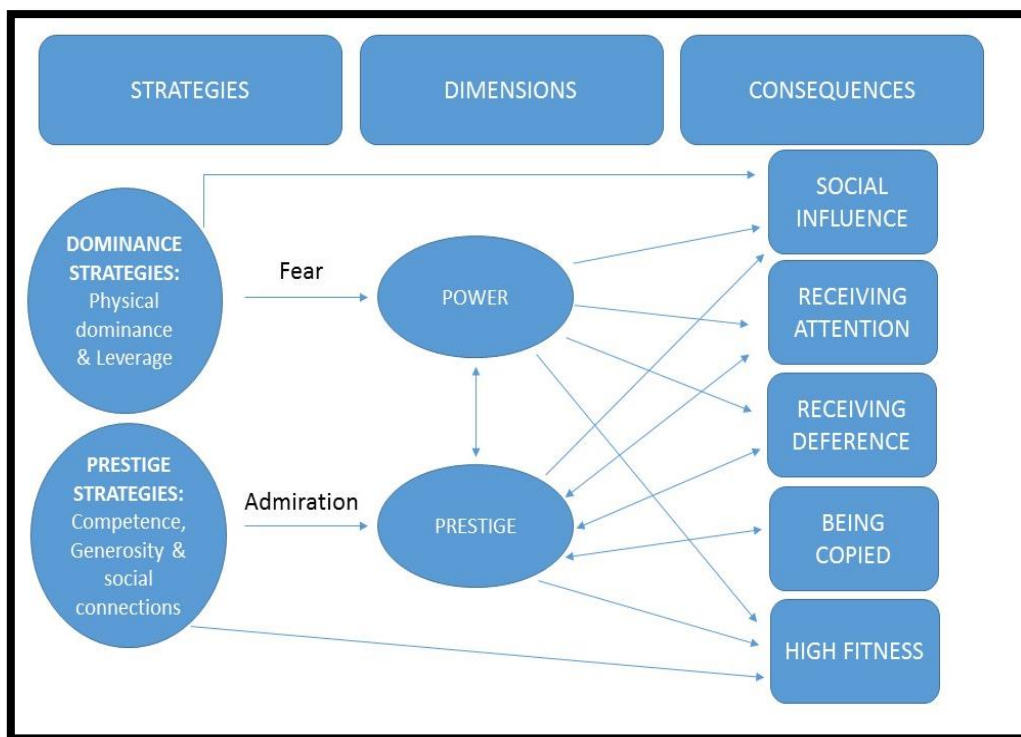


Figure 7. The Integrated Dual Evolutionary Model of Social Hierarchy (IDM)

Power and social influence can be acquired through the use of either dominance or prestige strategies (see arrows connecting dominance strategies to social influence, both directly and indirectly through power, and the arrows connecting prestige strategies to power, prestige, and indirectly to social

⁷ ‘Prestige’ is used here as synonym of ‘status’ in the social psychology literature (see Section 5.3.2.2.).

influence through status in Figure 8). I call *dominance strategies* all the actions that individuals consciously or unconsciously do to induce fear in other individuals through the imposition of costs and/or the threat of those costs. In dominance strategies I include both physical dominance and leverage (Lewis, 2002). The successful use of dominance strategies sometimes leads to the acquisition of formal power. For example, the military general Augusto Pinochet acquired formal power and became the maximum authority of Chile (1973-1990) through the use of violence and coercion against the political authorities and their supporters. In some cases, the use of dominance strategies does not lead to attaining power but only social influence (e.g., terrorist attacks influence social behaviours without terrorists having taken power).

In contrast, prestige cannot be acquired through the use of dominance strategies, as people who fear the dominant individuals do not admire nor voluntarily confer prestige to them. I call *prestige strategies* all the actions that individuals consciously or unconsciously do to induce admiration in other individuals and, therefore, be granted with power and/or status. I include the display of (apparent) competence, (apparent) in-group commitment and the developing of more social connections within a group (Anderson & Kilduff, 2009a). From my perspective, these three strategies can also be used to acquire formal and informal power. For example, the prestige strategy is the path to formal power of democratic elected leaders, who are voluntarily conferred this position by the electorate due to their displays of (apparent) competence (e.g., knowledge of international relations) and/or compromise with particular causes (e.g., reforms to tackle climate change).

The consequences of prestige in the IDM are similar to the consequences of prestige in the SDM. Prestige leads to being socially influential (persuasion), receiving sustained attention, receiving voluntary deference, having higher fitness and being copied. The consequences of power depend on whether the powerful person has high prestige or not. The consequences of power without prestige are similar to the consequences of dominance in the SDM: being socially influential (obedience), receiving coerced attention and deference, and having higher fitness. If the powerful person has prestige the consequences would be similar to the consequences of prestige without power but the occupation of a powerful position would in many cases increase his/her prestige and amplify the degree in which the positive consequences of status are attained.

The IDM focuses on three level of analysis: strategies to acquire high social rank and social influence, dimensions of social rank and consequences of social rank. However, I consider the social and environmental context is another very important level of analysis to add to this model and I encourage research on how context affects the strategies that people use to attain social rank and the consequences of power and status. For instance, it has been predicted that the lack of exit options for followers (Price & Van Vugt, 2014) and higher levels of wealth inequality (Ronay et al., 2018) favour the adoption of a dominant approach to the attainment, maintenance and increase of power, but tests of these predictions are lacking. Furthermore, the usefulness of the prestige strategies altruism/morality and competence to attain prestige have been shown to depend on the cultural contexts. In a series of studies, Torelli, Leslie, Stoner, and Puente (2014) have shown that (i) individualism is positively related to perceptions of high prestige individuals as competent and to the conferral of high prestige to competent individuals, while collectivism is positively related to perceptions of

high prestige individuals as warm and to the conferral of high prestige to warm individuals and (ii) that people from an individualistic culture (US Americans) are more likely to display competence as a way to attain higher prestige, while people from a collectivistic culture (Latin Americans) are more likely to display warm behaviours such as helping others to attain higher prestige.

In conclusion, the SDM has generated a great deal of research in different disciplines and a number of debates and conflicting evidence. In this chapter, I have reviewed the empirical literature on the dominance-prestige distinction and adjacent fields and have proposed a model that builds on the SDM. I expect this model to be useful for integrating research from different fields.

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CHAPTER 6:

When Do People Prefer Dominant over Prestigious Political Leaders?

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Contributions:

This chapter was conceptualised by Adam Flitton, Alex Mesoudi and me. Data analysis and interpretation was conducted by me with the help of Adam Flitton for running the models in Stata for Table 13. Original draft was written by me. It was reviewed and edited by Adam Flitton, Alex Mesoudi and me.

6.0.- Abstract

Previous research has sought to explain the rise of right-wing populist leaders in terms of the evolutionary framework of dominance and prestige. In this framework, dominance is defined as high social rank acquired via coercion and fear, and prestige is defined as high social rank acquired via competence and admiration. Previous studies have shown that right-wing populist leaders are rated as more dominant than non-populist leaders, and right-wing populist / dominant leaders are favoured in times of economic uncertainty and intergroup conflict. In this paper I explore and critique this application of dominance-prestige to politics. First, I argue that the dominance-prestige framework, originally developed to explain inter-personal relationships within small-scale societies characterised by face-to-face interaction, does not straightforwardly extend to large-scale democratic societies which have frequent anonymous interaction and complex ingroup-outgroup dynamics. Second, I show that economic uncertainty and intergroup conflict predict not only preference for dominant leaders, but also prestigious leaders. Third, I show that perceptions of leaders as dominant or prestigious are not fixed, and depend on the political ideology of the perceiver: people view leaders who share their ideology as prestigious, and who oppose their ideology as dominant, whether that ideology is liberal or conservative. Fourth, I show that political ideology is a stronger predictor than economic uncertainty of preference for Donald Trump vs Hillary Clinton in the 2016 US Presidential Election, contradicting previous findings that link Trump's success to economic uncertainty. I conclude by suggesting that, if economic uncertainty does not directly affect preferences for right-wing populist leaders, other features of their discourse such as higher emotionality might explain their success.

6.1.- Introduction

The last two decades has seen the rise of several right-wing populist leaders in democratic countries (Tartar, 2017, December 11) such as Donald Trump, Marine Le Pen, Viktor Órban, Matteo Salvini, Nigel Farage, Narendra Modi, Jair Bolsonaro and Geert Wilders. According to Mudde and Kaltwasser (2017), populists share a political discourse that divides society into two antagonistic groups: “pure” people vs the “corrupt” political, economic, cultural and media elite or establishment. They often criticise representative liberal democracy and argue that politics should be a direct expression of the will of the people (e.g., via referenda). Populism is not a complete ideology in itself, unlike socialism or fascism, but it attaches to other ideologies on the right or the left (Muddle and Kaltwasser, 2017).

The *dual evolutionary model of social hierarchy* (Cheng & Tracy, 2014; Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013; Henrich & Gil-White, 2001; Jiménez, Á.& Mesoudi, 2019, December 27; Redhead, Cheng, & O’Gorman, 2018a) has recently been used to understand the rise of such right-wing populist leaders (Kakkar & Sivanathan, 2017; McAdams, 2017). This model distinguishes between dominance and prestige as two independent strategies that people use to acquire high social rank and influence (Henrich & Gil-White, 2001). The *dominance strategy* entails the use of force and coercion against others. Its success depends on the capacity to defeat and/or induce *fear* in other individuals (Redhead, Cheng, & O’Gorman, 2018b). Consequently, people tend to dislike dominant individuals (Brand & Mesoudi, 2019; Cheng et al., 2013) and avoid proximity to them (Henrich & Gil-White, 2001). In contrast, the *prestige strategy* entails the display of competence within valued domains and/or pro-ingroup

behaviours. Its success depends on the capacity to induce *admiration* and voluntary deference in others because prestigious individuals are perceived as having instrumental value to accomplish one's own goals (Leary, Jongman-Sereno, & Diebels, 2014), such as socially learning valuable knowledge/skills (Henrich & Gil-White, 2001; Jiménez & Mesoudi, 2019) or being provided with tangible private (Pinker, 1998, p. 499) and public goods (Price & Van Vugt, 2014). This explains why people generally like and prefer prestigious individuals as both leaders and social companions (Cheng et al., 2013; Kruger & Fitzgerald, 2011; Laustsen & Bor, 2017; Petersen & Laustsen, 2019).

Kakkar and Sivanathan (2017) equated right-wing populist leaders with dominant political leaders. They argue that certain environmental contexts, in particular economic uncertainty, might reverse the preference for prestigious individuals over dominant individuals, at least when choosing between different political leaders. According to these authors, economic uncertainty induces in people a sense of lack of personal control, prompting them to find ways to compensate for that deficit. One of these compensatory strategies is to support dominant political leaders (Hogg & Adelman, 2013), who are perceived as able to defend the interests of the ingroup even at the expense of the well-being of out-groups (Halevy, Chou, Cohen, & Livingston, 2012).

Consequently, Kakkar and Sivanathan (2017) attribute the rise of right-wing populist leaders to the rise in economic uncertainty after the 2008 global financial crisis (see also Funke, Schularick, & Trebesch, 2016; Funke & Trebesch, 2018). First, Kakkar and Sivanathan found that, during the 2016 US Presidential campaign, participants rated the right-wing populist leader Donald Trump significantly higher in dominance and lower in prestige than the opposing

candidate, Hillary Clinton. Supporting the link to economic uncertainty, Kakkar and Sivanathan further showed that (i) individual voters' preference for Donald Trump before the election was significantly predicted by an aggregate zip-code-based measure of economic uncertainty composed of housing vacancy rate, poverty rate and unemployment rate, and (ii) at a country level, using data from the World Values Survey from 2004-2016 (Inglehart et al. 2018) with 138,323 respondents from 69 countries, preference for dominant leaders in general (a preference for "a strong leader who does not have to bother with parliament and elections") was significantly predicted by the change of unemployment from one year to the next within that country according to the World Bank.

Theories and findings such as those of Kakkar and Sivanathan (2017) are valuable in integrating across disciplines (psychology, economics, politics and anthropology) and providing novel explanations for socially and politically important trends. However, precisely because of this importance, such claims and evidence should be carefully evaluated and scrutinised. In this article, I critically evaluate the above theory and evidence linking right wing populist leaders to dominance via economic uncertainty. I first discuss the limitations of the current applications of the dual evolutionary model of social hierarchy to modern politics and the rise of right-wing populism, arguing for a greater role of political ideology. Second, I formulate a number of hypotheses derived from the limitations I identify. Third, I test these hypotheses using data from the WVS as well as the data collected by Kakkar and Sivanathan (2017) to analyse the perceptions of and preferences for Donald Trump and Hillary Clinton. Finally, I discuss my results in the context of the broader literature on prestige-dominance, political psychology and populism.

6.1.1.- The dual evolutionary model of social hierarchy as applied to politics

Although originally conceived as an explanation for social rank hierarchies within small, face-to-face groups, the prestige-dominance distinction has also been applied to the political arena in large-scale societies, as described above for the 2016 US Presidential Election (Kakkar & Sivanathan, 2017; McAdams, 2017; Witkower, 2017). In these applications, Donald Trump is depicted as dominant because of his more aggressive vocabulary, threats against political rivals (e.g., “lock her up”), non-verbal displays of dominance (e.g., occupying more space and extending his arms) (Witkower, 2017) and the display of emotional and personality traits associated with dominance (Cheng, Tracy, & Henrich, 2010) such as high neuroticism, low agreeableness and hubristic pride (McAdams, 2017; Nai, Martínez I Coma, & Maier, 2019). Conversely, Hillary Clinton is depicted as prestigious because of her greater political experience and expertise (e.g., having previously been Secretary of State) as well as her more frequent demonstrations of knowledge and non-verbal displays associated with the prestige strategy (e.g., smiling) during the Presidential debates (Witkower, 2017).

However, the application of the dual evolutionary model of social hierarchy to modern politics and the rise of right-wing populist leaders is not without difficulties. The model was initially developed to explain the acquisition of high social rank and social influence within small groups (e.g., hunter-gatherer bands or sports teams) in which members interact face-to-face and personally know each other. In contrast, the acquisition of political power in modern society occurs within large societies (e.g., the population of the USA exceeds 325 million people) in which members only interact with and know a small proportion of other

members. Consequently, the acquisition and maintenance of political power and political influence within the modern political sphere are more complex than within the small groups to which the model was originally applied.

First, the key distinction between the dominance and prestige strategies in the dual evolutionary model is that the social influence attained through dominance is imposed upon others, while the social influence attained through prestige is voluntarily given by others (de Waal-Andrews, Gregg, & Lammers, 2015; Henrich & Gil-White, 2001). However, democratic procedures like the presidential elections that led to the victory of Donald Trump are especially tuned to the prestige strategy given that political power is voluntarily given to the party or coalition of parties that have the greatest freely-conferred support within a society⁸. Given the fact that Donald Trump attained the US Presidency through democratic elections, not through a coup d'état, labelling his strategy to power "dominance" is questionable.

Second, the dominance and prestige strategies in the original model were assumed to be displayed towards other members of the ingroup, such as other members of a small-scale society like the !Kung or the Yanomamo (Henrich & Gil-White, 2001), sport teams (Cheng et al., 2010) and other community groups (Brand & Mesoudi, 2019). In modern politics, however, the use of both strategies are often directed towards outgroups, such as when political leaders of one country pursue a military attack or trade war against another country (potentially a dominance strategy) or when leaders make reforms in their own country to gain

⁸ In modern democracies, the winners of elections are not always the ones that have the greatest support in absolute terms. For instance, Hillary Clinton had more votes (48.5%) than Donald Trump (46.4%) in the US Presidential elections of 2016. Nevertheless, Donald Trump became the President of the US. This is due to the specific system within a country to turn votes into seats.

admiration and be emulated by the international political community (potentially a prestige strategy). However, it is not clear that the concepts of prestige and dominance straightforwardly translate to this intergroup context. For example, a dominant action by a political leader directed towards an outgroup (e.g., bombing another country) might lead to the acquisition of prestige among ingroup members (e.g., by the demonstration of commitment to protect the in-group from external threats). When facing intergroup conflict, research has found that people increase their preferences for male leaders who have traits associated with the use of the dominance strategy such as facial masculinity, muscle strength and height (Laustsen & Petersen, 2017; Little, Burriss, Jones, & Roberts, 2007; Petersen & Laustsen, 2019), features that people presumably perceive as facilitating the use of aggression against outgroups during intergroup conflict (Laustsen & Petersen, 2017). For instance, Little et al. (2007) found that people prefer hypothetical election candidates with more physically dominant faces during war time and less physically dominant faces during peace time. However, this and other studies have not tested whether intergroup conflict simultaneously increases people's preferences for prestigious political leaders. It is plausible that prestigious leaders are desirable in intergroup conflict because they are more knowledgeable about international relations, or more skilled negotiators and, therefore, achieve the best deals possible for their ingroup preventing much of the damage of a long-lasting intergroup conflict.

Furthermore, although members of one's country might often be perceived as the 'in-group', the existence of different ideologies within a country often leads to conflicts, and groups with opposing ideologies within the same country become perceived as outgroups. This has consequences for the perceptions of dominance and prestige of political leaders and political decisions, as the same

decisions might be seen differently by people within the same country but belonging to different ideological groups. For instance, the Catalanian Independence Referendum (1st October 2017) carried out by the pro-independence Catalonia regional government despite being declared illegal by the Constitutional Court of Spain was considered a coup d'état (i.e., an act of dominance) by people who defend the territorial integrity of Spain (e.g., Wintour, 2017), but a democratic process capturing the will of the people (i.e., a prestigious act) by defenders of the independence of Catalonia (e.g., Asamblea Nacional Catalana, 2018). Conversely, the application of article 155 of the Spanish Constitution by the Spanish Government, which resulted in the control of the Catalanian regional power by the Spanish government, was considered a coup d'état (i.e., an act of dominance) by people in favour of the independence of Catalonia, but a reestablishment of democracy (i.e., a prestigious act) by defenders of the territorial integrity of Spain (e.g., Burgen, 2017).

