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The development of tag-based cooperation via a socially acquired trait

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ABSTRACT

Recent theoretical models have demonstrated that phenotypic traits can support the non-random assortment of cooperators in a population, thereby permitting the evolution of cooperation. In these "tag-based models", cooperators modulate cooperation according to an observable and hard-to-fake trait displayed by potential interaction partners. Socially acquired vocalizations in general, and speech accent among humans in particular, are frequently proposed as hard to fake and hard to hide traits that display sufficient cross-populational variability to reliably guide such social assortment in fission–fusion societies. Adults' sensitivity to accent variation in social evaluation and decisions about cooperation is well-established in sociolinguistic research. The evolutionary and developmental origins of these biases are largely unknown, however. Here, we investigate the influence of speech accent on 5–10-year-old children's developing social and cooperative preferences across four Brazilian Amazonian towns. Two sites have a single dominant accent, and two sites have multiple co-existing accent varieties. We found that children's friendship and resource allocation preferences were guided by accent only in sites characterized by accent heterogeneity. Results further suggest that this may be due to a more sensitively tuned ear for accent variation. The demonstrated local-accent preference did not hold in the face of personal cost. Results suggest that mechanisms guiding tag-based assortment are likely tuned according to locally relevant tag-variation.

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1. Introduction

The most fundamental requirement for the evolution of cooperation is that the costs incurred by cooperation are offset by the benefits received from others such that a net fitness advantage is reaped relative to the population average (Fletcher & Doebeli, 2009). In recent decades, there has been considerable theoretical and empirical progress in identifying the structuring principles and proximate psychological mechanisms guiding assortment (i.e. the non-random association of cooperators with the cooperation of others). Humans do not cooperate indiscriminately with others, but are sensitive to a range of strategic cues about prospective and past social partners' cooperative potential.

Recent modeling work in biology has demonstrated the theoretical potential for phenotypic traits to guide the assortment of cooperators in the absence of past encounters, genetic relatedness, or reputational information. In these models, genetic or cultural traits, or "tags", serve as signals of cooperative potential to prospective cooperative partners (Antal, Ohtsuki, Wakeley, Taylor, & Nowak, 2009, Jansen & van Baalen, 2006, Masuda & Ohtsuki, 2007, Riolo, Cohen, & Axelrod, 2001).

In similarity-based models, for example, individuals cooperate with others whose tags are similar to their own. Insofar as signals are reliable (i.e. robust against invasion by free-riding individuals who bear the tag but do not cooperate), tag-based cooperation can evolve and be sustained in a population of unrelated individuals that is otherwise composed of indiscriminate cooperators and defectors (Antal et al., 2009, Sigmund, 2009).

Empirical research suggests a central role for similarity-based assortment and cooperation in humans. A recent study found that participants cooperated more in a public goods game with individuals whose facial image had been morphed with their own than with individuals whose image had been morphed with that of another stranger (Krupp, Debruine, & Barclay, 2008). A large body of research in psychology has further demonstrated the homophilic foundations of human groupishness and parochialism extending beyond the sphere of morphologically similar close kin (Bernhard, Fischbacher, & Fehr, 2006, Billig & Tajfel, 1973, Heyes, in press, Kinzler, Shutts, Dejesus, & Spelke, 2009, Koopmans & Rebers, 2009). In such scenarios, culturally acquired tags often serve as markers of shared social identity and group membership.

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Recently, some researchers have suggested that not all culturally acquired traits are created equally. Some traits, such as language and accent, are harder to fake than others and appear particularly well-suited as guides to phenotypic assortment (Bernhard et al., 2006, Irwin, 1987, Kinzler et al., 2009, Nettle & Dunbar, 1997, Roberts, 2008, Sigmund & Nowak, 2001, Tooby & Cosmides, 1989, Traulsen, 2008). Decades of sociolinguistic research have shown how accent, dialect, and language background powerfully guide evaluations and preferences in social interaction (e.g. Giles, 1977, Labov, 2001). Accent permits placement of individuals both geographically and in terms of social status, and strongly influences social perception and decisions about affiliation and potential for cooperation (e.g., (Trudgill, 2000). Preferential interaction with local, native-accented speakers over foreign-accented speakers emerges early in child development (Kinzler, Corriveau, & Harris, 2011, Kinzler, Dupoux, & Spelke, 2007) and accent appears to trump other salient cues to identity in children's social preferences — US 5-year-old children prioritized accent over race when choosing a friend (Kinzler et al., 2009). Children are also sensitive to linguistically marked status differences. A recent study found that multilingual South African children who attended English-speaking schools preferred speakers of English over speakers of their native Xhosa, a relatively much lower-status language (Kinzler, Shutts, & Spelke, 2012). Accent thus appears to guide social assortment along at least two potentially fitness-relevant dimensions from early in development, reliably marking individuals in terms of similarity and status.

