

Title: How societal stereotypes might form and evolve via cumulative cultural evolution.

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Abstract

The current article examines how societal stereotypes might form and evolve through a process of cumulative cultural evolution as social information is repeatedly passed from person to person. Social psychology research has done much to inform our understanding about the substantial influence stereotypes exert on us as individuals and on our society, yet comparatively little is known about how society's pools of stereotype knowledge form and how they evolve. Here we review evidence that as social information is repeatedly passed from person to person there is a continuous cycle of stereotype formation and evolution that is driven by constraints and biases in: 1. observations of the social environment; 2. cognitive representations of the social environment; 3. social transmissions of cognitive representations of the social environment. We suggest the reason stereotypes exist and persist is because they are perfectly adapted for human cognition and that the reason they are perfectly adapted for human cognition is because they are the cumulative product of human cognition.

Introduction

Stereotypes are characterisations of social categories whereby group membership is associated with the possession of certain attributes (e.g., *scientists are geeky, Scottish people are miserly, men like the color blue*; Allport, 1954). Social psychology research has done much to inform our understanding about the substantial influence stereotypes exert on us as individuals and on our society (Macrae & Bodenhausen, 2000). When people endorse stereotypes, it leads to prejudice and discrimination towards members of minority groups (Devine, 1989); even when people refute stereotypes, the mere knowledge of their content can lead to bias in thoughts and behaviour (e.g., Greenwald & Banaji, 1995). Yet, in a complex social environment, stereotypes play a vital cognitive role in efficiently structuring social information (Macrae & Bodenhausen, 2000). Given their ubiquity and influence it is perhaps surprising that relatively little is known about how society's pools of stereotype knowledge form and how they evolve.

Theories of stereotype formation from a diverse range of perspectives have tended to focus on the social and cognitive determinants of stereotypes within individuals. These include, but are far from limited to, theories documenting the importance of intergroup bias (e.g., Bigler & Liben, 2007), cognitive bias (e.g., Hamilton & Gifford, 1976), communication bias (see Kashima, Fiedler, & Freytag, 2008), group essentialism (e.g., Yzerbyt, Corneille, & Estrada, 2001), group entitativity (e.g., Crawford, Sherman, & Hamilton, 2002), category formation (e.g., McGarty, 2002), perceived status and competition (e.g., Fiske, Cuddy, Glick, & Xu, 2001). These theories, and many other besides, further our understanding of *why* stereotypes form *within* individuals but they tend not directly address *how* stereotypes *across* individuals. How does human culture go from situations where there is no stereotype associated with a group to situations where stereotype content of that group is near universally known? Once stereotypes are near universally known how does their content change over time?

The current article presents evidence supporting the possibility that societal stereotypes might form and evolve through a process of cumulative cultural evolution as social information is repeatedly passed from person to person. We begin by providing an overview of some of the key theoretical tenets of research into cultural evolution. We then describe recent experimental evidence of the formation of novel lab-based stereotypes via cumulative cultural evolution. Finally, we discuss how existing evidence of constraints and biases in observation of the social environment, in cognitive representations of the social environment and in social transmissions of cognitive representation of the social environment could all contribute to the formation and evolution of stereotypes.

Cultural evolution

There is a long, if somewhat sparse, tradition of experimental psychological research examining how the cultural evolution of knowledge is shaped by the interaction between people's observations of the environment, their cognitive representations of these observations and the social transmission¹ of these cognitive representations. Frederic Bartlett (1932) examined what happened to information as it was repeatedly passed from person to person down a chain of individuals in a lab (a method akin to the children's game often called 'telephone' or 'Chinese whispers'). Using a variety of different experimental scenarios (e.g., story-telling, drawings), Bartlett found reliable evidence that the content of information was prone to substantial transformation as it passed from person to person. People in Bartlett's chains tended to forget information incongruent to the observed context or to their expectations. Similarly, people were

¹ In this article, we frequently use the terms "transmission" and "social transmission" rather than "communication" to describe the interpersonal process of passing information from person to person. This is because many of the serial reproduction experiments we describe involve taking the memory output of one generation and using it as the training input for the next generation without any communicative intent (e.g., Bartlett, 1932; Kirby et al., 2008; Martin et al., 2014); in such experiments, there is no communicative intent or awareness on the part of the transmitter or receiver of the information sharing process. In reality, the real-world process of social transmission is most likely to involve a process of communication whereby the person transmitting the information or the person receiving it, or both, has either intent and/or awareness of the information sharing process.

likely to erroneously add information congruent to the observed context or to their expectations. The loss of incongruent information and the addition of congruent information meant that as it passed down the chains, information changed in predictable ways – it became simpler, logically structured, more memorable and consequently easier to accurately transmit across generations.

