Cognitive Development 60 (2021) 101111

Contents lists available at ScienceDirect

Cognitive Development

journal homepage: www.elsevier.com/locate/cogdev

Does accent trump skin color in guiding children's social preferences? Evidence from Brazil's natural lab

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ARTICLE INFO

Keywords:
Social behavior
Accent
Race
Cross-cultural
Brazil

ABSTRACT

Previous research has shown significant effects of race and accent on children's developing social preferences. Accounts of the primacy of accent biases in the evolution and ontogeny of discriminant cooperation have been proposed, but lack systematic cross-cultural investigation. We report three controlled studies conducted with 5–10 year old children across four towns in the Brazilian Amazon, selected for their variation in racial and accent homogeneity/heterogeneity. Study 1 investigated participants' (N = 289) decisions about friendship and sharing across color-contrasted pairs of target individuals: Black-White, Black-*Pardo* (Brown), *Pardo*-White. Study 2 (N = 283) investigated effects of both color and accent (Local vs Non-Local) on friendship and sharing decisions. Overall, there was a significant bias toward the lighter colored individual. A significant preference for local accent mitigates but does not override the color bias, except in the site characterized by both racial and accent heterogeneity. Results also vary by participant age and color. Study 3 (N = 235) reports results of an accent discrimination task that shows an overall increase in accuracy with age. The research suggests that cooperative preferences based on accent and race develop differently in response to locally relevant parameters of racial and linguistic variation.

1. Introduction

Friendship and cooperation are universal in human sociality, but the psychological processes that guide decisions about who to befriend and with whom to cooperate vary considerably across development and culture (e.g., House et al., 2013; Roberts, Williams, & Gelman, 2017). A vast social psychological literature suggests that social-categorical distinctions based on gender, age, status and race are psychologically prominent in guiding social and prosocial preferences in young children (Renno & Shutts, 2015a; Shutts, 2015). More recently, language, and particularly acoustic properties of linguistic variation (i.e., accent), have been identified as important

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https://doi.org/10.1016/j.cogdev.2021.101111
Received 21 December 2020; Received in revised form 7 July 2021; Accepted 16 August 2021
Available online 4 September 2021
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markers guiding social preferences (e.g., Kinzler, Dupoux, & Spelke, 2007). Although this research is mostly conducted among a culturally narrow and limited pool of Euro-American participants, these proclivities have been accounted for generally in terms of their possible function in human cognitive and social evolution at large (e.g., Kinzler, Shutts, & Correll, 2010). Here, we investigate children's developing social preferences based on race (or, more specifically, "color") and accent across four Brazilian Amazonian towns that vary in their racial and linguistic characteristics.

As an ancient, early developing, hard-to-hide and hard-to-fake trait that signals social identity, accent has been proposed as a socially-acquired "tag" that can reliably guide cooperative behavior toward other cooperators (Cohen, 2012). It may therefore have played a role in the evolution of human cooperation among strangers within increasingly large, mobile and dispersed societies. Although race (as a social category) is similarly hard to hide and hard to fake, the conditioning of social perceptions and behaviors according to apparent racial distinctions is thought to be comparatively recent in human evolutionary history. It has therefore been suggested that perceived racial distinctions have unlikely had a specific role in human social and cognitive evolution (e.g., Kinzler et al., 2010; Liberman, Woodward, & Kinzler, 2017; Richerson, 2018). Accent has been posited as a more plausible structuring principle by which cooperators in a population successfully assort together, thus explaining early emerging and robust accent-based preferences found among young children.

In this view, evidence that young children's social preferences are strongly biased toward native-accented individuals supports the idea that contingent affiliation and cooperation based on accent is phylogenetically specialized in human evolution. For example, Kinzler, Shutts, DeJesus, and Spelke (2009) suggest that "natural selection may have favored social attention to accent in a way that it did not for race" (p. 625) and relate this directly to observed priorities in social-cognitive development: "Given that social groups in ancient times likely differed in accent, but not in race, children may be predisposed to rely primarily on accent to guide their social evaluations of novel individuals" (p. 632). In line with this proposal, Kinzler et al. (2009) found that 5-year old White children from monolingual families in the USA prioritized accent over race when choosing a friend. Although there was a strong positive White bias in the absence of any speech, children favored the Black local-accented child over the White foreign-accented child.