The same is applicable to the perceptions of liberal (e.g., Hillary Clinton) and conservative (e.g., Donald Trump)⁹ political leaders as either dominant or prestigious. Conservatives might feel that liberal politicians are imposing their views on society by pushing the direction of cultural change towards liberal values. Similarly, liberals might feel that conservative politicians are imposing their views on society by pushing the direction of cultural change towards conservative values. As both conservatives and liberals see political leaders of the opposing ideology as a threat to their personal values, or seeking to coerce them into following alternative values, they might perceive them as dominant. In contrast, political leaders of their own ideology are seen as defending and trying

⁹ I use the terms 'liberal' and 'conservative' as they are used in the US: 'liberal' as synonymous of left-wing and Democrat and 'conservative' as synonymous of right-wing and Republican.

to implement the values that those people view as correct and, therefore, people might perceive these politicians as competent and confer prestige on them. These perceptions of political leaders of their own ideology as prestigious and political leaders of the opposing ideology as dominant might be exacerbated due to the increasing political polarization experienced in the last two decades, at least in the US (Lukianoff & Haidt, 2018, pp. 128-132).

Third, it is not clear why economic uncertainty would reverse the general tendency of preferring prestigious leaders over dominant leaders as Kakkar and Sivanathan (2017) propose. Although dominant leaders might benefit their ingroup by competing more aggressively over limited resources against outgroups, prestigious individuals, who are assumed to be more competent, might take the right decisions to bring the country out of an economic recession. Therefore, supporting a prestigious leader might also be a way to compensate the lack of control while facing economic uncertainty.

Furthermore, it is unclear why economic uncertainty would be a better predictor of preference for dominant / right-wing populist leaders than political ideology, as has been claimed (Kakkar & Sivanathan, 2017). Ideology is an alternative explanation for the rise of right-wing populist leaders. This ideological explanation posits that the political discourse and proposed policies of right-wing populist leaders are more attractive for a part of the electorate than the political discourse and policies of well-established political leaders. This explanation is often described as a *cultural or political backlash* against post-materialist political movements such as feminism and environmentalism (Inglehart & Norris, 2016, 2017) and/or political correctness (Campbell & Manning, 2018, pp. 151-161). Inglehart and Norris (2017) found support for the ideological explanation in a

study in which they tested whether ideology or economic uncertainty better accounts for the recent rise of right-wing populism. They used data from the European Social Survey (2002-2014) to predict voting preferences for a right-wing populist party from several control (e.g., age, gender, education), economic (e.g., unemployment, subjective economic uncertainty, living on social benefits) and ideological (e.g., anti-immigration, right-wing self-identification, mistrust in global governance) variables. They found mixed support for the economic uncertainty explanation. For example, right-wing populists were supported more by unemployed people but less by people receiving social welfare. In contrast, all the ideological predictors (anti-immigration attitudes, mistrust in global and national governance, authoritarian values and right-wing ideology) positively predicted support for populist leaders, giving clear support for the ideological explanation. These results highlight the importance of political values in predicting support for right-wing populist leaders. Consequently, I suggest that political ideology actually plays a greater role than economic uncertainty in explaining the rise in popularity of right-wing populist leaders. Nevertheless, political ideology and economic uncertainty might interact. Ideology might predict who decides to vote for a right-wing populist leader, but economic uncertainty might have created a window of opportunity for right-wing populists, with their discourse becoming attractive to a greater number of people after the financial crisis.

In conclusion, there exist certain parallels between right-wing populist leaders such as Donald Trump and the dominance strategy (e.g., use of aggressive vocabulary against political rivals). However, there are limitations to this parallel. Donald Trump and other right-wing populist leaders often use this strategy against outgroups or political rivals. This differs from the dual

evolutionary model of social hierarchy in which the dominance strategy is directed towards ingroup members. The use of dominance against outgroups might serve to gain prestige within the ingroup, blurring the original dominance-prestige distinction. Consequently, failing to take the ingroup/outgroup distinction into account might lead to incorrect inferences such as concluding that people prefer dominant political leaders under certain contexts (e.g., economic uncertainty) without considering how political ideologies influence perceptions of dominance and prestige of political leaders (e.g., Kakkar & Sivanathan, 2017) or how dominance strategies against out-groups might confer prestige within in-groups (Halevy et al., 2012).

6.1.2.- Hypotheses

Based on the discussion above, I formulated a number of hypotheses (Table 10) that specify the conditions under which dominant and prestigious leaders should be preferred. Hypotheses H1-H3 predict preferences for dominant (H1a, H2a and H3a) and prestigious (H1b, H2b and H3b) political leaders as a result of experiencing economic uncertainty (H1), perceived lack of control (H2) and inter-group conflict (H3). These hypotheses are not mutually exclusive. Dominance and prestige have been shown to be two independent strategies to acquire high social rank and social influence through different means (Cheng & Tracy, 2014; Cheng et al., 2013). Consequently, economic uncertainty, perceived lack of control and intergroup conflict might predict preference for both dominant and prestigious political leaders. Hypotheses H4-H6 derive from our argument that political ideologies influence perceptions of political leaders as either dominant or prestigious and the greater importance that I ascribe to political ideology over economic uncertainty in predicting voting preferences. These

hypotheses are tested in Studies 1 and 2 described below, which extend and improve on the methods and analyses of previous studies (e.g., Kakkar and Sivanathan 2017) that partially address only some of the hypotheses.

Economic Uncertainty	H1a: Economic uncertainty positively predicts preferences for a dominant leader.
	H1b: Economic uncertainty positively predicts preferences for a prestigious leader.
Perceived lack of control	H2a: Perceived lack of control positively predicts preferences for a dominant leader.
	H2b: Perceived lack of control positively predicts preferences for a prestigious leader.
Inter-group conflict	H3a: Inter-group conflict positively predicts preferences for a dominant leader.
	H3b: Inter-group conflict positively predicts preferences for a prestigious leader.
Perceptions of conservative political leaders	H4: Liberal ideology is positively related to perceptions of conservative political leaders as dominant and negatively related to perceptions of liberal leaders as dominant ¹⁰ .
Perceptions of liberal political leaders	H5: Liberal ideology is positively related to perceptions of liberal political leaders as prestigious and negatively related to perceptions of conservative leaders as prestigious ¹¹ .
Voting decisions	H6: People's political ideology is a stronger predictor of people's voting decisions than economic uncertainty.

Table 9. Hypotheses. Hypotheses H1-H3 refer to the relationship between economic uncertainty, perceived lack of control and inter-group conflict, and preferences for both dominant and prestigious political leaders (Study 1). Hypotheses H4-H5 refer to how people's political ideology are related to the perceptions of political leaders as dominant or prestigious (Study 2). Hypothesis H6 related to whether political ideology is a better predictor of voting decisions than economic uncertainty or not.

¹⁰ Because the scale used to measure political ideology ranges from conservative (1) to liberal (7), this hypothesis could also be framed as "conservative ideology is negatively related to perceptions of conservative political leaders as dominant and positively related to perceptions of liberal leaders as dominant.

¹¹ Because the scale used to measure political ideology ranges from conservative (1) to liberal (7), this hypothesis could also be framed as "conservative ideology is negatively related to perceptions of liberal political leaders as prestigious and positively related to perceptions of conservative leaders as prestigious.

6.2.- Study 1

6.2.1.- Introduction

The aim of this study is to test whether economic uncertainty (H1a & H1b), perceived lack of control (H2a & H2b) and intergroup conflict (H3a & H3b) positively predict preferences for dominant and prestigious leaders respectively. I use data from the longitudinal World Values Survey (henceforth WVS; Inglehart et al., 2018) for the period 2010-2016. H1a and H2a have been previously tested with this dataset but with a longer timeframe (2004-2016) by Kakkar and Sivanathan (2017), I am using the data from 2010 to 2016 because only the data from this period contain all the variables of interest. Hypotheses H1b, H2b, H3a and H3b (related to prestige, and intergroup conflict) have not previously been addressed.

Kakkar and Sivanathan used a 4-point Likert item that asked respondents their opinion of “having a strong leader who does not bother with parliament or elections” (1=very good, 4=very bad, reverse coded) as a measure of *preference for a dominant leader*. For *perceived general lack of control*, they used a 10-point Likert item, which asked respondents to indicate how much freedom of choice and control they have over the way their lives turn out (1=no choice at all, 10 = a great deal of choice, reverse coded). They also used five control variables from the WVS (subjective social class, gender, age, political ideology and income category). However, they did not use any of the economic uncertainty variables included in the WVS. Instead, as their measure of *economic uncertainty*, they used the change in unemployment in a country from one year to the next, which was extracted from the World Development Indicators (WDI) database from the World Bank. They found support for hypotheses H1a and H2a (Table 10): both

economic uncertainty and perceived general lack of control positively predicted preference for a dominant leader. However, the adjusted R^2 is very low ($Adj R^2=0.002$) and there is no difference in the adjusted R^2 between the model including only the control variables and the models that also included economic uncertainty alone or together with perceived lack of control. This might be the consequence of using the same value of economic uncertainty (i.e., change in unemployment) for all the respondents from the same country within a year, which totally eliminates the variation in economic uncertainty between individuals in the same country. To improve on their analysis, I use individual-level variables extracted from the WVS to measure economic uncertainty. Moreover, I adopt a model comparison approach to compare the strength of economic uncertainty, perceived lack of control and intergroup conflict in predicting preferences for both dominant and prestigious leaders.

6.2.2.- Methods

I used the same item as Kakkar and Sivanathan (2017) to measure the outcome variable *preference for a dominant leader*. The second outcome variable, *preference for a prestigious leader*, was measured with a 4-point Likert item (1=very good, 4=very bad) in which respondents gave their opinion about the way of governing: “having experts, not government, make decisions according to what they think is best for the country” (1=very good, 4 very bad, reverse coded). I chose this item because it is consistent with Henrich and Gil-White’s prestige definition, which centres on knowledge and skill as key aspects of leadership.

For the predictor variable *economic uncertainty* I used five items. Two of those items asked respondents to indicate how worried they were about the

possibility of losing or not finding a job (EcUnJOB) and about not being able to give their children a good education (EcUnEDUCATION) (1=very much, 4= not at all, reverse coded). The remaining three items asked respondents to indicate how often in the last 12 months they or their family have gone without enough food to eat (EcUnFOOD), without medicine or medical treatments they needed (EcUnMEDICINE), and without a cash income (EcUnCASH) (1=often, 4=never, reverse coded). *Intergroup conflict* was measured with three 4-point Likert items indicating how often respondents are worried about a war involving their country (InConINTWAR), a civil war (InConCIVILWAR) or a terrorist attack (InConTERRORISM) (1=very much, 4=not at all, reverse coded). Each item for both the economic uncertainty variable and the intergroup conflict variable were used as separate predictors to preserve their meaning. This also entailed to treat each Likert item as ordinal rather than averaging it and treating it as continuous. *Perceived lack of control* was measured with the same item as Kakkar and Sivanathan (2017) used (see Section 6.2.1.). As *control variables* we used the same variables as Kakkar and Sivanathan (2017): age, gender, income category (10-point Likert scale from lowest group to highest group within respondents' country), subjective social class (5-point Likert scale, 1=upper class, 5=lower class, reverse coded) and political ideology (10-point Likert item from left to right).

After excluding respondents who did not provide information from one or more of these variables, the dataset contained 52325 respondents (26209 females, 26116 males) aged 16-99 ($M=41.27$, $SD=15.95$) from 54 different countries.

Because both outcome variables (preference for a dominant leader and preference for a prestigious leader) are ordered categorical variables and

respondents lived in different countries, I used ordinal mixed effects logistic regression models to analyse the data (Bürkner & Vuorre, 2019) with intercepts varying by country of respondents. As the predictor variables of interest (i.e., the items used as proxies for economic uncertainty, lack of control and intergroup conflict) were ordered categorical variables, I modelled their relationship with the outcome variable as monotonic effects (Bürkner & Charpentier, 2018) with the package *brms* (Bürkner, 2017). As most variables were ordered, instead of continuous, I did not centre or standardize the variables.

6.2.3.- Results

6.2.3.1.- Which variables predict preference for a dominant leader?

To analyse the relationship between the predictors of interest and the preference for a dominant political leader I ran several Bayesian regression models with default flat priors in *brms* and compared their model fit using leave-one-out cross validation information criterion (LOOIC; Vehtari, Gelman, & Gabry, 2017). See Table 11 for regression coefficients and LOOIC values. Similarly to Akaike Information Criterion (AIC) and Watanabe-Akaike Information Criterion (WAIC), a lower LOOIC indicates better model fit. First, I ran a null model (LOOIC=132040.6, SE=212.0), with only the intercepts as predictors. The Variance Ratio (a Bayesian equivalent to the Intraclass Correlation) in this null model was 0.06, meaning that the 6% of the variance in preferences for dominant leaders is explained by the clustering of respondents within countries. This is a relatively small value but important enough to justify the use of multilevel modelling to attain accurate estimates. This model was compared to a control model (LOOIC=131955.3, SE=212.6), which included all the control variables. As the model fit of the control model was better than the fit of the null model, I used

the control model as a base for constructing and comparing the model fit of subsequent models.

Unstandardized Coefficients	NULL	CONTROL	ECONOMIC UNCERTAINTY	LACK OF CONTROL	INTERGROUP CONFLICT	FULL
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Intercept [1]	-1.11 (0.12)	-1.00 (0.12)	-0.53 (0.13)	-0.94(0.13)	-0.68 (0.13)	-0.40 (0.13)
Intercept [2]	0.23 (0.12)	0.35 (0.12)	0.83 (0.13)	0.40 (0.13)	0.68 (0.13)	0.96 (0.13)
Intercept [3]	1.86 (0.12)	1.98 (0.12)	2.46 (0.13)	2.03 (0.13)	2.31 (0.13)	2.59 (0.13)
Gender [Male]		-0.03 (0.02)	-0.04 (0.02)	-0.03 (0.02)	-0.02 (0.02)	-0.03 (0.02)
Age		-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
mo (Subjective Social Class)		0.12 (0.02)	0.13 (0.02)	0.12 (0.02)	0.12 (0.02)	0.13 (0.02)
mo (Income Category)		-0.00 (0.01)	0.01 (0.00)	-0.00 (0.01)	-0.00 (0.01)	0.01 (0.00)
mo (Political Ideology)		0.02 (0.00)	0.02 (0.00)	0.02 (0.00)	0.02 (0.01)	0.02 (0.00)
mo(EcUnJOB)			0.05 (0.01)			0.05 (0.01)
mo(EcUnEDUCATION)			0.04 (0.01)			-0.02 (0.01)
mo(EcUnFOOD)			0.15(0.02)			0.15 (0.02)
mo(EcUnMEDICINE)			0.06(0.01)			0.06 (0.01)
mo(EcUnCASH)			-0.04 (0.01)			-0.04 (0.01)
mo (Perceived Lack of Control)				0.01 (0.00)		0.00 (0.00)
mo (InConINTWAR)					0.07 (0.01)	0.06 (0.01)
mo(InConCIVILWAR)					0.12 (0.01)	0.11 (0.01)
mo(InConTERRORISM)					-0.06 (0.01)	-0.05 (0.01)
LOOIC	132040.6	131955.3	131509.0	131940.8	131669.3	131335.1
Variance Ratio	0.12					

Table 10. Unstandardized Coefficients (B) and their standard errors (in brackets) for each of the main ordinal regression models with preference for a dominant leader as the outcome. Square brackets indicate reference categories for the categorical predictors..Ordinal predictors were modelled as monotonic effects and are labelled mo(variable). More regression models and further details can be found in SM5a. LOOIC = leave-one-out cross validation information criterion (lower values indicate better fit to the data; see text for details). Variance Ratio represents the proportion of variance explained by the clustering of individuals within States.

To test H1a, which predicted that economic uncertainty is positively related to preferences for a dominant leader, I ran a model that included the 5 items for economic uncertainty and the control variables (LOOIC= 131509.0, SE=215.5).

Supporting H1a, the economic uncertainty model had a better fit than the control model (LOOIC=131955.3, SE=212.6). Four items (EcUnJOB: $B=0.05$, $SE=0.01$, 89% CI [0.04, 0.06]; EcUnEDUCATION: $B=0.04$, $SE=0.01$, 89% CI[0.02, 0.06]; EcUnFOOD: $B=0.15$, $SE=0.02$, 89% CI [0.12, 0.18; EcUnMEDICINE: $B=0.06$, $SE=0.01$, 89% CI[0.04,0.07]) were, as expected, positively related to preference for a dominant leader, while one item (EcUnCASH, $B=-0.05$, $SE=0.01$, 89% CI [-0.07, -0.04]) was, contrary to expectations, negatively related to preference for a dominant leader.

To test H2a, which predicted that perceived lack of control is positively related to preferences for a dominant leader, I ran a model that included perceived lack of control and the control variables (LOOIC=131940.8, SE=212.8). This model had a better fit than the control model (LOOIC=131955.3, SE=212.6). However, the fit of this model was worse than the fit of the economic uncertainty model (LOOIC= 131509.0, SE=215.5), which indicates that perceived lack of control was less important in predicting preference for a dominant leader than economic uncertainty. The addition of perceived lack of control to the economic uncertainty model did not improve the latter's model fit (LOOIC=131509.8, SE=215.5) and the credible interval for perceived general lack of control crossed zero ($B=0.01$, $SE=0.01$, 89% CI[-0.01, 0.01]) indicating an unreliable effect of perceived lack of control on preferences for a dominant leader.