Researchers from a diverse range of academic backgrounds have provided insight into how the evolution of human culture is influenced through the social transmission and cultural diffusion of information (see Kashima, 2008). In the first half of the 20th Century some anthropologists (e.g., Perry, Rivers, Smith) and ethnologists (e.g., Frobenius, Graebner, Schmidt) proposed that the content of all human culture could be traced back to a single common source (e.g., ancient Egypt), with knowledge of cultural practices being passed directly from person to person and from society to society. Since the 1970s several anthropologists, biologists, geneticists and cognitive scientists have advanced theories of cultural evolution, which suggest human culture evolves in a manner analogous to biological evolution (e.g., Boyd & Richerson, 1988; Campbell, 1975; Cavalli-Sforza & Feldman, 1981; Dawkins, 1976; Sperber, 1996). Kashima (2008) suggests these “neo-diffusionist” theories of culture, while divergent in many respects, are based on similar underlying propositions; that is, 1. Cultural information exists; 2. Cultural information exists in a form that can be communicated between people; 3. People learn cultural information from other people’s communications; 4. The distribution of cultural information within a population defines the population’s characteristics. In the current article, we focus on how the first three of these propositions impact stereotype formation and maintenance through cultural evolution.

The last 25-years has seen the emergence of cross-disciplinary research examining the ways in which human culture progressively changes over time through what is often termed *cumulative cultural evolution* (Boyd & Richerson, 1996, 2005; Tomasello, 1999). Extending the ideas espoused by neo-diffusionist theories of culture, theories of cumulative cultural evolution advocate that as information is repeatedly socially transmitted, it evolves in a manner analogous to biological evolution (Mesoudi, 2009, 2011). It is suggested that every time information passes from one person

(i.e., an information transmitter) to another person (i.e., an information recipient), it affords the recipient the opportunity to modify and potentially improve on the information they receive (e.g., Caldwell & Millen, 2008). Where information modifications prove adaptive, these are likely to propagate, leading to lasting cultural change that is likely to persist until a future adaptive modification; where information modifications are not adaptive, they are unlikely to persist and will instead become extinct (Tomasello, Kruger, & Ratner, 1993). Thus, human culture evolves by accumulating adaptations through a process of natural selection. It is suggested that the process of cumulative cultural evolution has played a central role in advanced human achievements such as the development of language, mathematics and sophisticated technology (Boyd & Richerson, 1988, 1996, 2005).

The past decade has seen a substantial increase in lab-based experimental research examining the process of cumulative cultural evolution (Baum, Richerson, Efferson, & Paciotti, 2004; Caldwell & Millen, 2008; Flynn, 2008; Kirby, Cornish, & Smith, 2008; Kirby, Griffiths, & Smith, 2014; Mesoudi, 2009; Whiten, Caldwell, & Mesoudi, 2016). For instance, recent research suggests artificial languages that are repeatedly socially transmitted accumulate structure, become increasingly learnable and consequently grow to be ever more transmissible over time (Keller, 1994; Kirby et al., 2008; Kirby et al., 2014). It seems the way in which languages form and evolve via cumulative cultural evolution is dependent on people's observation of linguistic behaviour in their environment, the way they cognitively represent this linguistic information, and the way they socially transmit this linguistic information (thereby creating new linguistic behaviour that can be observed by others). Because there are social and cognitive constraints on the processes of observation, cognitive representation and social transmission of linguistic information, there are "bottlenecks" that force languages to evolve adaptively (Christiansen & Chater, 2016; Kirby et al., 2008).