These findings have motivated broad claims about the evolutionary importance of accent as an assortative guide in affiliation and cooperation (Cohen, 2012). The apparent priority of accent over other salient markers of social identity so early in development has prompted the proposal that "accent is a privileged guide to cultural learning" and that "social preferences and reasoning based on accent may have origins in cognitive evolution"; specifically, "cognitive evolution may have favored attention to accent over other social variables (e.g., race) that would not likely have differed across neighboring groups in ancient societies" (Kinzler et al., 2011).

Several important empirical questions remain, however. First, to what extent do US children from monolingual families represent the broad human population (cross-culturally and for most of its history)? Two pieces of evidence warrant pause for thought. In systematic cross-cultural research across a wide range of behavioral and psychological domains, participants from Western populations (including the US), show up as outliers relative to the wider sample (Henrich, Heine, & Norenzayan, 2010). The reasons for this are manifold and they vary according to the focus of investigation. In the case of sensitivity to linguistic variation, there is specific reason to assume that negligible exposure to linguistic varieties is indeed anomalous in the context of world cultures and human history. Migration, mobility, inter-group exchange, and exogamy are pervasive and ancient features of human society — most human communities are multilingual (or speak multiple dialects) and monolingualism is a relatively recent phenomenon (Lieberson, 1981). Perhaps the accent-guided social preferences of children from linguistic contexts characterized by regular exposure to diverse regional accents, dialects, or languages would be weaker or stronger than in largely monolingual populations, such as the US sample.

Second, a further question arises concerning the accent contrasts used. Arguably, second-language foreign-accented speech is not the most relevant contrast for an investigation of perceivers' responses to natural linguistic variations in the local population. Subtle regional variations potentially generate more or less striking effects in social preference (e.g., depending on acoustic distance between sounds, social relevance and familiarity, etc.). The use of second-language speakers further raises the possibility that perceiver preferences are driven by features of speech that have little to do with accent per se but rather with subtle cues to linguistic command or confidence generally. Contrasts using first-language, regional variations are needed to ascertain the importance of specifically accent variation as a guide to social preference.

Finally, is accent-guided social preference exhibited in measures of (costly) cooperation? Although choices about friendship alliances may be indicative of preferential willingness to cooperate, this inference has not been directly tested using standard measures of cooperation.

The present research sought to establish the empirical value of tag-based models in human cooperation and to address the above questions through an investigation of the role of accent in early developing cooperative behavior. We measured accent-guided friendship and cooperative preferences in 5–10 year old children in 4 Brazilian Amazonian towns (in Pará [PA] and Mato Grosso [MT] states). Two towns have a single dominant accent (Cachoeira do Arari, PA; Jauru, MT) and two towns are characterized by accent diversity (Ulianópolis, PA; Canarana, MT). The multi-accent towns are relatively new towns, having been established from the 1960s partly through government incentives offered to prospective migrant landowners across the country. The towns continue to attract newcomers, maintaining accent variation through the generations. Local-accented speech varieties from each town were contrasted with unfamiliar, regional accented speech from Madeira (European Portuguese). European Portuguese was selected for its marked contrast with the Brazilian varieties as determined through phonetic comparison in prior work (Segura da Cruz & Saramago, 1999). To avoid potential familiarity effects from standard European varieties, we used Madeiran Portuguese. Along with the Azores, Madeiran pronunciation reportedly differs most from the standard European accent. In a second study with a different group of age-matched participants, we assessed ability to discriminate between the two stimulus accents.

2. Methods

2.1. Study 1

2.1.1. Participants

479 children, aged 5–10, participated within state schools across the four sites (Cachoeira: 93, 39 males; Ulianópolis: 130, 62 males; Canarana: 120, 65 males; Jauru: 123, 67 males).

2.1.2. Materials and design

Participants were presented individually with 3 counterbalanced sharing trials and a final friendship trial. In each trial, participants made a forced choice between 2 individuals (presented as still images of identical puppets on a computer screen). One individual spoke with a native local accent (or, in the case of multi-accent towns, with the accent that matched that of the participant) and the other individual spoke, using the same statements, with a native Madeiran accent. Speech samples were pre-recorded with 10–11 yr-old children from each accent. The study was conducted by a native Brazilian female assistant from Belém, the capital city of the state of Pará.

The three sharing trials varied as follows;

- in the Equal trial, participants had the option of gaining a sweet and giving one sweet to either the local-accented individual (hereafter "Local") or the other-accented individual ("Other").
- in the Costly trial, participants chose between gaining one sweet and giving one to Local or gaining two sweets and giving one to Other.
- in the Unequal trial, participants had the option of gaining one sweet and either giving one sweet to Local or giving two sweets to Other.

In the final friendship trial, participants chose the puppet they would prefer as a friend. Though the same puppets and phrases were

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