Despite this and other evidence for accent as an early emerging and robust priority in children's prosociality, others have proposed that perceptual carvings of the social world are tuned throughout infancy, early childhood and beyond to variable cultural and demographic features of specific environments (e.g., Cohen, 2012; Cohen & Haun, 2013). In this view, social and cooperative behavior is universally discriminant, but specific contours of discriminant cooperation are ontogenetically specialized according to relevant parameters of the local environment (Bigler & Liben, 2007; Heyes, 2012). Although acoustic signals in the form of language and accent variation may have the advantage of being reliably distinguished and produced from early in infancy, and parochial cooperation commonly cleaves along ethno-linguistic lines (e.g., Bernhard, Fischbacher, & Fehr, 2006; Giles & Johnson, 1987), there might be no necessary phylogenetic specialization or priority for language-based assortment. Rather, discriminant cooperation is developmentally specialized according to parameters that most saliently and reliably indicate likely returns on cooperation in a given developmental context.

To begin to address this debate, we previously explored variation in the development of social preference biases for accent across differing ontogenetic contexts (Cohen & Haun, 2013). In a study following a similar methodology to Kinzler et al. (2009), we investigated 5−10 year old children's preferences across four towns in the Brazilian Amazon in both friendship and sharing contexts. Two of the towns are characterized by a single dominant accent and two are characterized by accent diversity (having been relatively recently established through state-incentivized urban-rural migration). Although there was a significant preference for the local accented individual overall, a clear friendship preference for the local accented individual was identified only among older (9−10 year old) children. A preference to share with the local accented over the non-local accented individual emerged earlier (by age 7–8). However, it did not hold when sharing with the local vs. the nonlocal individual incurred a cost to self, and did not generalize across sites – only children from towns characterized by accent diversity significantly preferred the local accented individual.

These preliminary results suggest that naturally occurring accent variation is not a necessary parameter by which young children condition their social preferences, whether in friendship or sharing behavior, and that developmental context matters. While this suggests more variability and less robusticity than is typically assumed within phylogenetic-specialist accounts, the study did not explicitly compare and situate accent with other potentially relevant social categories, such as race or ethnicity, and could not therefore examine whether accent biases emerge more strongly and even override race biases. It is possible that, in the presence of other salient social identity markers, such as race, accent becomes more salient or relevant in children's decisions about friendship and sharing. Alternatively, like accent, the social category of race may not be a strong guide to social preferences, or become salient only in particular socio-environmental contexts in which racial variation is particularly culturally relevant, such as among minority vs. majority race children (Kinzler & Dautel, 2012; Shutts, Kinzler, Katz, Tredoux, & Spelke, 2011) or among those children who grow up in racially heterogeneous vs. homogeneous environments (Pauker, Xu, Williams, & Biddle, 2016). Either way, this would suggest that previously assumed social-categorical pillars of children's social worlds do not generalize cross-culturally, and offer further support for the view that discriminant sociality develops across ontogeny according to locally relevant parameters.

Based on previous evidence for overall accent and race biases (e.g., Sacco et al., 2019) in the Brazil context, here we aimed to examine their interaction. The primary question the current study sought to address is whether accent biases trump race biases similarly across settings that vary along relevant cultural parameters. Secondary questions concern the relative importance of self-similarity biases, the developmental trajectories along which patterns of preference emerge, and potential differences among distinct domains of social preference (affiliation and resource sharing). Below we describe the research context and specify our questions and hypotheses in more detail.

1.1. Current research and context

The present research investigated race and accent effects on children's developing social preferences. In two studies, we assessed friendship and sharing preferences among children across four Brazilian Amazonian towns in the states of Pará (PA) and Mato Grosso (MT). A third study supplements the results of the two main studies with further data on children's ability to discriminate the local and non-local accent.

We selected the four towns for comparison because of their variation in linguistic and racial characteristics. Two of our research sites - Cachoeira do Ararí (PA) and Jauru (MT) have a single dominant accent, and two sites - Ulianópolis (PA) and Canarana (MT) – are characterized by accent diversity (see Cohen & Haun, 2013). The dominant language across regions and sites is Brazilian Portuguese. The accent heterogeneity originates in the implementation of a large-scale economic regeneration program under President Kubitschek (1956–1961). Improved communications led to an influx of people to the area from various regions of Brazil, and numerous "new towns" emerged from this time (Ulianópolis and Canarana acquired municipal status in the early 1990s). Distinct accent varieties persist today in these towns, though our ethnographic research indicates that the distinctions have diminished over time and across generations. Accents are associated primarily with historical geographical provenance and there was no prior evidence that these local accent varieties were associated with status differentials or any marked social segregation. Rather, children would have been exposed to different accents in daily life. It was observed by school teachers and parents that children are now beginning to exhibit their own accent 'blends'. Accent differences were observed and described primarily in phonetic terms (rather than grammar or vocabulary). It should be noted, however, that systematic linguistic investigation was beyond the scope of this study.