To test H3a, which predicted a positive relationship between intergroup conflict and preference for a dominant leader, I ran a model that included the three intergroup conflict items and the control variables (LOOIC=131669.3, SE=215.1). Supporting H3a, the intergroup conflict model had a better fit than the control model (LOOIC=131955.3, SE=212.6). Two of the intergroup conflict items

(InConINTWAR, $B=0.07$, $SE=0.01$, CI 89% [0.05, 0.09]; InConCIVILWAR: $B=0.12$, $SE=0.01$, 89% CI [0.10, 0.14]) were, as expected, positively related to preference for a dominance leader, while one item (InConTERRORISM, $B=-0.06$, $SE=0.01$, 89% CI [-0.08, -0.04]) was, contrary to expectations, negatively related. However, the fit of these models was worse than the fit of the economic uncertainty model ($LOOIC=131509.0$, $SE=215.5$), which indicates that intergroup conflict had less importance than economic uncertainty in predicting preference for a dominant leader.

Lastly, I ran a full model including all the variables. This model had the best fit of all models ($LOOIC=131335.1$, $SE=217.0$). This indicates that, although economic uncertainty is a stronger predictor than intergroup conflict, intergroup conflict is still an important predictor of preference for a dominant leader. In the full model, three of the economic uncertainty variables were positively associated with preference for a dominant leader (EcUnJOB: $B=0.05$, $SE=0.01$, 89% CI [0.03, 0.06]; EcUnFOOD: $B=0.15$, $SE=0.02$, 89% CI [0.12, 0.17]; EcUnMEDICINE: $B=0.06$, $SE=0.01$, 89% CI [0.04, 0.08]), while two of the economic uncertainty variables were negatively related (EcUnEDUCATION: $B=-0.02$, $SE=0.01$, 89% CI [-0.03, -0.01]; EcUnCASH: $B=-0.04$, $SE=0.01$, 89% CI [-0.06, -0.02]); two of the intergroup conflict variables were positively related to preference for a dominant leader (InConINTWAR: $B=0.06$, $SE=0.01$, 89% CI [0.04, 0.08]; InConCIVILWAR: $B=0.11$, $SE=0.01$, 89% CI [0.09, 0.13]), while one was negatively related (InConTERRORISM: $B=-0.05$, $SE=0.01$, 89% CI [-0.07, -0.03]). Perceived lack of control had an unreliable effect on preference for a dominant leader as its credible interval crossed zero ($B=0.00$, $SE=0.00$, 89% CI [-0.00, 0.01]).

6.2.3.2.- Which variables predict preference for a prestigious leader?

Here I ran the same models as for preference for a dominant leader but with preference for a prestigious leader as outcome variable (Table 12). The null model (LOOIC=131903.6, SE=214.2) had a Variance Ratio of 0.06, justifying the use of multilevel modelling. Again, this null model had worse fit than the control model (LOOIC=131641.5, SE=215.7). Consequently, I used the control model as a base for constructing and comparing the model fit of the subsequent models.

Unstandardized Coefficients	NULL	CONTROL	ECONOMIC UNCERTAINTY	LACK OF CONTROL	INTERGROUP CONFLICT	FULL
Intercept [1]	-1.92 (0.09)	-2.06 (0.09)	-1.65 (0.10)	-2.07 (0.09)	-1.80 (0.09)	-1.60 (0.10)
Intercept [2]	-0.37 (0.09)	-0.51 (0.09)	-0.09 (0.10)	-0.52 (0.09)	-0.25 (0.09)	-0.04 (0.10)
Intercept [3]	1.60 (0.09)	1.46 (0.09)	1.89 (0.10)	1.45 (0.09)	1.73 (0.09)	1.94 (0.10)
Gender [Male]		0.02 (0.02)	0.02 (0.02)	0.02 (0.02)	0.03 (0.02)	0.03 (0.02)
Age		-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
mo (Subjective Social Class)		-0.03 (0.04)	0.03 (0.04)	-0.04 (0.04)	-0.03 (0.04)	0.02 (0.04)
mo (Income Category)		0.22 (0.10)	0.29 (0.08)	0.21 (0.10)	0.26 (0.09)	0.30 (0.08)
mo (Political Ideology)		-0.11 (0.03)	-0.11 (0.03)	-0.11 (0.03)	-0.12 (0.03)	-0.12 (0.03)
mo(EcUnJOB)			0.05 (0.03)			0.02 (0.03)
mo(EcUnEDUCATION)			0.29 (0.03)			0.22 (0.03)
mo(EcUnFOOD)			-0.03 (0.04)			-0.02 (0.04)
mo(EcUnMEDICINE)			0.19 (0.04)			0.18 (0.04)
mo(EcUnCASH)			0.14 (0.04)			0.14 (0.04)
mo (Perceived Lack of Control)				-0.03 (0.04)		-0.01 (0.00)
mo (InConINTWAR)					0.16 (0.04)	0.10 (0.04)
mo(InConCIVILWAR)					0.05 (0.05)	-0.03 (0.05)
mo(InConTERRORISM)					0.15 (0.03)	0.15 (0.04)
LOOIC	13190 3.6	131641.5	131600.2	131864.0	131704.8	131541.0
Variance Ratio	0.06					

Table 11. Unstandardized Coefficients (B) and their standard errors (in brackets) for each of the main ordinal regression models with preference for a prestigious leader as the outcome. Square brackets indicate reference categories for the categorical predictors. Ordinal predictors were modelled as monotonic effects and are labelled mo(variable). More regression models and further details can be found in the SM5b. LOOIC = leave-one-out cross validation information criterion (lower values indicate better fit to the data; see text for details). Variance Ratio represents the proportion of variance explained by the clustering of individuals within States.

Supporting H1b, the economic uncertainty model (LOOIC=131600.2, SE=216.2) had a better fit than the control model (LOOIC=131641.5, SE=215.7). Four items were, as expected, positively related to preference for a prestigious leader (EcUnJOB: B=0.05, SE=0.01, 89% CI [0.04, 0.07]; EcUnEDUCATION: B=0.04, SE=0.01, 89% CI [0.02, 0.06]; EcUnFOOD: B=0.15, SE=0.02, 89% CI [0.12, 0.18]; EcUnMEDICINE: B=0.06, SE=0.01, 89% CI [0.04, 0.08]), while one item (EcUnCASH: B=-0.04, SE=0.01, 89% CI [-0.06, -0.02]) was, contrary to expectations, negatively related.

Contrary to H2b, the lack of control model (LOOIC=131864, SE=214.7) had worse fit than the control model (LOOIC=131641.5, SE=215.7). The inclusion of perceived lack of control to the economic uncertainty model hardly improved its model fit (LOOIC=131600.2).

Contrary to H3b, the intergroup conflict model (LOOIC=131704.8, SE=215.8) had worse fit than the control model (LOOIC=131641.5, SE=215.7).

The full model including all the variables (LOOIC=131541.0, SE=216.6) had the best fit of all the models. In the full model, three of the economic uncertainty items were positively related to preference for a prestigious leader (EcUnJOB: B=0.05, SE=0.01, 89% CI [0.03, 0.06]; EcUnFOOD: B=0.15, SE=0.02, 89% CI [0.11, 0.18]; EcUnMEDICINE: B=0.06, SE=0.01, 89% CI [0.04, 0.08]), while one item was negatively related (EcUnCASH: B=-0.04, SE=0.01, 89% CI [-0.06, -0.01]) and another item had an unreliable effect (EcUnEDUCATION: B=-0.02, SE=0.01, 89% CI [-0.04, 0.01]); two of the intergroup conflict items were positively related to preference for a prestigious leader (InConINTWAR: B=0.06, SE=0.01, 89% CI [0.03, 0.08]; InConCIVILWAR: B=0.11, SE=0.01, 89% CI [0.08, 0.13]), while one item was negatively related

(InConTERRORISM: $B=-0.05$, $SE=0.01$, 89% CI [-0.08, -0.03]. Perceived lack of control had an unreliable effect of preference for a prestigious leader ($B=-0.01$, $SE=0.00$, 89% CI [-0.01, 0.00]).

6.2.4.- Discussion

In Study 1, I tested whether economic uncertainty, perceived lack of control and intergroup conflict positively predict preference for dominant and prestigious leaders. Previous research has focused on how these variables predict preference for a dominant leader but, to the best of my knowledge, no research has tested how these variables predict preference for a prestigious leader. Moreover, previous studies with data from the WVS (Kakkar and Sivanathan 2017) used group-level measures of the predictor variables, whereas I used individual-level measures, providing a more fine-grained analysis.

Similarly to Kakkar and Sivanathan (2017), I found that some of our measures of economic uncertainty predicted preference for a dominant leader. In my study, however, the same measures of economic uncertainty also predicted preference for a prestigious leader. The fact that economic uncertainty is related to preferences for both types of leaders casts doubt on previous claims of the specificity of the link between economic uncertainty and preference for dominant leaders. My results suggest that economic uncertainty might simply increase preference for leadership in general, instead of for dominant leadership in particular.

Alternatively, the relationship between economic uncertainty and preference for both dominant and prestigious leaders might be mediated or moderated by respondents' traits or states. Here, I examined the relationship between one of these individual variables, perceived general lack of control, and

preference for dominant and prestigious leaders. Perceived general lack of control has been proposed to be positively related to preference for a dominant leader and to be the psychological mechanism by which facing economic uncertainty makes an individual more likely to prefer a dominant leader (Kakkar & Sivanathan, 2017). I therefore proposed that perceived lack of control would also be positively related to preference for prestigious leaders. However, I did not find support for any of these predictions as perceived lack of control had an unreliable effect on predicting preference for both dominant and prestigious leaders. Consequently, perceived lack of control does not seem to be the mechanism that explains the higher preference for both dominant and prestigious leaders when facing economic uncertainty.

Similarly to previous studies (Laustsen & Petersen, 2017; Little et al., 2007), I found that some of my measures of intergroup conflict predicted preference for a dominant leader. Although the fit of the intergroup conflict model for predicting preference for a prestigious leader was worse than the fit of the control model, two intergroup conflict items were positively related to preference for a prestigious leader in the full model, which had the best fit of all. This again casts doubt of the specificity of the relationship between intergroup conflict and preference for a dominant leader. As I suggest above, dominant behaviours directed against outgroups might serve to gain prestige within the ingroup (Halevy et al., 2012). This explains why people might prefer an authoritarian over a democratic government when political repression is exercised against outgroups considered enemies of the ingroup (e.g., political dissidents in Stalin's USSR). Although further research is necessary to confirm this, when respondents are asked about their preferences for dominant and prestigious leaders, it is likely

that respondents are imagining that the political authoritarianism and the expertise would be used in favour of the ingroup and/or against outgroups.

Compared to previous studies, my study has the advantage of comparing preferences for different types of leadership (dominance vs prestige) when studying the effects of specific social contexts such as economic uncertainty or intergroup conflict on preferences for one type of leader. Another advantage is the simultaneous use of different measures of economic uncertainty and intergroup conflict. As the results suggest, not all measures of these variables are positively related to preferences for dominant and prestigious leaders. It seems that being worried about not having or finding a job, and not having had enough food and medicine in the last 12 months are stronger predictors on preferences for dominant and prestigious leaders than being worried about access to education and not having enough income. Similarly, open intergroup conflict (inter-country or civil war) positively predict preference for dominant and prestigious leaders, while more unidirectional violence (terrorism) is negatively related to preference for both types of leaders. I am not sure why these different economic uncertainty and intergroup conflict variables are related to preferences for both types of leaders in different directions. However, the results make clear that selecting some of these variables might bias the conclusions of studies investigating the relationship between particular economic and intergroup contexts and preferences for different types of leaders. Consequently, I recommend using multiple proxies for economic uncertainty and intergroup conflict in future studies.

Study 1 has the limitation of using measures of dominant (“strong leader who does not bother with parliament or elections”) and prestigious (“experts, not

government, [who] make decisions according to what they think is best for the country”) leaders that describe dictators and technocrats respectively. Dictatorship and technocracy are not incompatible forms of ruling a country. For example, technocrats occupied ministries and had special relevance in Franco’s dictatorship in the 1960s in Spain. Moreover, these measures (dictator/technocrat) are not totally comparable to the measures of dominance and prestige commonly used to study the dual evolutionary model of social hierarchy such as the scale developed by Cheng et al. (2010). This problem was addressed in Study 2.

6.3.- Study 2

6.3.1.- Introduction

In this study, I first analyse how political ideology influences perceptions of political leaders as dominant or prestigious (H4 and H5; see Table 1). Following Kakkar and Sivanathan (2017), I use self-ratings of political ideology and ratings of the perceived dominance and prestige of Donald Trump and Hillary Clinton collected during the campaigns for the 2016 US Presidential Elections. American politics provides a particularly clear ingroup vs outgroup within-country comparison, with only two major political parties (Democrats and Republicans) represented by single candidates (in 2016, Clinton and Trump respectively) that are divided on many political and social issues. In line with H4, I expect to find that liberal ideology is positively related to perceptions of Trump as dominant and negatively related to perceptions of Clinton as dominant. In line with H5, I expect to find that liberal ideology is positively related to perceptions of Clinton as prestigious and negatively related to perceptions of Trump as prestigious. Second, I compare the strength of political ideology and economic uncertainty in predicting preferences for Donald Trump or Hillary Clinton. Following H6, I expect

to find that political ideology is a stronger predictor of voting decision than economic uncertainty.

While H4 and H5 are unexplored in previous research, H6 has been explicitly addressed by Kakkar and Sivanathan (2017). In a pretest to their Study 1, they asked 120 Amazon Mechanical Turk (AMT) participants to rate the prestige (agreement with statements such as “I think compared to Hillary Clinton, Donald Trump is a kind of leader who is respected and admired by other members”) and dominance (agreement with statements such as “I think compared to Donald Trump, Hillary Clinton is a kind of leader who might be feared by some members”,) of both candidates using an adapted shorter version of a validated scale of prestige and dominance (Cheng et al., 2010). Agreement was rated on a Likert scale from 1 (not at all) to 7 (very much). Participants also rated their own political ideology on a 7-point Likert scale from 1 (conservative/republican) to 7 (liberal/democrat), but the authors did not use this for their analysis. The data was collected during the day of the third presidential debate (20 October 2016). The results showed that the ratings of dominance were significantly higher for Trump ($M=5.5$, $SD=1.5$) than for Clinton ($M=4.7$, $SD=1.8$), while the ratings of prestige were higher for Clinton ($M=4.7$, $SD=1.7$) than for Trump ($M=3.54$, $SD=1.87$), leading to Kakkar and Sivanathan equating Donald Trump with a dominant leader.

On the same day, they asked 750 AMT participants about their intention to vote for Donald Trump, Hillary Clinton or neither, as well as their political ideology using the scale described above. They measured economic uncertainty using an aggregated measure of the rates of unemployment, house vacancy and poverty within the ZIP code of each participant, extracted from the Distress

Community Index (Economic Innovation Group, 2016). A multinomial regression with economic uncertainty, political ideology and several control variables showed that economic uncertainty was positively related to preference for Trump over Clinton. As the coefficient of economic uncertainty was larger than the coefficient for political ideology they concluded that “economic uncertainty predicted a preference for Donald Trump over and above (...) political partisanship” (p. 6736). However, their coefficients were not standardized and, therefore, their conclusion might be misleading. In fact, the difference in proportion of variance explained by their models with (Adjusted $R^2 = 0.227$) and without economic uncertainty (Adjusted $R^2 = 0.222$) is only 0.5%, which diminishes the importance of economic uncertainty in predicting voting intention for Trump. In Study 2, I use the data from Kakkar and Sivanathan (2017). Like those authors, I conducted multinomial regressions, but I adopt a model comparison approach to make more reliable comparisons between the strength of economic uncertainty and political ideology, rather than comparing unstandardised coefficients. As I did not find a way to run multinomial Bayesian regression using ordered categorical predictors, I ran frequentist models using AIC instead of LOOIC for the model comparisons and treated ordered categorical variables as if they were continuous. A difference of at least two AICs is considered to constitute a reliable difference between models in their fit to the data. All the models were run in Stata 16 (StataCorp, 2019).

6.3.2.- Methods

For testing H4 and H5, I used the data from the sample of 120 participants in Kakkar and Sivanathan (2017). For testing H6, I used the data from the sample of 750 participants in Kakkar and Sivanathan (2017). I also tested H6 using the

actual results of the US Presidential Elections of 2016. To this end, I conducted binomial regressions in which Donald Trump's victory within each state was predicted by the level of economic uncertainty within the state and the percentage of votes obtained by the Republicans in previous Presidential Elections (2012) as a proxy for political ideology.

6.3.3.- Results

As prestige and dominance have been conceptualized as two separate constructs (See Section 6.1.2) and the results of previous studies have shown that prestige and dominance barely correlate (Brand & Mesoudi, 2019; Cheng et al., 2013; Cheng et al., 2010; Kakkar, Gobel, & Sivanathan, Submitted; Monge-López & Álvarez-Solas, 2017; Redhead, Cheng, Driver, Foulsham, & O'Gorman, 2018), I first explored whether averaged ratings of prestige and dominance for each political candidate were correlated. Contrary to previous studies, I found a moderate negative correlation between the ratings of dominance and prestige for both candidates (Clinton: $r=-0.42$, Trump: $r=-0.48$; see Figure 9).