There are some obvious conceptual parallels between the properties of language and the properties of stereotypes. Both language and stereotypes rely on cultural consensus. To function

successfully a language requires widespread knowledge of its rules and meanings (Lehrer, 1984); similarly, one of the striking features of societal stereotypes is that there are high levels of consensus about their content, irrespective of whether people endorse them or not (Devine, 1989; Katz & Braly, 1933; Lepore & Brown, 1997). Both language and stereotypes allow users to make rule-based inferences that can be utilised in new situations. For example, grammatical sentences can be constructed even though the content of the sentence may be entirely novel (Kirby, 2001); equally, we can use category-based stereotypes to make inferences about people we have never previously encountered (Allport, 1954; Brewer, 1988; Fiske & Neuberg, 1990). Both language and stereotypes are culturally learned through iterated learning, often acquired tacitly through repeated interactions with other people without the need for explicit instruction (Kirby et al., 2008; Stangor & Schaller, 2000; Stangor, Sechrist & Jost, 2001). Both languages and stereotypes are profoundly influenced by various “bottleneck” constraints (Christiansen & Chater, 2016; Kirby et al., 2008); people can never observe the entirety of all possible linguistic/social information, people can never cognitively represent the entirety of linguistic/social information they observe, and people can never socially transmit to others the entirety of the cognitive representations they form of their linguistic/social observations. Given these parallels, it is possible that, like language, societal stereotypes are another aspect of human culture whose origins lie in cumulative cultural evolution.

The formation of novel lab-based stereotypes via cumulative cultural evolution

Building on classic and contemporary experimental examinations of how information evolves as it is socially transmitted (Bartlett, 1932; Kirby et al., 2008), we recently demonstrated that novel stereotype-like structure spontaneously forms and evolves when social information is repeatedly passed from person to person in the lab (Hutchison et al., in revision; Martin et al., 2014). We tested people in continuous transmission chains like those used to examine the formation and evolution of languages (e.g., Kirby et al., 2008). At the start of each chain we randomly assigned personality attributes to ‘alien beings’ that were individually unique but that also shared category

membership (i.e., some aliens were the same shape, some were the same colour, some moved in the same way). The first person in a chain (i.e., Generation 1) attempted to learn which attributes were associated with a subset of these aliens; a subset of whatever alien-attribute associations this person recalled were used as the basis of the training materials for the next person in the chain (i.e., Generation 2).

We found that as information passed from person to person it changed in predictable ways (Martin et al., 2014). An initially random set of information that was difficult to remember became increasingly memorable as it passed through the generations. Any tendency towards structure evidenced in the attribute assignments of one participant were detected and amplified in the recollections of the next. Over multiple generations a systematic stereotype-like relationship developed, with category features becoming so strongly associated with the possession of specific attributes that they could be used to accurately infer information about social targets that had never been seen before (e.g., by the end of one chain all green aliens were agreed to be arrogant and pushy, while red aliens were thought to be shy).

One of the striking features of the novel stereotypes formed by the end of the chains was that they had no basis in the information people were exposed to at the start of the chains (by design, we initialised each chain with an assignment of attributes to aliens which contained no reliable category-attribute correlations). Where such category-based overrepresentations developed—as after the initial generations of our chains—these were repeatedly observed and then amplified by subsequent generations. When there was no existing category-based overrepresentation—such as at the very beginning of our chains—relationships between attributes and features appeared spontaneously. In this way, cumulative cultural evolution can provide a mechanism to explain not only those aspects of stereotypes based on underlying realities but also those that are seemingly arbitrary or of no obvious origin (Allport, 1954; Cunningham & Macrae, 2011; LaPiere, 1936).

As social information was passed from person to person down our transmission chains it was repeatedly forced through bottlenecks each of which had the potential to shape the way that it evolved (Christiansen & Chater, 2016; Kirby et al., 2008). Because participants only observed a subset sample of the entire alien population, the social information they were learning initially passed through a bottleneck of observation. Because participants were unable to correctly remember all they observed, the information then passed through a bottleneck of cognitive representation. Finally, because only a subset of remembered information was passed to the next participant in the chain, the information passed through a social transmission bottleneck. In the example of this experiment, there is no real difference between the observation and social transmission bottlenecks as they essentially the same randomly determined process. However, by combining the bottleneck pressures of cognitive representation with those of social transmission we witnessed the formation of novel lab-based stereotypes under conditions relatively free from the influence of social identity and intergroup bias.