In addition to the accent dimension, both Cachoeira do Ararí and Ulianópolis (Pará state) are relatively more racially homogeneous (predominantly *pardo*, or "brown") and both Jauru and Canarana (Mato Grosso state) are relatively more racially heterogeneous (predominantly *pardo* and white). This sets up a "natural lab" for systematic comparison of the development of children's conditioned

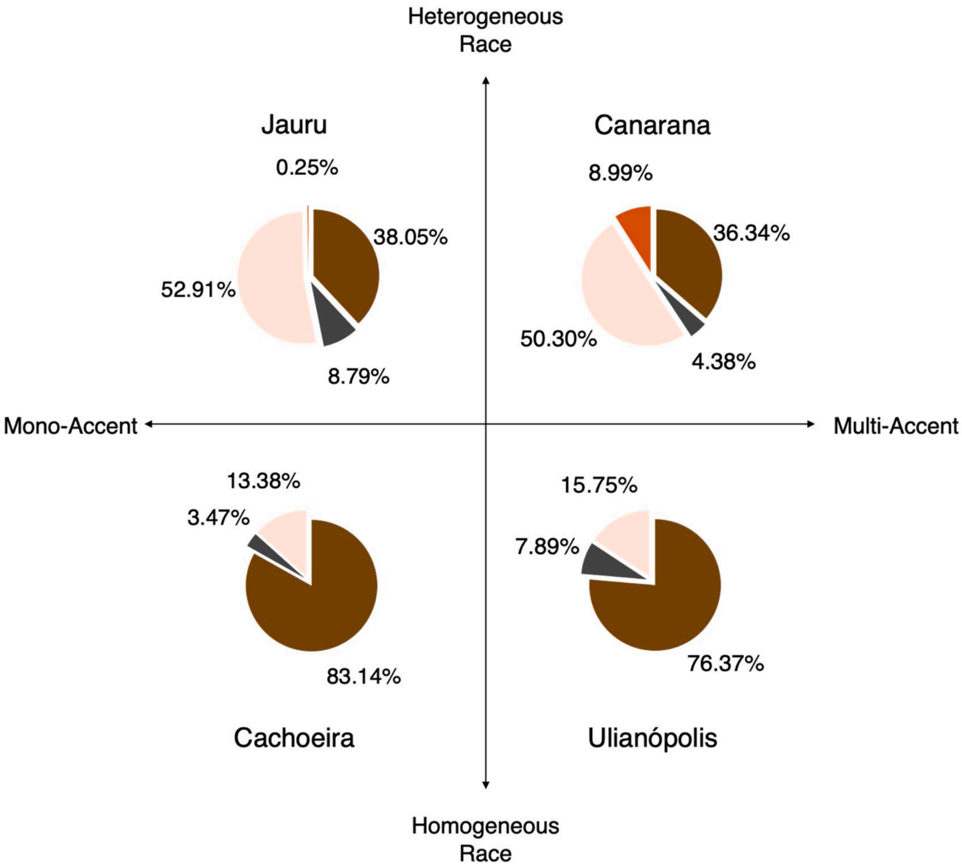

Fig. 1. National census data on race/color for each research site. Pie charts depict self-declared color categories from the national census as a proportion of the total number of declared responses in each site: *Branco* (White)*, Pardo* ("brown") *Preto* (Black), Indígena (Indigenous). N.B. Only the Canarana chart shows "Indigenous" category, indicated in red (0% in Jauru and Cachoeira; 0.07 % in Ulianópolis; refer to online publication for full color figure). Charts do not include data for "Asian" (all < 0.25 %). Total population for each site in 2000 (2010 in parentheses) – Jauru: 12,764 (10,455); Canarana: 15,408 (18,754); Cachoeira do Ararí: 16,700 (20,443); Ulianópolis: 19254 (43,341). Source: 2000 IBGE and 2010 IBGE demographic census (IBGE, 2000, 2010). Accent (multi- and mono- accent) and race/color (heterogeneous/homogeneous) profiles for the purposes of this study are also indicated.

social preferences according to race and accent markers across environments that vary on key socio-demographic parameters.