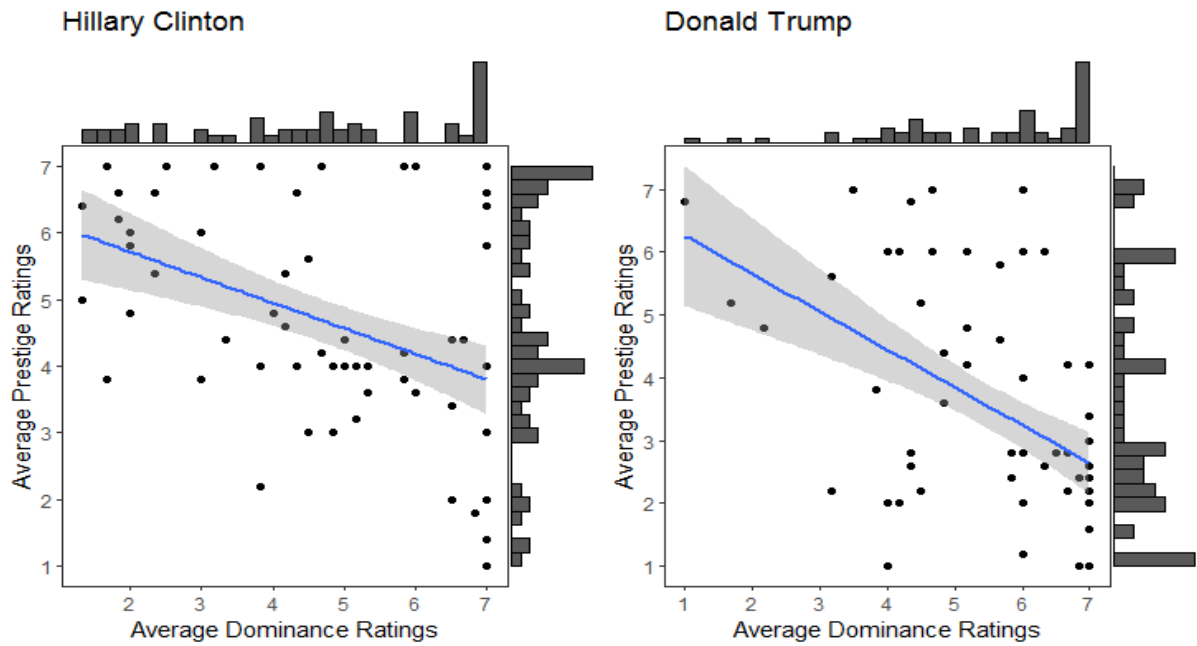


Figure 8. Relationship between the average dominance ratings and average prestige ratings for each candidate with 89% confidence intervals (grey area) and marginal histograms. Left: average dominance ratings and average prestige ratings for Hillary Clinton. Right: average dominance ratings and average prestige ratings for Donald Trump.

Supporting H4, I found that liberal ideology was positively related to ratings of Trump as dominant ($r=0.57$) and negatively related to ratings of Clinton as dominant ($r=-0.45$). Supporting H5, I found that liberal ideology was positively related to ratings of Clinton as prestigious ($r=0.44$) and negatively related to ratings of Trump as prestigious ($r=-0.56$). See Figure 10.

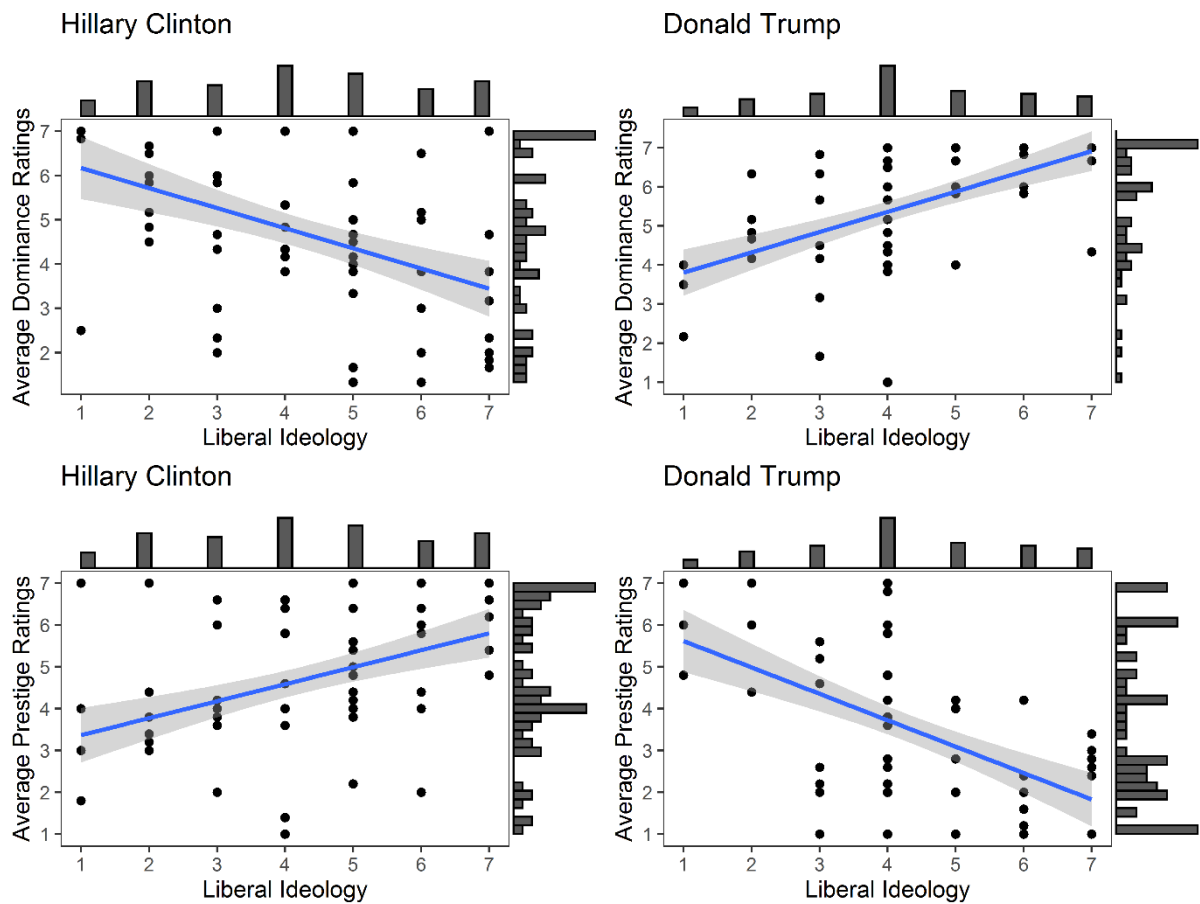


Figure 9. Relationship between the average prestige ratings and average dominance ratings for each candidate and political ideology of participants on a scale from 1 (conservative/Republican) to 7 (liberal/Democrat) with 89 % Confidence Intervals (grey areas) and marginal histograms. Left: Clinton. Right: Trump.

To test H6, that political ideology is a stronger predictor of voting decisions than economic uncertainty, I carried out a number of multinomial logistic regression models (Finch, Bolin, & Kelley, 2014, pp. 131-133) with voting for neither Trump nor Clinton as the reference category (Table 13). First, I compared the fit of a null model with and without intercepts varying by State. The fit of the single-level null model (AIC = 1541.978) was better than the fit of the multilevel null model (AIC = 1544.296). Consequently, multilevel modelling was not necessary here. All the subsequent models are single-level models.

Second, I compared the fit of the null model with a control model, which included age, gender and income as predictors (AIC=1518.949). Given its better fit, I used the control model as a base for the following models. Third, I compared the control model with a model that also included separately the three economic uncertainty variables (poverty rate, unemployment rate, and housing vacancy rate). The model fit of this economic uncertainty model ((AIC = 1516.061) was slightly better than the control model. However, a model with the control variables and political ideology as predictors had considerably better fit (AIC = 1283.126) than the economic uncertainty model. Lastly, a full model was computed, which had the best fit of all models (AIC=1220.082). These results support H6, i.e., political ideology is a stronger predictor of voting decision than economic uncertainty. In the full model, liberal ideology positively predicted preference for Clinton ($b=0.62$, $SE=0.07$, 89% CI [0.51, 0.73]) and negatively predicted preference for Trump ($b=-0.60$, $SE=0.08$, 89% CI [-0.73, -0.47]). Among the economic uncertainty variables, the only one that supports a greater preference for Trump ($B = 7.29$, $SE = 3.39$, 89 % CI [1.87, 12.70]) than for Clinton ($B = 0.52$, $SE = 2.90$, CI [-4.10, 5.16]) when facing economic uncertainty is housing vacancy rate. Poverty rate is negatively related to both preferences for Clinton ($B= -2.42$, $SE=1.31$, CI 89% [-4.52, -0.32]) and Trump ($B = -0.96$, $SE = 1.57$, 89% CI [-3.47, 1.55]). However, the CI for Trump crosses zero indicating that the negative relationship is not reliable. Unemployment rate is also negatively related to preferences for both Clinton (-1.06 , $SE = 1.44$, 89% CI [-3.37, 1.25]) and Trump ($B = -1.90$, $SE = 1.78$, 89% CI [-4.76, 0.94]). For both candidates, this negative relationship is not reliable as both CIs cross zero.

Five alternative statistical procedures were conducted to confirm these results (see Appendix C.1). In all these, I found that political ideology was a stronger predictor of voting decision than economic uncertainty.

Vote for Clinton					
Unstandardize d Coefficients	NULL	CONTROL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Constant	0.67 (0.09)	-0.47 (0.41)	0.68 (0.63)	-3.57 (0.57)	-2.47 (0.20)
Gender [Female]		0.45 (0.18)	0.44 (0.18)	0.27 (0.20)	0.25 (0.20)
Age		0.01(0.00)	0.00 (0.01)	0.01 (0.01)	0.01(0 .01)
Income		0.14 (0.06)	0.11 (0.06)	0.17 (0.07)	0.14 (0.07)
Poverty			-1.61 (1.21)		-2.42 (1.31)
Unemployment			-2.21 (1.35)		-1.06 (1.44)
Housing vacancy			1.41 (2.68)		0.53 (2.90)
Liberal Ideology				0.62 (0.07)	0.62(0 .07)
Vote for Trump					
Unstandardize d Coefficients	NULL	CONTROL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Constant	-0.21 (0.10)	-1.51 (0.49)	--1.41 (0.76)	1.07 (0.62)	1.489 (0.90)
Gender [Female]		-0.24 (0.23)	-0.23 (0.23)	-0.21 (0.25)	-0.16 (0.25)
Age		0.04 (0.01)	0.03 (0.01)	0.03 (0.01)	0.03 (0.01)
Income		0.13 (0.07)	0.13 (0.07)	0.08 (0.08)	0.07 (0.08)
Poverty			-1.77 (1.47))-0.96 (1.57)
Unemployment			-0.58 (1.61)		-1.91 (1.78)
Housing vacancy			5.87 (3.08)		7.29 (3.39)
Liberal Ideology				-0.59 (0.08)	-0.60 (0.08)
AIC	1541.9 8	1518.95	1516.06	1223.04	1220. 08
Pseudo-R²		0.03	0.03	0.22	0.23

Table 12. Multinomial regressions with neither Trump nor Clinton as reference category and state as a random effect. Standard Errors are shown in parentheses. The model comparisons using the Akaike Information Criteria (AIC) show that the political ideology model (in bold) has the best fit to the data.

Lastly, I tested H6 by comparing how well economic uncertainty and political ideology predicted the actual victory of Donald Trump in the 2016 Presidential elections in each State (Table 14). I compared a null model (AIC=69.30) with a model with the economic uncertainty variables at the level of the State (AIC=67.30), a model with political ideology measured with the percentage of votes for Republicans in the elections of 2012 (AIC=19.37) and a full model that included both economic uncertainty and political ideology (AIC=20.52). Although the economic uncertainty model improved the fit of the null model, both the political ideology model and the full model had a better fit to the data. In the political ideology model, the percentage of votes for Republicans in 2012 positively predicted the victory of Donald Trump in a State ($b=0.81$, $SE=0.38$, 89% CI [0.19, 1.44]). Three alternative statistical procedures were conducted to confirm these results (see Appendix C.2. for details). In all these, we found that political ideology was a stronger predictor of voting decision than economic uncertainty.

Unstandardized Coefficients	NULL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Constant	0.41 (0.29)	4.70 (4.53)	-37.61 (17.63)	-149.89 (96.21)
Housing		0.77 (0.30)		-1.55 (1.23)
Unemployment		-0.45 (0.17)		0.15 (0.42)
Poverty		0.55 (0.25)		1.62 (1.25)
Political Ideology			0.81 (0.38)	2.89 (1.88)
AIC	69.30	67.30	19.37	20.52
Pseudo-R ²		0.35	0.77	0.84

Table 13. Binomial regressions predicting the victory of Donald Trump within each State of the US in the 2016 Presidential Elections. The model comparisons using the Akaike Information Criteria (AIC) show that the political ideology model (in bold) has the best fit to the data.

6.3.4.- Discussion

In Study 2, I first examined how political ideology influences ratings of prestige and dominance of political leaders, using Donald Trump and Hillary Clinton as stimuli. Second, I compared the strength of political orientation and economic uncertainty in predicting preference for Trump or Clinton.

Contrary to previous studies that found that ratings of dominance and prestige for the same individuals are uncorrelated, the ratings of dominance and prestige for both Trump and Clinton were negatively correlated. This might be due to the polarized attitudes towards both candidates in the US at the time of collecting the data. Supporting this, I found that ratings of both dominance and prestige were influenced by political ideology. As predicted by H4 and H5, liberal ideology was positively correlated with ratings of Trump as dominant and Clinton as prestigious, and negatively correlated with ratings of Hillary as dominant and Trump as prestigious. This highlights the importance of exploring the relationship between individual variables such as political ideology with dominance and prestige before concluding that a politician is either dominant or prestigious. Kakkar and Sivanathan (2017) concluded that Trump was a dominant leader and Clinton a prestigious leader because ANOVAs comparing the ratings of dominance and prestige of both candidates yielded p-values smaller than 0.05. However, as the variation in the ratings was related to political ideology the inferences about the preferences for dominant or prestigious political leaders in this context is misleading. Consequently, future studies should pay careful attention to potential systematic variation in the perceptions of dominance and prestige of the stimuli to avoid potential misleading inferences (see Mileva, Jones, Russell, & Little, 2016, p. for another example of variation of perceptions of dominance and prestige related to participants' characteristics). This is especially

important when studying political issues, as the lack of political diversity in social science disciplines such as psychology, which is heavily skewed towards the left (Langbert, Quain, & Klein, 2016), might lead to less questioning of research methods that yield results in agreement with researchers' own political views (Duarte et al., 2015, Martin, 2016), as well as biased results if psychology undergraduates are used as participants.

Although the results of Study 2 show that perceptions of dominance and prestige of both candidates are associated with participants' political ideologies, this does not mean that Clinton and Trump did not differ in their use of the dominance and prestige strategies during the presidential debates. Indeed, Witkower (2017) demonstrated that Clinton showed more demonstrations of knowledge and non-verbal displays associated with the prestige strategy such as smiling than Trump, while Trump made more verbal attacks and showed more non-verbal displays associated with the dominance strategy (e.g., occupying more space and extending his arms) than Clinton. As argued earlier, the use of the dominance strategy against outgroups (which for Republicans would be Democrats) might lead to higher prestige among members of the in-group. Experimental evidence, however, is necessary to test this prediction.

Supporting H6, my results also contradict Kakkar and Sivanathan's conclusion that economic uncertainty is a stronger predictor of voting decision for Trump than political ideology. This is because I conducted model comparisons taking in and out both predictors, which I considered more appropriate for comparing the relative strength of economic uncertainty and political ideology than comparing unstandardized coefficients. Political ideology was also a

stronger predictor than economic uncertainty in predicting preference for Donald Trump when I used the data of the actual 2016 US Elections.

A limitation of the study, however, is that the data does not include any measure of whether the popularity of Donald Trump in the 2016 elections was motivated by a cultural or political backlash against post-materialist values and political correctness as participants were not asked about these issues. Furthermore, when people decide to vote for a specific candidate in the elections it is also possible that they move towards the candidate's ideology ¹², which would explain why political ideology is such a strong predictor of voting decision. Supporting this, the results of a longitudinal study show that people tended to vote for the candidates of the same party in the US Presidential Elections of 2012 and 2016 but that from one to the other there was a slight but important change in party identification in favour of the Republican party (Mutz, 2018b). The same study also found that personal economic hardship including subjective judgement of the economic situation did not predict voting for Trump. However, increases in Social Dominance Orientation (SDO), which is related to preference for group-based dominance, positively predicted voting for Trump. The results of Mutz's study are congruent with Inglehart and Norris' cultural backlash hypothesis and, as in my study, they diminish the importance of economic uncertainty in predicting preference for Trump over Clinton (but see debate about the correct way to analyse and interpret the data; Morgan, 2018a, 2018b; Mutz, 2018a).

¹² People can also vote against a candidate or political party, instead of in favour of a candidate/party. In this sense, some people who did not like Donald Trump voted for him because they dislike more Hillary Clinton and/or the Democrats. Some people who did not like Hillary Clinton voted for her because they dislike more Donald Trump and/or the Republicans.

6.4. – General Discussion

In this article, I first reviewed how the dual evolutionary model of social hierarchy has been used to explain the rise in popularity and electoral victories of right-wing populist leaders such as Donald Trump. Second, I highlighted the limitations of applying this model to large-scale democratic societies without clearly distinguishing between ingroups and outgroups. Third, I showed that both economic uncertainty and intergroup conflict predict preference for *both* dominant and prestigious leaders using data from the WVS. Consequently, it does not seem that either economic uncertainty or intergroup conflict have a unique link with increased preferences for dominant leaders, as previous research has suggested (Kakkar & Sivanathan, 2017; Laustsen & Petersen, 2017; Little et al., 2007). Third, I showed that perceptions of political leaders as either dominant or prestigious are not universal, but depend on people's political ideologies. Conservatives perceive conservative political leaders as prestigious and liberal political leaders as dominant, while liberals perceive conservative political leaders as dominant and liberal political leaders as prestigious. This highlights the importance of distinguishing between ingroups and outgroups within societies when reaching conclusions about preferences for dominant or prestigious leaders. Fourth, I showed that political ideology is a stronger predictor of preference for Donald Trump and Hillary Clinton than economic uncertainty, contradicting previous conclusions attributing greater importance to the economy than ideology in explaining Donald Trump's victory in 2016 (see Kakkar & Sivanathan, 2017).