A continuous cycle of stereotype evolution

Extrapolating from our recent novel stereotype formation findings we will now review evidence which supports the possibility that a continuous cycle of stereotype formation and evolution that is driven by the cumulative effects of information bottlenecks in people's social observations (Stage 1), social cognitive representations (Stage 2) and social transmissions (Stage 3), the effects of which accumulate over time as information is repeatedly socially transmitted (see Figure 1).

Insert Figure 1 around here

Figure 1. A schematic representation of the proposed three stages of stereotype formation and maintenance via cumulative cultural evolution.

Observation (Stage 1): The formation and maintenance of societal stereotypes begins with people observing their social environment – because these observations represent an infinitesimally small sample of the total number of potential observations that exist across the entire social environment they create a bottleneck of social observation. Some of these observed samples will be first-hand observations that are based on the perceived characteristics of other people and the categories to which they belong. However, many of these observed samples will be second-hand observations that are gleaned, for example, from conversations with individuals or exposure to mass media. Whether the observed samples are first-hand and second-hand, the resulting bottlenecks possess properties that could contribute to the formation and evolution of both stereotypes that have some grounding in reality (Judd & Park, 1993) and stereotypes that are seemingly spurious or of no obvious origin (Cunningham & Macrae, 2011; LaPiere, 1936).

There are many examples of stereotypes that have a kernel of truth, based as they are on genuine category-attribute associations at the level of category populations (Judd & Park, 1993; Madon et al., 1998). For example, the stereotype of Scottish people includes the attribute of having red hair, and Scottish people are genetically more likely to have red hair than are people from any other nation (Moffat & Wilson, 2011). Where such category-attribute population associations exist, they are likely to be detected in people's observed samples of the social environment. Whether genuine category-attribute relationships are detected is likely to be governed by the principles of statistical inference. Therefore, one would expect population level category-attribute associations to be most likely to be detected in samples, and therefore most likely to influence stereotype formation and evolution, under circumstances when these associations are strong, when sample sizes are large and when samples are unbiased.

Crucially, many genuine category-attribute relationships are not driven by the fact that most category members possess a certain attribute, rather they appear to be based on relative comparisons between categories. For example, it is estimated that only 6% of Scottish people have red hair, a figure that is substantially lower than estimates of brown, blonde or black hair (Moffat &

Wilson, 2011). Similarly, a tiny percentage of the world's red-haired populace live in Scotland. Thus, if one were to take a random sample of Scottish people very few would have red hair and if one were to take a random sample of the world's redheads very few of them would be Scottish. Yet because the percentage of Scottish people with red hair is relatively higher than the percentage of people from any other nation, people's observed samples are relatively more likely to include Scottish people with red hair than they are people from any other nation.

In reality, most of people's observations of social categories are unlikely to be based on samples that are genuinely random or representative of the category population. For example, if an observer, who is ignorant of the Scottish stereotype, encounters a sample of Scottish people of whom none have red hair, that observer would be unlikely to form a 'Scottish-red hair' association, despite the existence of a genuine relative category-attribute association across the category population. Alternatively, if an observer encounters a sample of Scottish people of whom half happen through random chance to be *miserly*, that observer would be likely to form a 'Scottish-miserly' association despite the lack of a genuine category-attribute association across the category population. Because spurious category-attribute associations derived from skewed samples are likely to diverge across different individuals, the overwhelming majority of these are likely to be washed-out and never gain the momentum required to become part of the content of societal stereotypes (Smith et al., 2017). However, it is likely that some of these spurious category-attribute associations will occur often enough to gain sufficient traction to further influence how social information evolves and potentially enter societal stereotypes.

While randomly occurring sampling bias might result in the formation of some spurious category-attribute associations, the formation and evolution of societal stereotypes is more likely to be influenced by widely experienced biases in culture (Fujioka, 1999; Harris & Sanborn, 2013) and cognition (Fiedler, 2000). People's sample observations are likely to be skewed by the constraints of their subjective cultural experience (e.g., skewed by their social contact and socio-economic status, skewed by well-known category exemplars, skewed by popular fictional characterisations, skewed

by media representations), which leads them to make errant inferences about category-attribute associations. The problem of skewed sample observations is compounded because people share fundamental cognitive biases that constrain their ability to understand and control for these sampling constraints (e.g., by predictor sampling, by criterion sampling, by selective outcome sampling, by orthogonal sampling; see Fielder, 2000). Irrespective of the source of observed sampling biases, if they occur with sufficient frequency across the population they have the potential to create spurious category-attribute associations that influence the development of societal stereotypes in a similar manner to genuine category-attribute associations.

Societal stereotypes begin with bottlenecks created by the constraints associated with people's sample observations of the social environment. Sometimes these sample observations lead to the development of category-attribute relationships that contain some kernel of truth about the category population (Judd & Park, 1993; Madon et al., 1998). Often these sample observations lead to the development of category-attribute relationships that are errant and of no obvious origin (Cunningham & Macrae, 2011; LaPiere, 1936). Whether they are accurate or errant, for category-attribute associations to persist and influence the formation and evolution of societal stereotypes they need to be cognitively stored in a manner that can subsequently be transmitted to other people.

Cognitive representation (Stage 2): People's cognitive limitations mean they do not possess the ability to perceive, store and recall all social information they observe (Schacter, 1999) – this shortfall in social information processing capacity creates a bottleneck of cognitive representation. When people remember information, they do not precisely recall their observations; rather, their memories are subjective reconstructions susceptible to distortion (Schacter, 1999). This means that people's memories of their observations of the social environment are prone to both the omission of details that were originally present and the addition of details that were not (Roediger & McDermott, 1995). Because people share a bias towards perceiving categorical structure where none exists (Hamilton & Gifford, 1976; Medin & Smith, 1981) and because people share a bias

towards sense-making (Bartlett, 1932) and internal consistency (Schacter, 1999; Spiro, 1980), information that is inconsistent with category structure is often lost from memories while information that is consistent with category structure is more likely to persist or be erroneously added (Bartlett, 1932; Sherman & Bessenoff, 1999). Thus, when people encounter different individuals who belong to the same category, they are more likely to remember similarities between them – whether such similarities exist or not – and to forget the ways in which they differ (Stangor & McMillan, 1992). Because of these cognitive limitations and biases people's cognitive representations of their social environment are likely to be simplified and categorically structured (McGarty, 2002).

Work on stereotype formation via illusory correlation has elegantly demonstrated that people tend to draw errant stereotype-like inferences about social groups they have observed (Hamilton and Gifford, 1976). Specifically, when they have observed two unevenly sized groups of people (e.g., 67% from Group A and 33% from Group B) both of which share the same proportions of desirable and undesirable behaviours (e.g., both have 67% desirable behaviours & 33% undesirable behaviours), people tend to mistakenly remember that there is a correlation between these skewed distributions, such that the majority group are remembered as having more desirable behaviours and the minority group are remembered as having more undesirable behaviours (Hamilton & Gifford, 1976; for a meta-analysis see Mullen & Johnson, 1990). There is also a separate body of work documenting the tendency for people to form category stereotypes through spurious correlations because they fail to appropriately consider confounding factors (e.g., Schaller & O'Brien, 1992). While there are several alternative explanations for both the illusory correlation and spurious correlation effects (see Fiedler, 1996, 2000; Meiser & Hewstone, 2006), it is clear that people's cognitive (mis)representations of the information they observe in their social environment leads them to create stereotypes that they have not actually observed.