Although previous work has equated right-wing populist leaders to dominant leaders (e.g., Trump) and well-established (liberal) politicians (e.g., Clinton) to prestigious leaders (Kakkar & Sivanathan, 2017), Study 2 clearly

shows that people perceive the dominance and prestige of political leaders differently depending on their own ideological similarity to those political leaders. Furthermore, as economic uncertainty does not seem to affect people's voting decision directly, I suggest looking at the political discourse of right-wing populist leaders and how it interacts with the discourse of other political actors to explain their rise in electoral popularity. Previous research has shown that particular features of information such as being simple (Heath & Heath, 2008), concrete (Heath & Heath, 2008), emotional (Eriksson & Coultas, 2014; Heath, Bell, & Sternberg, 2001; Heath & Heath, 2008; Stubbersfield, Flynn, & Tehrani, 2017) or negative (Bebbington, MacLeod, Ellison, & Fay, 2017) increases its chances of being transmitted accurately. As the right-wing populist discourse seems to contain these features in a greater proportion (e.g., higher emotional content; Breeze, 2018; Wirz, 2018) than the political discourse of traditional politicians, I suggest that this might explain the rise in electoral popularity of right-wing populist leaders. Nevertheless, the political discourse of part of the left (e.g., the emotional discourse of Greta Thunberg at the UN; PBS NewsHour, 2019) and against right-wing populist leaders (e.g., the emotional reaction after the election of Donald Trump as President of the US; Campbell & Manning, 2018, pp. viii-xix) sometimes presents the same content characteristics (i.e., simple, concrete, emotional and negative). Consequently, I suggest that the study of the transmissibility of the right-wing populist discourse and the discourse against right-wing populism should always take into account the political ideology of participants and the interaction between ideological groups.

In conclusion, while there have been prominent claims linking the rise of right-wing populist leaders, via economic uncertainty, to the dominance strategy of social rank acquisition and leadership, in this paper I have highlighted several

limitations of this thesis, alongside re-analyses and novel analyses to support my arguments. I hope to have contributed to continuing interdisciplinary efforts to improve our understanding of these major social and political trends that increasingly characterise our current times.

6.4.- References

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CHAPTER 7:

General Discussion

“It is a profound error to claim that learning is about replacing ignorance with understanding. Knowledge expands, but so does ignorance, as with a greater understanding of a subject also comes a greater appreciation for all the questions that remain unanswered”.

Scott H. Young. *Ultralearning*, 2019, p. 256.

7.1.- Summary of findings

The key aim of this thesis was to answer two broad research questions derived from Henrich and Gil-White’s (2001) theory of the evolution of prestige: (i) the use of prestige cues for social learning (**Chapters 2-4**) and (ii) dominance and prestige as two strategies to acquire high social rank and social influence in human groups (**Chapters 5-6**). I have investigated these two research questions through literature syntheses across disciplines (**Chapter 2** and **Chapter 5**), transmission chain experiments (**Chapter 3** and **Chapter 4**) and statistical analyses of publicly available survey data (**Chapter 6**).

Chapter 2 reviewed ethnographic and experimental research on the adaptive value and actual use of prestige-biased social learning. Henrich and Gil-White (2001) predicted a positive association between prestige and competence in valued domains for a social group. They also predicted a positive association between prestige and age, as knowledge/skill tends to increase with age. If these conditions are met, prestige-biased social learning would be adaptive. In the

literature, however, this positive association seems to depend on the existence of social and environmental stability. When the social and environmental contexts change rapidly, the predicted positive relationship between prestige and knowledge/skill might be disrupted by either (i) people conferring prestige according to old-fashioned values, while researchers measuring people's competence in a newly important domain; or (ii) people conferring prestige according to new values, while researchers measuring people's competence in no longer important domains. Henrich and Gil-White (2001) also predicted that people use prestige cues to select models from whom to learn. The empirical evidence reviewed in **Chapter 2**, however, provided mixed support for this prediction. Multiple factors affecting the use of prestige-biased social learning were identified such as the difficulty of the task (i.e., the greater the difficulty, the more likely one is to use prestige-biased social learning), the relevance of the domain for the individuals (i.e., the greater the relevance of the domain for the individuals, the more likely they are to use prestige-biased social learning), the existence of benefits or costs associated with the task (i.e., people tend to use more prestige-biased social learning when they are rewarded or punished by their performance, for example in a laboratory experiment), the availability of alternative social learning biases such as success bias (i.e., prestige-biased social learning should be less used when success-biased social learning is possible, which has not been found in the sole article studying this question reviewed in **Chapter 2** (Atkisson, O'Brien, & Mesoudi, 2012; but see Brand, Heap, Morgan, & Mesoudi, 2019, December 12, for recent evidence supporting this prediction)), and the measure of social influence used (i.e., prestige seems to have a greater influence on behaviour than on subjective opinions).

Chapter 3 presented a transmission chain experiment to study whether the information provided by high prestige sources is better transmitted than information provided by low prestige sources, and how the relevance of the prestige of the sources for a given topic affects the cultural transmission of the information. The responses of 192 participants were included in this study, who were randomly assigned to 48 chains of four cultural generations. The materials to transmit across the chains were arguments in favour of and against the replacement of textbooks by computer tablets at primary schools, which were associated to three sources of information who varied in prestige and relevance: the Head of the Department of Education of a leading university (high prestige, high relevance), an airline pilot (high prestige, low relevance) and a cleaner (low prestige, low relevance). Contrary to prestige-biased social learning, the information provided by both high prestige sources was not better transmitted than the information provided by the low prestige source.

Chapter 4 presented another transmission chain experiment, which, instead of studying the cultural transmission of information provided by sources with different levels of prestige, studied the cultural transmission of prestige and dominance social rank cues. The responses of 120 participants randomly assigned to 30 chains of 4 generations each were included in this study. The descriptions of three football players, who were described using either dominance, prestige or medium social rank cues, were used as materials to transmit across the chains. It was predicted that both dominance and prestige cues would be better transmitted across cultural generations than medium social rank cues. This prediction was supported. It was also predicted that dominance cues would be better transmitted across cultural generations than prestige cues. However, this prediction was not supported.

Chapter 5 reviewed the cultural evolution, social psychology and evolutionary psychology literature on the *standard dual evolutionary model of social hierarchy* (Henrich & Gil-White, 2001) and related areas of research. In this chapter I proposed a new integrated model, which distinguishes between three levels of analysis: strategies to acquire high social rank and social influence, dimensions of social rank and consequences of social rank. Similarly to the standard dual evolutionary model of social hierarchy, the proposed integrated model distinguishes between dominance and prestige strategies according to the mechanism used to attain social rank: the induction of fear in others vs the induction of admiration in others. However, this integrated model presents two key differences with the standard model: (i) it talks about dominance strategies and prestige strategies in the plural and (ii) it distinguishes between power (i.e., the asymmetrical control over resources) and status (i.e., the asymmetric level of respect, esteem and admiration than individuals received from others) as two different dimensions of social rank. The first key difference tries to accommodate conflicting findings in the literature and distinguishes between two dominance strategies (physical dominance and leverage) and three prestige strategies (competence, altruism/morality and development of social connections). The two dominance strategies seek to elicit fear in others but, whereas physical dominance elicits fear through the use of force or the threat of the use of force, leverage uses expert knowledge/skills and wealth to induce fear or threaten with the imposition of costs. These two dominance strategies seem to be used independently. In contrast, the three prestige strategies seem to be more dependent on each other and could be considered three components of the same strategy across many situations. The second key difference tries to adapt the standard model to apply to large-scale societies/groups with formal hierarchies

by synthesizing the standard model with the power-status distinction in social psychology. Importantly, the integrated model states that power can be attained either through dominance strategies or prestige strategies, while status can only be attained through prestige strategies. The consequences of social rank in the integrated model are very similar to the standard model as in both the type of social influence, attention and deference that high social rank individuals received depends on whether they are feared or admired.

Chapter 6 applies the *dual evolutionary model of social hierarchy* to the attainment of political power in large-scale democratic societies with formal social hierarchies. After reviewing some problems with the application of the standard dual evolutionary model of social hierarchy to this type of societies to explain the recent rise of right-wing populist leaders such as Donald Trump (Kakkar & Sivanathan, 2017), I tested whether economic uncertainty, perceived lack of control and intergroup conflict predicted preferences for dominant and prestigious leaders. Data from the longitudinal World Values Survey (Inglehart et al., 2018) for the period 2010-2016 pertaining to 52,325 respondents from 54 different countries was used. It was found that both economic uncertainty and intergroup conflict were positively related to preferences for both dominant and prestigious political leaders. This finding is contrary to claims that only dominant political leaders are preferred when people face economic uncertainty (Kakkar & Sivanathan, 2017) and intergroup conflict (Laustsen & Petersen, 2017; Little, Burriss, Jones, & Roberts, 2007). Next, I analysed how political ideology influenced the perception of the political leaders Donald Trump and Hillary Clinton as dominant and prestigious (N=120) and whether political ideology was a stronger predictor of preference for Donald Trump than economic uncertainty (N=750). Survey data collected by Kakkar and Sivanathan (2017) on the day of

the third US 2016 Presidential Election was used. It was found that liberal ideology was positively related to perceptions of Donald Trump as dominant and Hillary Clinton as prestigious, and negatively related to perceptions of Donald Trump as prestigious and Hillary Clinton as dominant. It was also found that political ideology was a stronger predictor of voting preference for Donald Trump than economic uncertainty, which again contradicts previous claims (Kakkar & Sivanathan, 2017). One important conclusion for this chapter was the need to take ingroup-outgroup relationships between different ideological groups into account when studying perceptions of dominance and prestige of political leaders.

7.2.- Implications

One of the conclusions from reviewing the literature in **Chapter 2** is that prestige-biased social learning might depend on the measure of social influence studied. For example, assessing the likability of a quote (Acerbi & Tehrani, 2018) is an easy task with no right-or-wrong answers and, consequently, people are more likely to be assessing it by themselves and less likely to be influenced by the prestigious. In contrast, designing an optimal arrow-head (Atkisson et al., 2012) or responding correctly to quiz questions (Brand et al., 2019, December 12) are more difficult tasks in which there exist optimal designs and correct answers. Therefore, people are more likely to use prestige-biased social learning in these types of tasks, above all when they could obtain higher rewards if attaining higher performance.

Another factor influencing prestige-biased social learning in experimental settings is how prestige (or social rank) is manipulated. This could explain the conflicting results in **Chapter 3** and **Chapter 4**. In both chapters, transmission

chain experiments were used, and the outcome measure in both chapters was the cumulative recall of information across chains of participants. However, the manipulation of prestige in **Chapter 3** was done through the use of descriptions of three individuals by their job titles (i.e., Head of Education of a leading university: high prestige, high relevance; airline pilot: high prestige, low relevance; cleaner: low prestige, low relevance), which were artificially kept in the material irrespective of participant recall, while the content of the information (i.e., the arguments in favour of and against the replacement of textbooks by computer tablets) was the material to be cumulative recalled by participants. Consequently, prestige was manipulated here as a *model-based transmission bias*. In **Chapter 4**, the information to transmit across the chains was prestige, dominance and medium social rank cues. Consequently, prestige (and the other types of social rank) was manipulated here as a *content transmission bias*. As model-based transmission bias, prestige did not have a reliable positive effect on cumulative recall (**Chapter 3**), while the content of the information (pro-tablets arguments vs anti-tablets arguments) did have a reliable effect on cumulative recall (i.e., the anti-tablets arguments were better transmitted than the pro-tablets arguments). As a content transmission bias, prestige (and dominance) has a reliable positive effect on cumulative recall (**Chapter 4**), as prestige (and dominance) cues were better transmitted than medium social rank cues. This suggests that the content of the information itself is a more important factor on the cumulative recall of information than the prestige of the source of information. However, the fact that prestige cues are better transmitted than medium social rank cues suggests that the identification of prestigious individuals might be important for other tasks, which is shown in multiple experiments (e.g., Atkisson et al., 2012; Brand et al., 2019, December 12; Chudek, Heller, Birch, & Henrich, 2012). If Henrich and Gil-

White (2001) are correct and prestige evolved as a way to select models from whom to socially learn, it is understandable that people recall well prestige cues as they could use these cues to identify models from whom to socially learning valuable knowledge/skills such as foraging skills in a hunter-gathering society.

Chapter 5 argued that power could be attained through either dominance strategies or prestige strategies, while status could only be attained through prestige strategies. **Chapter 6** extends this by arguing that it is problematic to depict the strategies that Donald Trump and other right-wing political leaders use to attain political power through democratic procedures as dominance strategies. Because being voted for is a form of receiving voluntary support, this is well-tuned to prestige strategies, not dominance strategies. This does not mean that dominance strategies could not have a role in democratic societies. For instance, the use of threats or verbal attacks towards political rivals are still used by political leaders in democratic societies. However, these verbal attacks could be perceived as displays of competence by individuals who disagree with the political views of the verbally attacked political leader. In fact, Boyer and Parren (2015) have shown that sources that provide threat-related information are perceived as more competent. Consequently, carrying out these verbal attacks could be useful for attaining higher levels of prestige among people with similar ideology.

Chapter 6 also argued that people tend to perceive political leaders of rival political ideologies as dominant, while they tend to perceive political leaders of their own ideology as prestigious. Correlational analyses between ratings of dominance and prestige for Donald Trump and Hillary Clinton and participants' political ideologies gave support to this prediction. This result is probably due to

the perception of competence of political leaders who defend one's own values and the perception of threat of political leaders who defend alternative values. It is, therefore, fundamental to control for the effects of political ideologies on participants' preferences for dominant and prestigious political leaders. This is an important implication of the findings in **Chapter 6** because politics is a research area in which researchers' and participants' own political attitudes and beliefs are likely to threaten the quality of inferences derived from empirical findings.

Chapter 6 also found that both economic uncertainty and intergroup conflict increase preferences for both dominant and prestigious political leaders, which suggests a preference for leadership in general under these contexts instead of a preference for dominant leaders in particular. This result has a clear implication for research on people's preferences for dominant political leaders. It suggests the need of testing the preferences for both dominant and prestigious political leaders simultaneously, as testing only the preferences for one of these types of leaders might lead us to reach inaccurate conclusions.

7.3.- Future Directions

7.3.1- Prestige, Dominance and memorability

Chapter 3 studied how the prestige of the sources of information affects the cumulative recall of that information. Although an unreliable effect of prestige on cumulative recall was found, further tests (e.g., using different manipulations of prestige or different materials to recall) are necessary in order to confirm/disconfirm this unreliable effect of prestige on recall. In **Chapter 3**, a first-order cue (i.e., job titles) was used to manipulate prestige. It is possible that second-order cues such as the asymmetric amount of attention received by

different models could have a clearer effect on recall. This could be tested by the use of videos featuring individuals providing a message while they are either being paid attention by others or being ignored by others. For example, the models could be university professors or sportspeople and the attentive or disengaged audience could be students or journalists, respectively.

In the discussion of **Chapter 3**, it was suggested that the unreliable effect of prestige on cumulative recall might be due to the artificial way prestige was manipulated. Participants in the experiment had never previously encountered the prestigious individuals, while in everyday life they have known and admired prestigious individuals for some time. It is, therefore, recommended to conduct similar experiments but using as sources of information individuals who participants already know and admire (e.g., a very popular university professor if the study is conducted with undergraduates). It might be the case that under these circumstances, prestige does have a reliable effect on recall. Similarly, the relevance of the material to recall for participants is another factor that it is necessary to look at. In **Chapter 3**, the information to remember were arguments about a society-level issue over which participants do not have much control. However, if the information to remember is advice that they could directly implement in order to improve some area of their lives, the effects of prestige on recall could be more reliable. For example, daily routines to increase productivity (e.g., waking up at 5am, having a high protein breakfast, doing the most important activity for the day just after breakfast) could be used as materials to recall. If participants are interested in improving their own productivity, it is likely to find prestige-biased effects.

Chapter 4 studied the cultural transmission of prestige and dominance cues finding that both types of cues are better recalled than medium social rank cues, while there is no clear difference in cumulative recall between prestige and dominance cues. These findings might be influenced by the experimental materials. Consequently, it is necessary to do further tests to check the reliability of these results. In this study, descriptions of football players were used as experimental materials. Football is both a cooperative (within a team) and competitive (between teams) sport. It might be worth looking at other domains without either the cooperative or the competitive component to see whether the similar effects of dominance and prestige are kept. Similarly, the proximal mechanism by which dominance cues and prestige cues are better recalled has not been studied. In the discussion for **Chapter 4**, I suggested that the proximate mechanism could be a higher level of emotionality elicited by dominant and prestigious individuals or a higher level of concreteness of being at the top of dominant and prestigious hierarchies than people being at the middle of those hierarchies. Consequently, future studies might benefit by controlling the level of emotionality and concreteness of the experimental materials to test the predictions.

7.3.2.- Transformations of prestige-biased social learning, dominance and prestige strategies in large-scale societies

A recurrent theme in many of the chapters has been the transformation of prestige-biased social learning. In **Chapter 2**, it was argued that *cross-domain prestige-biased social learning* is more adaptive in small-scale societies, in which it is more likely that prestigious individuals would be competent across domains (Acerbi, 2016), than in large-scale digital societies, in which there is a higher risk

of acquiring locally maladaptive information from globally prestigious individuals such as pop singers or Hollywood celebrities (Barkow, O'Gorman, & Rendell, 2012). In contrast, *within-domain prestige-biased social learning* seems to be largely adaptive in large-scale digital societies. **Chapter 3** distinguished between two types of prestigious individuals depending on their societal level of influence: (i) *prestigious individual at the group level*, i.e., individuals who are admired within a face-to-face group united by a common activity (e.g., a football team), and (ii) *prestigious individuals at the society level*, i.e., individuals who are admired by some valued knowledge/skill within a society but with whom people do not normally directly interact, and are only aware of due to digital or other forms of mass media.

How large-scale and digital societies have transformed prestige-biased social learning and the use of dominance and prestige strategies are important issues that require more attention in the field. First, large-scale digital societies tend to have explicit prestige metrics such as number of followers on social media. These explicit metrics are likely more accurate prestige cues than assessing by oneself the attention and deference received by specific individuals from others within a face-to-face small community. However, it is not clear that the predicted correlation between receiving attention and being competent holds when the attention is received through social media as these platforms are specifically designed to capture people's attention as long as possible (Alter, 2017). Consequently, future research needs to look at how explicit prestige metrics in the digital age affect the adaptive value and use of prestige-biased social learning.