While cognitive limitations and misrepresentations of the social environment can lead to the formation of errant stereotypes, there is also evidence that stereotypes themselves are a major

source of such errors (Allport & Postman, 1947; Fyock & Stangor, 1994; Hamilton & Sherman, 1996; Rojahn & Pettigrew, 1992; Stangor & McMillan, 1992). It has been shown repeatedly that people are better at remembering information consistent with their knowledge of stereotypes relative to information inconsistent with these stereotypes (for meta-analyses see Fyock & Stangor, 1994; Stangor & McMillan, 1992; although for an alternative interpretation see Rojahn & Pettigrew, 1992). Similarly, there is evidence people experience stereotype-consistent memory intrusions that lead them to falsely believe they have encountered stereotype-consistent information that was never present (Lenton, Blair, & Hastie, 2001). Any bias in memory for stereotype-consistent information – whether it is a bias in favour of correctly recalling stereotype-consistent information (Fyock & Stangor, 1994) or a bias towards stereotype-consistent memory intrusions (Lenton et al., 2001), have the potential to influence the way individual people cognitively (mis)represent their own experience of social reality.

People's cognitive representations of their observations of the social environment are constrained by limitations and biases that make stereotypic category-attribute associations more likely to be errantly formed, detected and amplified. As Hamilton and Gifford suggested, “...*cognitive factors alone can be sufficient to produce differential perceptions of social groups*” (Hamilton & Gifford, 1976, p. 405). While cognitive factors alone might can produce stereotypes within individuals and potentially similar stereotypes across multiple individuals, the formation and evolution of societal stereotypes, the content of which are widely known if not necessarily endorsed (Devine, 1989), requires people to transmit their cognitive representations of their social observations to other people.

Social transmission (Stage 3): It is impossible for people to transmit to others all the cognitive representations they have formed of their social observations – constraints in the amount of information people share with others creates a bottleneck of social transmission. When people transmit their cognitive representations of their observations of the social environment to others

they create a new second-hand social environment from which other observers can learn. Because people's observations and cognitive representations are liable to produce stereotypic category-attribute associations (as described above), these are likely to appear in the *content* of social transmission. However, in addition to this, there is also evidence that stereotypic category-attribute associations are further amplified by the *process* of social transmission itself (Lee, Gelfand, & Kashima, 2014).

Because people are constrained in the quantity of information that it is feasible to transmit to others, they are highly selective in the information they choose to transmit and show a bias towards communicating information that is consistent with their own expectations or the perceived expectations of their audience (Clark, 1996; Clark & Kashima, 2007; Kashima, Lyons & Clark, 2013; Lyons & Kashima, 2003). Thus, second-generation observers are likely to be exposed to descriptions of the social environment that indicate a stronger category-attribute association than the first-generation observed. Because the second generation is presented with and observes a more skewed category-attribute association than was observed by the first-generation, their own biased cognitive representations and transmissions are likely to further amplify the magnitude of category-attribute bias when transmitted to a third-generation observer.

The gradual emergence of this stereotype-consistent common ground is harmonious with previous research examining the way information evolves as it is repeatedly communicated (Kashima et al., 2013; Lyons & Kashima, 2001). Yoshihisa Kashima and colleagues have used social transmission chain studies to demonstrate a multitude of ways in which people are biased towards communicating information that is consistent with their knowledge of societal stereotypes (Kashima, 2000). For example, in serial transmission chains that involved repeatedly communicating stories that contained both stereotype-consistent and stereotype-inconsistent information, people showed an increasing tendency to communicate stereotype-consistent information as the chains progressed (Kashima, 2000). Crucially, the emerging stereotype-consistent communication biases that Kashima and colleagues have found seem to be driven by social pressures rather than cognitive constraints

(Lyons & Kashima, 2003). When people are retelling a story for other people the information they choose to share is influenced by their knowledge of the person they are transmitting the story to (Clark & Kashima, 2007). Transmitters are often influenced by their perception of whether their audience is likely to have knowledge of the content of the stereotype (Kashima et al., 2013), whether their audience is likely to endorse the content of the stereotype (Lyons & Kashima, 2003), and whether such communications are likely to strengthen the social connection between themselves and their audience (Clark & Kashima, 2007). Thus, irrespective of what information people can accurately recall from memory, the information they choose to communicate to others is likely to contain stereotype-consistent bias, the effects of which accumulate as information is repeatedly socially transmitted.

Not only does stereotype knowledge influence what people remember and transmit to others, it also manifests itself in subtle and systematic ways in the language people use (Wigboldus, Semin, & Spears, 2000). When people describe stereotype-consistent events they tend to do so with a higher level of linguistic abstraction (e.g., “the man was aggressive”) than when describing stereotype-inconsistent events (e.g., “the woman raised her voice”; Maass, Salvi, Arcuri, & Semin, 1989; Semin & de Poot, 1997; Wigboldus et al., 2000). While these linguistic differences are seemingly unintended, they have the power to influence others’ perceptions of events (Franco & Maass, 1996; von Hippel, Sekaquaptewa, & Vargas, 1997). For example, because people use a greater level of linguistic abstraction in their descriptions of stereotype-consistent events, recipients of such communications are more likely to believe that people’s actions are driven by their personal characteristics rather than their situation (Wigboldus et al., 2000). This subtle linguistic bias means that stereotype-consistent communications are more likely to reinforce existing category-attribute associations.

Future directions

If understanding how societal stereotypes form and evolve requires examining the cumulative effects of cognitive bias and social transmission, another exciting prospect is to reverse this logic and examine the content of stereotypes to inform our understanding of people's shared cognitive biases. In the real-world different stereotypes have different content. Some stereotype content is relatively negative (e.g., *untrustworthy estate agents*), some is relatively positive (e.g., *trustworthy scientists*), whilst some stereotype content is more mixed or even contrary (e.g., *older adults* are stereotypically both *bad-tempered* and *kindly*). It is possible that the differences and similarities in stereotype content associated with the different groups are driven by the nature of the social cognitive biases people share. Indeed, the influential *stereotype content model*, suggests that much of the content of societal stereotypes can be explained by shared biases associated with the way that groups of different status are perceived (Fiske et al., 2002). A similar approach has also been taken in linguistics, where the existence of substantial skews in the design of human languages motivated hypotheses regarding cognitive biases in individuals, which were subsequently confirmed experimentally (Culbertson, Legeendre & Smolensky, 2012). By examining the content of societal stereotypes across a divergent range of real-world social categories, it is possible that future research might be able to uncover the nature and extent of the social cognitive biases that people share.

Conclusion

In this article, we have reviewed evidence that the formation and evolution of societal stereotypes is driven by information bottlenecks in social observation, social cognitive representation and social transmission, the effects of which accumulate over time as information is repeatedly socially transmitted. We suggest that the reason stereotypes exist and persist is because they are perfectly adapted for human cognition and that the reason they are perfectly adapted for human cognition is because they are the cumulative product of human cognition. Specifically, we contend that societal stereotypes are simplified, categorically structured, and easily learnable information systems, because people share fundamental cognitive biases towards simplification,

categorical structure and easily learnable systems in the way that they observe, cognitively represent and transmit social information.

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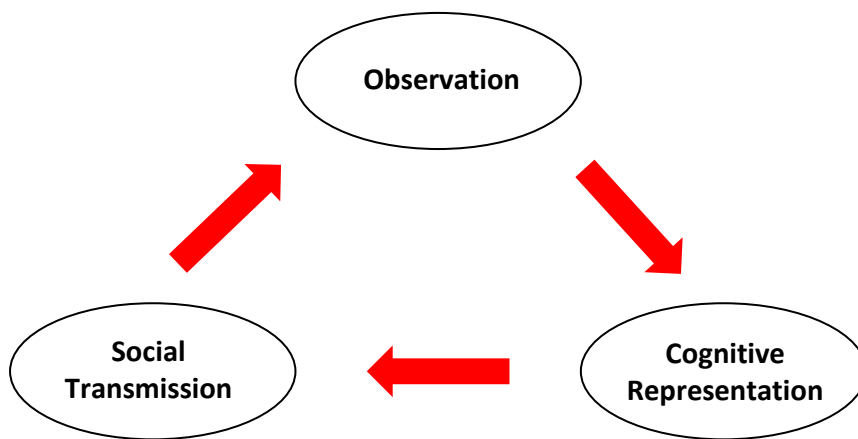


Figure 1. A schematic representation of the proposed three stages of stereotype formation and evolution via cumulative cultural evolution.