Second, the relationship that followers have with prestigious individuals at the society and the group level are very different. Henrich and Gil-White's (2001) argument only refers to the latter. At the group level, prestigious individuals and their followers know each other and prestigious individuals exchange proximity to them with deference, which is useful for acquiring their knowledge/skills. In large-scale digital societies, however, prestigious individuals at the society level do not personally know their followers and do not exchange proximity for deference with most of them. Moreover, they face few constraints on the number of followers they can have as they can broadcast their expertise to millions of people through digital technologies. In turn, followers have online access to multiple prestigious individuals within a given domain, and they could potentially benefit from many of them without providing very costly forms of deference such as taking care of the children of prestigious individuals or giving presents to prestigious individuals. Instead, followers just follow prestigious individuals on social media or buy their products (e.g., books or online courses on how to become successful on a given domain). Comparing how prestige-biased social learning works at the group and society level is a promising new area of investigation.

Third, prestige-biased social learning in large-scale digital societies often takes the form of socially learning from advice given by prestigious individuals, instead of observing their behaviour and copying it without the mediation of language, which is more common within face-to-face small groups. Advice-based social learning has been largely unexplored in the cultural evolution literature but it seems to be more used than observation-only-based social learning (Çelen, Kariv, & Schotter, 2010) and to enhance cumulative culture (Morgan et al., 2015; Zwirner & Thornton, 2015). Furthermore, much of the advice given by prestigious individuals in large-scale digital societies is transferable between domains. For

instance, one of Arnold Schwarzenegger's rules for success is "to have a vision" (Heiman, 2018, December 20) by which he means to be clear what one wants to achieve. This advice has the advantage of not being constrained to the domains in which he has been successful (i.e., bodybuilding, acting, politics). Socially learning this type of advice from prestigious individuals and applying it to the domain of interest for what is socially learned could be called *transferrable prestige-biased social learning*, which is a third type of prestige-biased social learning that is different from within-domain and cross-domain prestige-biased social learning. Transferable prestige-biased social learning seems to be more common in large-scale digital societies, and if the advice given is really transferrable across domains would be largely adaptive.

Lastly, digital technologies have created an information overload (Rodriguez, Gummadi, & Schoelkopf, 2014), which makes it difficult and costly for people to assess by themselves the quality of the numerous, and often contradictory, pieces of information found on the Internet (e.g., on diets). This is a condition that makes it more likely that prestige-biased social learning (and other forms of social learning) can be used to select the information that is worth paying attention to and learn. The effect of information overload on the use of prestige-biased social learning needs to be studied in the future.

7.3.3.- Political discourse, political polarization and populism

In **Chapter 6**, I suggested that certain characteristics of right-wing populist discourse might make these types of leaders more attractive to part of the electorate. One of the features of their political discourse that might explain their success is their higher level of emotional content. Wirz (2018) conducted an experiment to test whether populist messages elicit higher levels of emotions than

pluralist messages and whether the elicitation of emotions mediates the relationship between populist messages and persuasion. To this end, Wirz created a number of messages about the topic of balanced wages, which captured either populist advocating messages (i.e., favouring the people), populist conflicting messages (discrediting outgroups) or pluralistic messages (e.g., seeing society as multifaceted). People rated how these messages elicited the emotions of hope, pride, anger and fear. The results show that the populist advocate messages elicit more hope and pride than pluralistic messages, while populist conflicting messages elicit more anger and fear. Furthermore, the elicitation of the emotions of hope and anger mediates the relationship with populist messages and persuasion but the elicitation of pride and fear does not. This supports the idea that the style of communication of populist leaders might be a key factor explaining their recent rise in popularity by their higher emotional appeal.

However, populist discourse does not act in isolation and its appeal might be in part explained as a reaction to the political discourse of other actors. For the case of the 2016 US Presidential elections, the discourse of left-wing identity politics seems to have played an important role (Masket, 2018). Left-wing identity politics shares with previous liberal movements such as the Civil Rights Movement in the 1960s, second wave feminism in the 1960s-80s, and the Gay Pride movement in the 1960s-90s, a political discourse opposed to racism, sexism and homophobia. However, they have different views of society (Pluckrose & Lindsay, 2018) and they frame their messages in different ways. Early liberal anti-discrimination movements tended to appeal to the common humanity of all the individuals in a society (Lukianoff & Haidt, 2018; Pluckrose & Lindsay, 2018) and, consequently, they framed their political discourse in an

inclusive way (e.g., we want a country in which people are judged by their character and not by their colour, gender, sexual orientation and other identity characteristics). These early movements fought for a society in which every individual has the same opportunity, freedoms and rights independent of the colour of their skin, their gender or sexual orientation (Lukianoff & Haidt, 2018; Pluckrose & Lindsay, 2018). In contrast, the more recent left-wing identity politics analyses social problems as differences in power between racial, gender and sexual orientation groups and seek to rectify these power imbalances between groups (Pinker, interview for Better Left Unsaid The Film, 2019). More extreme strands of left-wing identity politics appeals to a common-enemy (Lukianoff & Haidt, 2018), depicting white heterosexual men as a monolithic privileged group (Pluckrose & Lindsay, 2018) and, consequently, framing their political discourse in a divisive way (i.e., dividing people as oppressors/oppressed based on identity characteristics and criticising universalist and group-blind political discourse as discriminatory; Chua, 2018). One of the consequences of this new view of society is a concept creep (Haslam, 2016) or an extension of the meaning of terms such as racism, sexism and homophobia. For example, a white person practising yoga has been recently considered a form of racism called 'cultural appropriation' (Cambell, 2018). Another consequence is the development of a deeply emotional reaction to any criticism of this new view of society, which often leads to protesting, sometimes violently, for the silencing of speakers or the firing of dissident academics (Campbell & Manning, 2018; Lukianoff & Haidt, 2018).

For many authors, this discourse of left-wing identity politics has stimulated inter-group conflict (Campbell & Manning, 2018, pp. 257-258; Lukianoff & Haidt, 2018, p. 46) and produced a political environment that favours right-wing populist discourse and the electoral rise of their leaders (Chua, 2018;

Lilla, 2016; McConnell, 2016; Soave, 2016). According to Pinker (Better Left Unsaid The Film, 2019,), the mechanism by which left-wing identity politics gives fuel to right-wing populism is the following: when certain opinions cannot be expressed and they are silenced by identity politics activists, people suspect that the people who silence others are not able to show that these opinions are wrong. Consequently, people assume that these suppressed ideas might be true and become more susceptible to accept more extreme and dogmatic versions of the initial hypotheses. In this way, left-wing identity politics and right-wing populism feed each other.

Nevertheless, there is only anecdotal evidence and verbal arguments in support of this link between left-wing identity politics and the rise of right-wing populism. Moreover, it does not seem to explain the rise of right-wing populism in all the countries in which there has been this rise. For instance, the result of the Brexit referendum in the UK does not seem to have been a reaction to left-wing identity politics. In Spain, a reaction against left-wing identity politics seems to have played a role in the rise of the right-wing party Vox in 2019, but this rise seems to have been more driven by a reaction against the Catalan independence movement.

Future studies need to look at how the exposition of left-wing identity politics and right-wing populist messages influence people's political attitudes and see if this is a factor that drives political polarization. Transmission chain experiments could also be used to analyse whether certain characteristics of these types of political discourses, such as being simpler and more emotional, give them a transmission advantage over other types of political messages (e.g., more complex, less emotional centrist messages).

Another important factor that could explain in part the electoral victory of Donald Trump is his ability to capture the attention of the public. According to Wu (2016, pp. 345-347), political contests can come in two different forms: an attention contest and a competence contest. Wu considers that Barack Obama prioritized the competence contest, while Donald Trump has mainly focused on the attention contest. In **Chapter 5**, it was argued that the prestige strategy requires one to capture the attention of other individuals to be able to attain prestige through displays of competence or generosity. Moreover, Henrich and Gil-White (2001) considered that receiving attention is a second-order prestige cue that people use to infer competence. It is, however, not clear how the enormous amount of attention received by Donald Trump during the electoral campaign influenced his electoral victory and whether this level of attention made him to gain prestige.

On one hand, the attention that he received from the media was mainly negative, which contradicts the achievement of prestige via being admired by others. Neither Henrich and Gil-White (2001) nor previous chapters of this thesis have addressed how negative attention could influence perceptions of prestige. One possibility is that if people who an individual do not like or trust (e.g., because these people have political ideas with which the individual disagrees) express negative attention towards a political actor, this could increase the prestige of this political actor in the eyes of that person. As the saying goes, “the enemy of my enemy is my friend”.

On the other hand, Donald Trump’s victory in the attention contest made him extremely influential by making “almost all political thought either a reflection, rejection or at least a reaction to his ideas” (Wu, 2016, p. 347). Consequently, the

over-exposure to his ideas and the drowning out of alternatives as a result could have made his ideas more appealing to some people. Consequently, he could have gained prestige and votes due in part to redundant transmission (Morin, 2016).

Future studies need to look at the effects of negative attention from different groups (e.g., political groups) on perceptions of prestige and how redundant transmission could explain the popularity of ideas coming from influential individuals such as Hollywood celebrities and political leaders (see Section 3.4. in **Chapter 3**).

7. 4.- Conclusion

In this thesis I have reviewed evidence on two key aspects of Henrich and Gil-White's (2001) theory of the evolution of prestige and integrated research on cultural evolution, social psychology, anthropology and evolutionary psychology (**Chapter 2 and Chapter 5**); I have conducted two transmission chain experiments, one showing that the prestige of the sources of the information does not improve the transmission of information (**Chapter 3**) and another showing that both dominant and prestige cues are better transmitted than medium social rank cues (**Chapter 4**); and I have discussed the limitations of applying the dominance-prestige distinction to democratic large-scale societies and the rise of right-wing populist leaders, and provided evidence that contradicts the specific claims linking preferences for dominant leaders to both intergroup conflict and economic uncertainty (**Chapter 6**). In this final chapter, I have discussed the implications of these findings and future directions for research. Hopefully, some of these new research questions will be addressed in this new decade.

7.5 References

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APPENDICES

Appendix A: Chapter 3

Appendix A.1: Supplementary Materials Associated with this Chapter.

All supplementary materials can be found here:

https://www.dropbox.com/sh/1c7p5rdklzybt5x/AAC5lQeDii-csdq_Fe36iRLXa?dl=0

SM1: Preregistered Documents:

- SM1a: Preregistered Form
- SM1b: Supplementary Materials for Preregistered Experiment
- SM1c: Preregistered R script with Dummy Data

SM2: Data Analyses for Experiment (R scripts)

- SM2a: Data Analyses with Preregistered R Script
- SM2b: Non-preregistered Bayesian Analyses
- SM2c: Non-preregistered Manipulation Checks

Appendix A.2.: List of Professions and their Associated Ratings (Pretest)

PROFESSIONS		PRESTIGE		RELEVANCE	
		Mean	SD	MEAN	SD
1	Head teacher of primary school	1.1	0.9	2.2	0.8
2	Psychologist, expert in autism	1.3	1.3	0.3	2.2
3	Waiter	-2.1	1.2	-2.2	1.2
4	Award-winning musician	1.8	1.0	-1.8	1.5
5	Computer scientist	0.6	0.8	0.8	1.5
6	Nurse	0.8	1.3	-0.4	1.6
7	Marketing director	0.5	1.3	-2.1	1.3
8	Architect	0.7	1.3	-1.7	1.5
9	Primary school teacher	0.3	1.1	2	1.2
10	Award-winning novelist	1.5	0.8	-1.4	1.4
11	Cleaner	-2.6	1.0	-2.2	1.2
12	Fishmonger	-1.4	0.7	-2.2	1.2
13	Call centre worker	-2.2	0.9	-2	1.2
14	League-winning footballer	1.6	1.5	-2.1	1.3
15	Aircraft pilot	1.5	1.2	-2.1	1.3
16	Head of the Department of Infectious Diseases of a leading university	2	0.8	-1.1	1.3
17	Education researcher	0.5	0.5	2.7	0.5
18	Doctor	1.9	0.7	0.3	1.8
19	Estate Agent	-0.6	1.3	-2	1.4
20	Assemble-line worker	-2.2	1.0	-1.9	1.3
21	Award-winning sitcom actor	1.3	1.4	-2	1.4
22	Warehouseman	-2.4	1.0	-2	1.2
23	Member of World Health Organization (WHO)'s expert committee on vaccination	1.8	1.2	-1.3	1.4
24	Head of the Department of Education of a leading University	1.6	1.1	2.4	0.8

Table 4. Ratings of prestige and relevance of all sources in Pretest (Means and Standard Deviations).

		PRESTIGE											
		MEDIAN	MIN	MAX	RES =-3 (%)	RES =-2 (%)	RES =-1 (%)	RES =0 (%)	RES =1 (%)	RES =2 (%)			
1	Head teacher of primary school	1	0	2	0	0	0	30	30	40	0		
2	Psychologist, expert in autism	1.5	0	3	0	0	0	40	10	30	20		
3	Waiter	-2.5	-3	0	50	30	0	20	0	0	0		
4	Award-winning musician	2	0	3	0	0	0	10	30	30	30		
5	Computer scientist	1	-1	2	0	0	10	30	50	10	0		
6	Nurse	1	-2	2	0	10	10	0	50	30	0		
7	Marketing director	0	-1	3	0	0	20	40	20	10	10		
8	Architect	1	-2	2	0	10	0	30	30	30	0		
9	Primary school teacher	0.5	-1	2	0	0	30	20	40	10	0		
10	Award-winning novelist	1.5	0	3	0	0	0	10	40	40	10		
11	Cleaner	-3	-3	0	80	10	0	10	0	0	0		
12	Fishmonger	-1.5	-2	0	0	50	40	10	0	0	0		
13	Call centre worker	-2	-3	0	40	50	0	10	0	0	0		
14	League-winning footballer	2	-1	3	0	0	10	20	10	20	30		
15	Aircraft pilot	1	0	3	0	0	0	20	40	10	30		
16	Head of the Department of Infectious Diseases of a leading university	2	1	3	0	0	0	0	30	40	30		
17	Education researcher	0.5	0	1	0	0	0	50	50	0	0		
18	Doctor	2	1	3	0	0	0	0	30	50	20		
19	Estate Agent	0	-3	1	10	20	10	40	20	0	0		
20	Assemble-line worker	-2.5	-3	0	50	30	10	10	0	0	0		
21	Award-winning sitcom actor	2	-2	3	0	10	0	10	20	50	10		
22	Warehouseman	-3	-3	0	60	30	0	10	0	0	0		
23	Member of World Health Organization (WHO)'s expert committee on vaccination	2	-1	3	0	0	10	0	20	40	30		
24	Head of the Department of Education of a leading University	2	0	3	0	0	0	20	20	40	20		

Table 5. Ratings of Prestige of All Sources in Pretest (Medians, Range and Frequency of Responses)

		RELEVANCE											
		MEDIAN	MIN	MAX	RES= -3 (%)	RES =-2 (%)	RES =-1 (%)	RES =0 (%)	RES =1 (%)	RES =2 (%)	RES =3 (%)		
1	Head teacher of primary school	2	1	3	0	0	0	0	20	40		30	
2	Psychologist, expert in autism	0.5	-3	3	20	0	10	20	20	10		20	
3	Waiter	-3	-3	0	60	20	0	20	0	0		0	
4	Award-winning musician	-2.5	-3	1	50	20	0	20	10	0		0	
5	Computer scientist	0.5	-2	3	0	10	0	40	10	30		10	
6	Nurse	0	-3	1	20	10	0	30	40	0		0	
7	Marketing director	-3	-3	0	60	10	10	20	0	0		0	
8	Architect	-2.5	-3	0	50	10	0	40	0	0		0	
9	Primary school teacher	2	-1	3	0	0	10	0	0	60		20	
10	Award-winning novelist	-1.5	-3	1	30	20	20	20	10	0		0	
11	Cleaner	-3	-3	0	60	20	0	20	0	0		0	
12	Fishmonger	-3	-3	0	60	20	0	20	0	0		0	
13	Call centre worker	-2.5	-3	0	50	20	10	20	0	0		0	
14	League-winning footballer	-3	-3	0	60	10	10	20	0	0		0	
15	Aircraft pilot	-3	-3	0	60	10	10	20	0	0		0	
16	Head of the Department of Infectious Diseases of a leading university	-0.5	-3	0	20	20	10	50	0	0		0	
17	Education researcher	3	2	3	0	0	0	0	0	30		70	
18	Doctor	1	-3	2	10	10	10	10	30	30		0	
19	Estate Agent	-3	-3	0	60	10	0	30	0	0		0	
20	Assemble-line worker	-2.5	-3	0	50	10	20	20	0	0		0	
21	Award-winning sitcom actor	-3	-3	0	60	10	0	30	0	0		0	
22	Warehouseman	-2.5	-3	0	50	20	10	20	0	0		0	
23	Member of World Health Organization (WHO)'s expert committee on vaccination	-1	-3	1	30	10	30	20	10	0		0	
24	Head of the Department of Education of a leading University	3	1	3	0	0	0	0	20	20		60	

Table 6. Ratings of Relevance of All Sources in Pretest (Medians, Range and Frequency of Responses)

[PAGE 1 CONSENT FORM]

COMPUTER TABLETS AND TEXTBOOKS AT PRIMARY SCHOOL



Welcome! This study has been created with the goal of studying the public's opinions about the use of computer tablets and textbooks at primary school. If you would like to collaborate with this research, you can participate by answering some questions here.

RESEARCHER

Ángel V. Jiménez. I am a postgraduate research student at the the University of Exeter. My supervisor is Dr. Alex Mesoudi.

PROCEDURE

The study involves reading a text carefully and answering some questions about the text and about your own opinions. We will also ask you some questions about your demographic characteristics (e.g., age, gender, nationality, etc.).

ELIGIBILITY

You must be 18 years old or over to participate in this experiment.

TIME DURATION

The study takes less than 20 minutes to complete.

PARTICIPANTS' RISK, BENEFITS AND RIGHTS

This study has been approved by the Biosciences Ethical Committee at the University of Exeter (Cornwall Campus). Your participation is anonymous, confidential and voluntary. There are no known risks associated with the experiment. If you decide to participate in this study, you will benefit by receiving £1.75 (as long as you comply with the instructions and pay attention to the questions) and learning about scientific research. You can withdraw from participating in the study at any time by simply closing the browser without having to give any kind of explanation.

FURTHER INFORMATION

If you have any question at any point during the study, please do not hesitate to contact me: aj419@exeter.ac.uk

PARTICIPANTS' CONSENT

Before starting the study, please answer the following questions.

[Q1] Are you 18 years old or older?

YES

NO

[Q2] Have you read the information about the study?

YES

NO

[Q3] Have you understood that you can withdraw at any time from the study without having to give any kind of explanation?

YES

NO

[Q4] Do you give your consent to publish your anonymous responses (including quotes of your words) in scientific articles, reports, webpages, publicly available datasets and other research outputs?

YES

NO

[Q5] Do you give your consent to participate in the study?

YES

NO

[Following a negative answer to one or more of the previous questions, the participant will be redirected to Q6, ending his/her participation. If all questions are answered with "YES", they will go on to Q7 and continue with the study]

[Q6]

Sorry, you cannot participate in this study because you do not meet one or more of the following requirements:

- a) Be 18 years old or older
- b) Have read the information about the study
- c) Have understood that you can withdraw at any time from the experiment without having to provide any kind of explanation
- d) Give your consent to participate in the experiment and use your responses in scientific publications and other research outputs.

[PAGE 2, PROLIFIC ID]

Before you start, please:

- maximize your browser window;
- switch off phone/e-mail/music & anything else distracting
- and please enter your Prolific ID:

[PAGE 2: PREVIOUS QUESTIONS]

We would like you to answer the following questions before starting with the actual experiment. Please answer honestly and without giving it much thought.

Indicate your degree of agreement with the following statement: "If the decision were in my hands, I would replace all textbooks by computer tablets in primary schools"

TOTALLY DISAGREE -3, -2, -1, 0, +1, +2, +3 TOTALLY AGREE

Could you please indicate your degree of confidence in your response to the previous statement?

VERY UNCONFIDENT -3, -2, -1, 0, +1, +2, +3 VERY CONFIDENT

Could you indicate your degree of familiarity with computer tablets?

VERY UNFAMILIAR -3, -2, -1, 0, +1, +2, +3 VERY FAMILIAR

[PAGE 3 INSTRUCTIONS]

In many schools across the world, computer tablets have started to replace traditional textbooks. This recent change has given rise to a heated debate about the benefits and risks of computer tablets and textbooks for children's education. We have asked a number of volunteers at schools in Australia about their views on this issue. In the following, you will learn about two of these volunteers and about their opinions about the use of computer tablets at primary school.

It is very important that you read the information at a pace that allows you full comprehension as you will be asked some questions about this information later.

If you have understood the instructions, click on NEXT when you are ready to start.

[PAGE 4: SOURCE OF INFORMATION + OPINION]

[Participants are randomly assigned to one of the 12 versions of the experimental materials, which represent 3 conditions with a fully counterbalanced order of presentation of the sources and views. See table below. Participants first read the information about one source (e.g., cleaner) and then the arguments provided by that source (e.g., probooks). Afterwards, they read the information about the second source (e.g., pilot) and the arguments provided by the second source (e.g., protablets).

CONDITION	VERSION	ORDER OF SOURCES	ORDER OF VIEWS
Condition 1: Cleaner vs Head of the Department of Education	1	CLEANER-HEAD OF DEPARTMENT OF EDUCATION	PROBOOKS-PROTABLETS
Condition 1: Cleaner vs Head of the Department of Education	2	CLEANER- HEAD OF DEPARTMENT OF EDUCATION	PROTABLETS-PROBOOKS
Condition 1: Cleaner vs Head of the Department of Education	3	HEAD OF DEPARTMENT OF EDUCATION - CLEANER	PROBOOKS-PROTABLETS
Condition 1: Cleaner vs Head of the Department of Education	4	HEAD OF DEPARTMENT OF EDUCATION - CLEANER	PROTABLETS-PROBOOKS
Condition 2: Cleaner vs Footballer	5	CLEANER- AIRLINE PILOT	PROBOOKS-PROTABLETS
Condition 2: Cleaner vs Footballer	6	CLEANER- AIRLINE PILOT	PROTABLETS-PROBOOKS
Condition 2: Cleaner vs Footballer	7	AIRLINE PILOT - CLEANER	PROBOOKS-PROTABLETS
Condition 2: Cleaner vs Footballer	8	AIRLINE PILOT - CLEANER	PROTABLETS-PROBOOKS
Condition 3: Head of the Department of Education vs Pilot	9	HEAD OF DEPARTMENT OF EDUCATION - AIRLINE PILOT	PROBOOKS-PROTABLETS
Condition 3: Head of the Department of Education vs Pilot	10	HEAD OF DEPARTMENT OF EDUCATION - AIRLINE PILOT	PROTABLETS-PROBOOKS
Condition 3: Head of the Department of Education vs Pilot	11	PILOT- HEAD OF DEPARTMENT OF EDUCATION	PROBOOKS-PROTABLETS
Condition 3: Head of the Department of Education vs Pilot	12	PILOT- HEAD OF DEPARTMENT OF EDUCATION	PROTABLETS-PROBOOKS

]

[SOURCE 1: LOW PRESTIGE AND LOW RELEVANCE SOURCE]

William Healey [Daniel Bryanson] works as a cleaner in a telemarketing company. Outside of his job, he volunteers for the Australian Learning Trust. As a volunteer, Mr. Healey [Mr Bryanson] visits schools once a fortnight and teaches the children about the importance of his job for society. He firmly supports the replacement of textbooks by computer tablets at primary school [He is firmly against the replacement of textbooks by computer tablets at primary school] for the following reasons:

[SOURCE 2: HIGH PRESTIGE AND HIGH RELEVANCE SOURCE]

William Healey [Daniel Bryanson] is the Head of the Department of Education of a leading university. Outside of his job, he [also] volunteers for the Australian Learning Trust. As a volunteer, Professor Healey [Bryanson] visits schools once a fortnight and teaches the children the importance of his job for society. He firmly supports the replacement of textbooks by computer tablets at primary schools for the following reasons: [He is firmly against the replacement of textbooks by computer tablets at primary school for the following reasons:]

[SOURCE 3: HIGH PRESTIGE AND LOW RELEVANCE SOURCE]

William Healey [Daniel Bryanson] is a commercial airline pilot who regularly flights between Auckland (New Zealand) and Madrid (Spain), Paris (France), Amsterdam (the Netherlands) and other European destinations. Outside of his job, he [also] volunteers for the Australian Learning Trust. As a volunteer, Mr Healey [Bryanson] visits schools once a fortnight and teaches the children the importance of his job for society. He firmly supports the replacement of textbooks by computer tablets at primary schools for the following reasons: [He is firmly against the replacement of textbooks by computer tablets at primary school for the following reasons:]

[PROBOOKS ARGUMENTS]

The continuous use of devices with screens such as computer tablets gives long-term vision problems to our children.

Children using textbooks learn much better as they are more engaged and understand the material better.

Children are more easily distracted when using computer tablets because they can play games instead of attending to the lesson.

The production of computer tablets requires the emission of a considerable amount of pollutants to the air, which contributes to the problem of the greenhouse effect.

Children receive more support from their parents when they use textbooks than when they use computer tablets because parents offer personalized help.

Textbooks can last hundreds of years and they don't require electricity or batteries to work.

[PROTABLETS ARGUMENTS]

The continuous carrying of textbooks from home to school gives long-term back pain to our children.

Children using computer tablets learn much better as they are more engaged and understand the material better.

Teachers have less control over children's learning when using textbooks because they cannot effectively manage what children are doing during the class.

The production of textbooks for our schools requires the consumption of tons of paper each year, which contributes to the problem of deforestation.

Children need less support from their parents when they use computer tablets than when they use textbooks because tablets offer personalized lessons.

Computer tablets permit the storage of hundreds of books and the instant access to those books from everywhere.

[PAGE 5: MANIPULATION CHECKS, ATTENTIONAL CHECKS AND DISTRACTOR TASK]

Please answer the following questions.

1.- The first person, William Healey [Daniel Bryanson] works as a:

- a) Head of the Department of Infectious Diseases of a leading university
- b) Cleaner
- c) Head of the Department of Education of a leading university
- d) Writer
- e) Warehouseman
- f) Airline Pilot
- g) Taxi Driver

2.- To what extent is the first person, William Healey [Daniel Bryanson], a relevant source of information for a debate about the benefits and risks of tablets and books at schools?

VERY IRRELEVANT -3, -2, -1, 0, +1, +2, +3, VERY RELEVANT

3.- If you are carefully reading the questions, select "Green":

- a) Brown
- b) Yellow
- c) Green
- d) Red

4.- Could you please say to what extent you consider that the first person, William Healey [Daniel Bryanson], is a prestigious individual within society?

- a) Not prestigious at all.
- b) Hardly prestigious
- c) A bit prestigious
- d) Very prestigious
- c) Incredibly prestigious

5.- The second person, Daniel Bryanson [William Healey], works as a:

- a) Head of the Department of Infectious Diseases of a leading university
- b) Cleaner
- c) Head of the Department of Education of a leading university

- d) Writer
- e) Warehouseman
- f) Airline Pilot
- g) Taxi Driver

6.- To what extent is the second person, Daniel Bryanson [William Healey], a relevant source of information for a debate about the benefits and risks of tablets and books at schools?

VERY IRRELEVANT -3, -2, -1, 0, +1, +2, +3, VERY RELEVANT

7.- Could you please say to what extent you consider that the second person, Daniel Bryanson [William Healey], is a prestigious individual within society?

- a) Not prestigious at all.
- b) Hardly prestigious
- c) A bit prestigious
- d) Very prestigious
- c) Incredibly prestigious

[PAGE 6: SURPRISE FREE RECALL TEST FOR SOURCE 1]

Now, we would like you to recall the previously presented arguments by the first person, William Healey [Danel Bryanson], about the use of computer tablets and textbooks at primary schools. Please try to be as accurate as possible. Bear in mind that we are NOT asking you about your opinion here. This task requires between 2 and a half minutes and

5 minutes to complete.

[Submit button will only appear after 2 and a half minutes] [countdown clock]

[PAGE 7: SURPRISE FREE RECALL TEST FOR SOURCE 2]

Now, we would like you to recall the previously presented arguments by the second person, Daniel Bryanson [William Healey], about the use of computer tablets and textbooks at primary schools. Please try to be as accurate as possible. Bear in mind that we are NOT asking you about your opinion here. This task requires between 2 and a half minutes and 5 minutes to complete.

[Submit button will only appear after 2 and a half minutes] [countdown clock]

[PAGE 8: DEMOGRAPHICS]

Now, we would like to know a few details about you.

1.- What is your age?

[Multiple options from 18 to 99]

2.- What is your gender?

a) Male

b) Female

c) Other

3.- Where are you from?

a) USA

b) United Kingdom

c) Other

4.- Are you a native English speaker?

a) Yes

b) No

5.- What is the city where you live or the nearest city from where you live?

6.- What is your profession?

[PAGE 9: PERSONAL OPINIONS ABOUT THE ISSUE]

Now, we would like to know your personal opinion about the issue.

Could you please indicate your degree of agreement with the following statement: "If I were an education policy maker I would replace textbooks by computer tablets all over the country".

TOTALLY DISAGREE -3, -2, -1, 0, +1, +2, +3 TOTALLY AGREE

Could you please indicate your degree of confidence in your response to the previous statement?

VERY UNCONFIDENT -3, -2, -1, 0, +1, +2, +3 VERY CONFIDENT

Could you please provide reasons to support one side or another in the debate about the question "should computer tablets replace textbooks at primary school?" Please write your opinion in the textbox below.

[PAGE 10: PARTICIPANTS' FEEDBACK]

What do you think the goal of this experiment is?

Did you experience any technical problems when completing this study?

Did you find something confusing or errors/typos? If so, please, explain.

4) Would you like to tell us anything else about this study?

[PAGE 11: DEBRIEFING]

Thank you very much for your participation in this experiment!

The goal of this study is to study how accurately information related to admiration-based high social rank (prestige) and fear-based high social rank (dominance) is socially transmitted. To this end, we created three descriptions of three local footballers that varied in prestige and dominance: John (high prestige, low dominance), Bill (high dominance, low prestige) and James (low dominance, low prestige). Each participant in the experiment is part of a chain. The first participants in the chains read and recall the original materials created by us. Then, we pass the recall of the first participants to the second group, who recall this information. This procedure is repeated four times, for four steps in the chain. This method permits both the quantitative analysis of the amount of information recalled and the qualitative analysis of the transformations introduced by participants, as the material is passed along the chains. Our prediction is that information related to high dominance (Bill) and high prestige (John) is better transmitted along our chains than information related to both low dominance and low prestige (James).

If you have any questions, please do not hesitate to contact me: aj419@exeter.ac.uk

When you click on "NEXT", you will be automatically redirected to the Prolific website, which will prove that you have taken part in this study

Appendix A.4.: Preregistered Table to Assess Recall

ARGUMENTS	PROTABLETS	PROBOOKS
P1 Anti - Health	<i>The continuous carrying of <u>textbooks</u> from home to school <u>gives</u> long-term <u>back pain</u> to our children.</i> Textbooks, books, handbooks → back pain, problems in the back, etc. SCORE = 1 point	<i>The continuous use of devices with screens such as computer <u>tablets</u> <u>gives</u> long-term <u>vision problems</u> to our children</i> Tablets → vision problems SCORE = 1 point
P2 P3 P4 Pro-learning	<i>Children <u>using</u> computer <u>tablets</u> <u>learn</u> much <u>better</u> as they are <u>more engaged</u> and <u>understand</u> the material <u>better</u>.</i> Tablets → learn better = 1 point Tablets → more engagement = 1 point Tablets → better understanding = 1 point	<i>Children <u>using</u> textbooks <u>learn</u> much <u>better</u> as they are <u>more engaged</u> and <u>understand</u> the material <u>better</u>.</i> Books → learn better = 1 point Books → more engagement = 1 point Books → better understanding = 1 point
P5 P6 Control vs Distraction	<i>Teachers have <u>less control</u> over <u>children's</u> learning when using textbooks because <u>they cannot</u> effectively <u>manage what children are doing</u> during the class.</i> Books → less control over children = 1 point Tablets → control what children do = 1 point	<i>Children are <u>more easily</u> distracted when <u>using</u> computer <u>tablets</u> because <u>they can</u> <u>play games</u> instead of <u>attending</u> to the lesson.</i> Tablets → children get more distracted = 1 point Tablets → play games during lesson = 1 point
P7 P8 Anti-Environment	<i>The <u>production</u> of textbooks for our schools requires the consumption of <u>tons of paper</u> each year, which <u>contributes to</u> the problem of <u>deforestation</u>.</i> Production of books → tons of paper = 1 point Production of books → deforestation = 1 point	<i>The <u>production</u> of computer <u>tablets</u> requires the <u>emission</u> of a <u>considerable amount</u> of <u>pollutants</u> to the air, which <u>contributes to</u> the problem of the <u>greenhouse effect</u>.</i> Production of tablets → lots of pollutants = 1 point Production of tablets → greenhouse effect = 1 point
P9 P10 Parental Support	<i>Children <u>need less support</u> from their <u>parents</u> when they use computer <u>tablets</u> than when they use textbooks because <u>tablets offer</u> <u>personalized lessons</u>.</i> Tablets → less need of support from parents = 1 point Tablets → personalized lessons = 1 point	<i>Children <u>receive more support</u> from their <u>parents</u> when they use <u>textbooks</u> than when they use computer <u>tablets</u> because <u>parents offer</u> <u>personalized help</u>.</i> Books → children received personalized help from parents when using textbooks = 1 point Parents are more familiarized with textbooks = 1 point
P11 P12 Storage and access vs duration and no need of energy	<i>Computer <u>tablets</u> permit the <u>storage</u> of <u>hundreds of books</u> and the <u>instant access</u> to those books <u>from everywhere</u>.</i> Tablets → lots of books in one device = 1 point Tablets → access to books from everywhere = 1 point	<i><u>Textbooks</u> can <u>last hundreds of years</u> and they <u>don't require</u> <u>electricity</u> or <u>batteries</u> to work.</i> Books → last longer = 1 point Books → don't need energy to work = 1 point

Table 17. Preregistered Table to Assess Recall.

Appendix B: Chapter 4

Appendix B.1.: Supplementary Materials Associated with this Chapter

All supplementary materials can be found here:

https://www.dropbox.com/sh/1c7p5rdklzybt5x/AAC5lQeDii-csdq_Fe36iRLXa?dl=0

SM3: Preregistered Documents:

- SM3a: Preregistered Form
- SM3b: Supplementary Materials for Preregistered Experiment
- SM3c: Preregistered R script with Dummy Data

SM4: Data Analyses for Experiment (R scripts)

- SM4a: Bayesian Data Analyses with Preregistered R script

[PAGE 1 CONSENT FORM]

PUBLIC'S PERCEPTIONS OF LOCAL FOOTBALL PLAYERS



Welcome! This study has been created with the goal of studying the public's perceptions of local football players. If you would like to collaborate with this research, you can participate by answering some questions here.

RESEARCHER

Ángel V. Jiménez. I am a postgraduate research student at the University of Exeter. My supervisor is Dr. Alex Mesoudi.

PROCEDURE

The study involves reading three descriptions about three football players and answering some questions about those descriptions. We will also ask you some questions about your demographic characteristics (e.g., age, gender, nationality, etc.).

ELIGIBILITY

You must be 18 years old or over to participate in this experiment.

TIME DURATION

The study takes less than 15 minutes to complete.

PARTICIPANTS' RISK, BENEFITS AND RIGHTS

This study has been approved by the Biosciences Ethical Committee at the University of Exeter (Cornwall Campus). Your participation is anonymous, confidential and voluntary. There are no known risks associated with the experiment. If you decide to participate in this study, you will benefit by receiving £1.5 and learning about scientific research. You can withdraw from participating in the study at any time by simply closing the browser without having to give any kind of explanation.

FURTHER INFORMATION

If you have any question at any point during the study, please do not hesitate to contact me: aj419@exeter.ac.uk

PARTICIPANTS' CONSENT

Before starting the study, please answer the following questions.

[Q1] Are you 18 years old or older?

YES

NO

[Q2] Have you read the information about the study?

YES

NO

[Q3] Have you understood that you can withdraw at any time from the study without having to give any kind of explanation?

YES

NO

[Q4] Do you give your consent to publish your anonymous responses (including quotes of your words) in scientific articles, reports, webpages, publicly available datasets and other research outputs?

YES

NO

[Q5] Do you give your consent to participate in the study?

YES

NO

[Following a negative answer to one or more of the previous questions, the participant will be redirected to Q6, ending his/her participation. If all questions are answered with "YES", they will go on to Q7 and continue with the study]

[Q6]

Sorry, you cannot participate in this study because you do not meet one or more of the following requirements:

- a) Be 18 years old or older
- b) Have read the information about the study
- c) Have understood that you can withdraw at any time from the experiment without having to provide any kind of explanation
- d) Give your consent to participate in the experiment and use your responses in scientific publications and other research outputs.

[PAGE 2, PROLIFIC ID]

Before you start, please:

- maximize your browser window;
- switch off phone/e-mail/music & anything else distracting
- and please enter your Prolific ID:

[PAGE 3] INSTRUCTIONS

In the following you will read three descriptions of three football players who play in different local football teams in the UK. We would like you to read these descriptions very carefully as you will be asked some questions about each of the football players later.

It is very important that you read the information at a pace that allows you full comprehension as you will be asked some questions about this information later.

If you have understood the instructions, click on NEXT when you are ready to start.

[descriptions of the three individuals]

PRESTIGIOUS (John)

Everybody in the football team admires John. He is so skilful as a football player that last year he scored the most goals in the local league. Consequently, this year members of the team unanimously voted to make him captain of the team. They also tend to copy whatever he does. At team meetings, the other members always pay careful attention to what he is saying with their eyes fixed on him. Nevertheless, he is modest about his football skills and he always takes other team members' wishes into consideration. Outside of the football team, he is also very popular. People often invite him to parties because they want to spend time with him.

Words = 114

DOMINANT (Bill)

Everybody in the football team is afraid of Bill. He is so violent as a football player that last month he injured two teammates during training. This year he self-appointed himself captain without the support of any team member. Other teammates tend to obey him. At team meetings, the other members always pay careful attention to what he is saying, though usually without making eye contact with him. He thinks he is the best player and he never takes other team members' wishes into consideration. Outside of the football team, people also dislike him, but people invite him to parties because they don't want to make him angry.

Words = 108

MIDDLE SOCIAL RANK (James)

People in the football team don't have strong emotions towards James. He is an average football player in the team, scoring only a few goals last year. This year he wanted to be the captain of the team, but he only received two votes. He isn't very influential among his teammates. At team meetings, the other members of the team often don't listen to him very carefully and don't tend to fix their eyes on him for long. He is modest about his football skills, and consequently takes other teammates' perspectives in high regards. Outside the team, he is not particularly popular but he does get invited to parties held by his closest friends because they like to hang out with him.

[PAGE 4] FIRST INDIVIDUAL

[Description of first individual]

[PAGE 5] SECOND INDIVIDUAL

[Same as for first individual]

[PAGE 6] THIRD INDIVIDUAL

[Same as for first individual]

[PAGE 7: DEMOGRAPHICS]

Now, we would like to know a few details about you.

1.- What is your age?

[Multiple options from 18 to 99]

2.- What is your gender?

a) Male

b) Female

c) Other

4.- Where are you from?

a) USA

b) United Kingdom

c) Other

5.- Are you a native English speaker?

a) Yes

b) No

5.- What is the city where you live or the nearest city from where you live?

6.- What is your profession?

7.- Could you indicate how much are you interested in football?

Not at all

Somewhat

Very much

1

2

3

4

5

6

7

[PAGE 8: SURPRISE RECALL TEST: FIRST INDIVIDUAL]

Now, we would like you to recall the previously presented description of the **first** **footballer**, **[name of the first footballer]**. Please try to be as accurate as possible. This

task requires between 1 and 3 minutes to complete.

[Submit button will only appear after 1 minute] [countdown clock]

[PAGE 9: SURPRISE RECALL TEST: SECOND INDIVIDUAL]

Now, we would like you to recall the previously presented description of the **second** **footballer**, **[name of the second footballer]**. Please try to be as accurate as possible.

This task requires between 1 and 3 minutes to complete.

[Submit button will only appear after 1 minute] [countdown clock]

[PAGE 10: SURPRISE RECALL TEST: THIRD INDIVIDUAL]

Now, we would like you to recall the previously presented description of the **third footballer, [name of the third footballer]**. Please try to be as accurate as possible. This

task requires between 1 and 3 minutes to complete.

[Submit button will only appear after 1 minute] [countdown clock]

[PAGE 11: DEBRIEFING]

Thank you very much for your participation in this experiment! The goal of this study is to study how accurately information related to admiration-based high social rank (prestige) and fear-based high social rank (dominance) is socially transmitted. To this end, we created three descriptions of three local footballers that varied in prestige and dominance: John (high prestige, low dominance), Bill (high dominance, low prestige) and James (low dominance, low prestige). Each participant in the experiment is part of a chain. The first participants in the chains read and recall the original materials created by us. Then, we pass the recall of the first participants to the second group, who recall this information. This procedure is repeated four times, for four steps in the chain. This method permits both the quantitative analysis of the amount of information recalled and the qualitative analysis of the transformations introduced by participants, as the material is passed along the chains. Our prediction is that information related to high dominance (Bill) and high prestige (John) is better transmitted along our chains than information related to both low dominance and low prestige (James).

If you have any questions, please do not hesitate to contact me: aj419@exeter.ac.uk

When you click on “NEXT”, you will be automatically redirected to the Prolific website, which will prove that you have taken part in this study

Appendix B3: Preregistered Table to Assess Recall

PROPOSITION	PRESTIGIOUS (John)	DOMINANT (Bill)	LOW SOCIAL RANK (James)
1	Is admired	Is feared	Doesn't arise strong emotions
2	Skilful	Violent	Average skill
3	Highest goal score	Injured teammates	Few goals
4	Chosen as captain	Self-entitled captain	Not enough votes for captain
5	Is copied	Is obeyed	Isn't very influential
6	Is paid attention to / Is listened to	Is paid attention to / is listened to	Is not paid (a lot of) attention to / Is not listened to (very carefully)
7	Received eye contact	People avoid eye contact	Rarely prolonged eye contact
8	Is modest	He think he is the best (arrogant/narcissist)	Is modest
9	Takes others into consideration	Doesn't take others into consideration	Take others' perspectives in high regard (Takes others into consideration)
10	Is popular / liked	Is unpopular/disliked	isn't particularly popular
11	Invited to parties	Invited to parties	Invited to parties of closest friends
12	People want to spend more time with him	People don't want to make him angry	Closest friends like to hang out with him

Table 58. Preregistered Table to Assess Recall.

Appendix C: Chapter 6

Appendix C.1.: Supplementary Materials Associated with this Chapter

All supplementary materials can be found here:

https://www.dropbox.com/sh/1c7p5rdklzybt5x/AAC5lQeDii-csdq_Fe36iRLXa?dl=0

SM5: Data Analyses for Study 1 (R scripts)

- SM5a: Data Analyses for Predicting Preferences for Dominant Political Leaders
- SM5b: Data Analyses for Predicting Preferences for Prestigious Political Leaders

SM6: Data Analyses for Study 2

SM6a: Data Analyses of the Relationship between Liberal Ideology and Perceptions of the Dominance and Prestige of Donald Trump and Hillary Clinton (R Script)

SM6b: Stata Code for Results in Table 13 and Alternative Analyses

SM6b: Data Analyses for Results in Table 14 and Alternative Analyses (R script)

Appendix C.1.: Alternative Analyses to predict preferences for Donald Trump and Hillary Clinton using the data by Kakkar and Sivanathan (2017)

Vote for Clinton					
Unstandardized Coefficients	NULL	CONTROL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Constant	0.67 (0.09)	-0.47 (0.41)	0.50 (0.53)	-3.57 (0.57)	-2.55 (0.67)
Gender [Female]		0.45 (0.18)	0.43 (0.18)	0.27 (0.20)	0.26 (0.20)
Age		0.01(0.00)	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)
Income		0.14 (0.06)	0.12 (0.15)	0.17 (0.07)	0.14 (0.07)
Economic Uncertainty			-4.15 (1.45)		-4.37 (1.58)
Political Ideology				0.62 (0.07)	0.62 (0.07)
Vote for Trump					
Unstandardized Coefficients	NULL	CONTROL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Constant	-0.21 (0.10)	-1.51 (0.49)	-1.43 (0.64)	1.07 (0.62)	1.04 (0.76)
Gender [Female]		-0.24 (0.23)	-0.24 (0.22)	-0.21 (0.25)	-0.21 (0.25)
Age		0.04 (0.01)	0.04 (0.01)	0.03 (0.01)	0.03 (0.01)
Income		0.13 (0.07)	0.13 (0.07)	0.08 (0.08)	0.08 (0.08)
Economic Uncertainty			-0.33 (1.69)		-0.13 (1.79)
Political Ideology				-0.59 (0.08)	0.59 (0.08))
AIC	1541.98	1518.95	1512.40	1223.04	1217.88
Pseudo-R²		0.03	0.03	0.22	0.22

	NULL	CONTROL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Vote for Trump					
Constant	0.66 (0.09)	-0.47 (0.41)	0.68 (0.63)	-3.57 (0.57)	-2.67 (0.77)
Gender [Female]		0.45 (0.18)	0.44 (0.18)	0.27 (0.20)	0.25 (0.20)
Age		0.00 (0.01)	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)
Income		0.14 (0.06)	0.11 (0.06)	0.17 (0.07)	0.14 (0.07)
Poverty			-1.63 (1.22)		-2.42 (1.32)
Unemployment			-2.14 (1.36)		-1.07 (1.44)
Housing Vacancy			1.20 (2.72)		0.45 (2.90)
Political Ideology				0.61 (0.7)	0.62 (0.07)
	NULL	CONTROL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Vote for Clinton					
Constant	-0.22 (0.12)	-1.51 (0.50)	-1.44 (0.78)	1.24 (0.66)	1.61 (0.95)
Gender [Female]		-0.25 (0.23)	-0.23 (0.23)	-0.21 (0.25)	-0.16 (0.26)
Age		0.04 (0.01)	0.03 (0.01)	0.03 (0.01)	0.03 (0.01)
Income		0.13 (0.07)	0.12 (0.07)	0.07 (0.08)	0.06 (0.08)
Poverty			-1.74 (1.52)		-0.73 (1.63)
Unemployment			-0.41 (1.67)		-1.78 (1.88)
Housing Vacancy			5.24 (3.27)		6.05 (3.65)
Political Ideology				-0.63 (0.09)	-0.63 (0.09)
AIC	1544.30	1521.69	1519.02	1221.42	1220.79

Table 19. Alternative Analysis 1 to Predict Preferences for Donald Trump and Hillary Clinton. Economic uncertainty = (housing vacancy rate + unemployment rate + poverty rate) / 3 measured at the zip code level. Multinomial model with fixed intercepts.

	NULL	CONTR OL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Vote for Trump					
Constant	0.66 (0.09)	-0.47 (0.41)	-0.51 (0.53)	-3.57 (0.57)	-2.53 (0.70)
Gender [Female]		0.45 (0.18)	0.43 (0.18)	0.27 (0.20)	0.26 (0.20)
Age		0.00 (0.01)	0.00 (0.06)	0.01 (0.01)	0.14 (0.07)
Income		0.14 (0.06)	0.11 (0.06)	0.17 (0.07)	0.62 (0.07)
Economic Uncertainty			-4.17 (1.45)		-4.41 (1.59)
Political Ideology				0.61 (0.7)	
	NULL	CONTR OL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Vote for Clinton					
Constant	-0.22 (0.12)	-1.51 (0.50)	-1.43 (0.65)	1.24 (0.66)	1.24 (0.80)
Gender [Female]		-0.25 (0.23)	-0.25 (0.23)	-0.21 (0.25)	-0.20 (0.25)
Age		0.04 (0.01)	0.03 (0.01)	0.03 (0.01)	0.02 (0.01)
Income		0.13 (0.07)	0.13 (0.07)	0.07 (0.08)	0.07 (0.08)
Economic Uncertainty			-0.32 (1.72)		-0.05 (1.89)
Political Ideology				-0.63 (0.09)	-0.63 (0.09)
AIC	1544.30	1521.69	1519.02	1221.42	1220.79

Table 20. Alternative Analysis 2 to Predict Preferences for Donald Trump and Hillary Clinton. Economic uncertainty = (housing vacancy rate + unemployment rate + poverty rate)/3 measured at the zip code level. Multinomial model with State as random intercept.

Vote for Clinton		Vote for Trump
Standardized Coefficients		
Constant	0.9 (0.30)	-0.54 (0.37)
Gender [Female]	0.28 (0.20)	-0.22 (0.25)
Age	0.06 (0.10)	0.26 (0.12)
Income	0.23 (0.10)	0.14 (0.12)
Duration Living in Zip Code	0.14 (0.10)	0.10 (0.12)
Total Population	0.05 (0.10)	-0.17 (0.12)
Density	-0.06 (0.11)	-0.08 (0.14)
Number of Zips in the County	0.09 (0.11)	0.11 (0.14)
Economic Uncertainty	-0.26 (0.10)	0.01 (0.11)
Political Ideology	1.08 (0.12)	-1.01 (0.14)
Pseudo-R ²	0.23	

Table 21. Alternative Analysis 4 to Predict Preference for Donald Trump and Hillary Clinton. Full model with standardized coefficients with same controls as Kakkar and Sivanathan (2017). Multinomial model with fixed intercepts. Same controls as Kakkar and Sivanathan (2017).

Vote for Clinton		Vote for Trump
Standardized Coefficients		
Constant	0.09 (0.30)	-0.62 (0.40)
Gender [Female]	0.28 (0.20)	-0.20 (0.25)
Age	0.06 (0.11)	0.27 (0.12)
Income	0.23 (0.10)	0.13 (0.13)
Duration Living in Zip Code	0.14 (0.10)	0.09 (0.12)
Total Population	0.05 (0.10)	-0.18 (0.13)
Density	-0.06 (0.11)	-0.10 (0.14)
Number of Zips in the County	0.09 (0.11)	0.22 (0.16)
Economic Uncertainty	-0.26 (0.10)	0.01 (0.11)
Political Ideology	1.08 (0.12)	-1.09 (0.15)

Table 22. Alternative Analysis 5 to Predict Preference for Donald Trump and Hillary Clinton. Full model with standardized coefficients with same controls as Kakkar and Sivanathan (2017). Multinomial model with random intercepts. Same controls as Kakkar and Sivanathan (2017).

Appendix C.2. Alternative Analyses for Predicting Preference for Trump with the Data of the Actual Results of the 2016 US Presidential Elections

Unstandardized Coefficients	NULL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Constant	0.41 (0.29)	-6.29 (2.62)	-37.61 (17.63)	-49.57 (24.61)
Economic Uncertainty		0.31 (0.12)		0.32 (0.27)
Political Ideology			0.81 (0.38)	0.91 (0.48)
AIC	69.30	63.60	19.37	19.79
Pseudo-R²		0.11	0.77	0.79

Table 23. Alternative Analysis 1 to Predict Trump's Victory within States. Logistic regression (outcome: 1=Trump's victory in a State, 0=Clinton's victory in a State. Proxy for political ideology = Percentage votes for Republicans in a State in 2012. Economic uncertainty variables (housing vacancy rate, unemployment rate and poverty rate) introduced as composite measure.

Unstandardized Coefficients	NULL	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Constant	- 0.03 (0.28)	-1.13 (2.20)	-1.85 (1.48)	-2.16 (2.40)
Economic Uncertainty		0.05 (0.10)		0.02 (0.11)
Political Ideology			0.04 (0.03)	0.03 (0.03)
AIC	71.19	71.31	61.52	63.30
Pseudo-R²		0.12	0.79	0.80

Table 24. Alternative Analysis 2 to Predict Trump's Victory within States. Logistic Regression for Proportional Data (outcome: percentage of votes for Trump in 2016). Proxy for political ideology = Percentage votes for Republicans in a State in 2012. Economic uncertainty = (housing vacancy rate + unemployment rate + poverty rate)/3.

Unstandardized Coefficients	NULL	HOUSING	UNEMPLOYMENT	POVERTY	ECONOMIC UNCERTAINTY	POLITICAL IDEOLOGY	FULL
Constant	- 0.03 (0.28)	0.94 (1.23)	-0.68 (2.93)	-0.81 (1.39)	0.84 (3.45)	-1.85 (1.48)	-1.58 (4.40)
Housing		0.11 (0.14)			0.14 (0.22)		0.03 (0.03)
Unemployment			0.01 (0.07)		-0.07 (0.12)		-0.07 (0.24)
Poverty				0.05 (0.09)	0.06 (0.17)		-0.01 (0.14)
Political Ideology						0.04 (0.03)	-0.00 (0.18)
AIC	71.19	68.20	72.98	70.504	68.56	61.52	66.12
Pseudo-R²		0.28	0.02	0.16	0.44	0.79	0.84

Table 25. Alternative Analysis 3 to Predict Trump's Victory within States. Logistic Regression for Proportional Data (outcome: percentage of votes for Trump in 2016). Proxy for political ideology = Percentage votes for Republicans in a State in 2012. Economic uncertainty variables (housing vacancy rate, unemployment rate and poverty rate) introduced as separate predictors.