We use the term “race” to refer to socially constructed categories that, although often socially and culturally highly significant, do not reflect any corresponding taxonomic reality in biology. More specifically, the research here is concerned with “color”, or *cor*, which, in the Brazilian context, overlaps significantly but incompletely with conceptions of race (color being relatively more fluid and relatively less categorical; see Telles, 2012). In general, although social constructions of color categories in Brazil are myriad, context-specific and fluid (as captured in the pervasive idea in the sociological literature on Brazil that “money whitens”, for example; Schwartzman, 2007), socioeconomic status is highly correlated with color. In common with other countries (see, for example, Santhanagopalan, DeJesus, Moorthy, & Kinzler, 2021), there is a persistent and pervasive positive bias toward stereotypically White features (e.g., lighter skin, hair and eyes, more “European”) and a relatively less positive, or negative, bias toward stereotypically Black features (e.g., darker skin, hair and eyes, more “African”) in social perception, attitudes and politics (Telles, 2004). The majority category in Brazil is neither Black nor White, but Pardo, stereotypically defined as those having brown skin, hair and eyes (Bailey, 2009; Sacco et al., 2019). These descriptive terms capture local conceptualizations of color variation, which are tied to a hierarchy of socioeconomic status. On the whole, Pardo social status is intermediary between Black (lower) and White (higher), and negative attitudes, stereotypes an stigmatization are particularly prevalent towards Blacks (Sacco et al., 2019). As these three categories capture the large majority of the population and the sample under study, we compared children’s decisions about friendship and sharing across Black-White, Black-Pardo and Pardo-White target pairs with and without local or non-local accented speech. Fig. 1 depicts the most recent census data available on proportions of Black, White, Pardo and Indigenous inhabitants for each study site at the time of data collection, as self-identified by census respondents. At the time of planning, the most recent census data (2010) were not yet publicly available. The data displayed are from the previous national census (2000; 2010 data are included in the legend for comparison).

Accent-stimuli in the current research contrasted local (familiar) speech with non-local (unfamiliar) speech. It should be noted here that accent, like race, can also serve as a marker of status in socially stratified societies (Giles, 1970, 2012), and Brazil is no exception (Lyngs, Cohen, Hattori, Newson, & Levin, 2016). For comparability with the most relevant previous research, however, we contrasted accents that were not known to carry any salient status significance for the children participating in our research. Our aim was merely to portray target speakers as sounding either similar to or different from and unfamiliar to our participants. Therefore, to avoid familiarity or status effects, Madeiran was selected as the variety of European Portuguese to which our participants would have had minimal exposure relative to mainland varieties. European Portuguese was selected for its marked contrast with the Brazilian varieties as assessed through phonetic comparison (Segura da Cruz & Saramago, 1999). Speech recordings were those used in Cohen and Haun (2013), with Madeiran Portuguese serving as the non-local accent and site-specific Brazilian Portuguese as the local accent. Statements were translations of original statements used by Kinzler et al. (2009).

1.2. Research questions and hypotheses

Study 1 investigated the influence of the target individuals’ skin/hair/eye color (Black, White and Pardo categories) on children’s friendship and sharing preferences across development (age) and across sites (racially homogeneous vs. racially heterogeneous sites). The study, which used a controlled, repeated-measures forced-choice design (e.g., choosing to share with a Black vs Pardo target individual), aimed to assess baseline effects of race/color (hereafter “color”) on children’s preferences. Study 2 investigated and compared the influence of target individuals’ color and accent on friendship and sharing preferences across development and across sites (racially heterogeneous vs. racially homogeneous; multi-accent vs. mono-accent). This study, which used the same design and stimuli as Study 1 but with the addition of local and non-local accented speech, enabled us to assess whether accent trumps color in children’s sharing and friendship preferences.

In both studies, we also investigated effects of participants’ own color category on preferences in order to determine the role of self-similarity on preferences. Self-similarity effects are hypothesized by homophilic accounts of cooperation, whereby cooperation is sustained through the assortment of similar individuals. Previous research on children’s race preferences has found that culturally nondominant groups do not always demonstrate a preference for their own racial group, rather preferring the dominant out-group (e.g., Dunham, Newheiser, Hoosain, Merrill, & Olson, 2014; Dunham, Stepanova, Dotsch, & Todorov, 2015). Color categories in Brazil are associated with hierarchies of cultural dominance and status similarly to those studied elsewhere, such as in South Africa and the USA (e.g. Black, White, Hispanic, multi-racial; e.g., Dunham et al., 2014). However, the relatively greater fluidity of color/racial identity in the Brazil context potentially constrains direct comparison with previously studied samples and allows us to begin to address how the very construal of race/color as (im)mutable identity impacts the relative importance of self-similarity and status in this novel context.

Following Cohen and Haun (2013), Study 3 investigated children’s abilities to discriminate the non-local and local accent, providing supplementary data with which to interpret patterns of variation detected in social preferences in Study 2 (e.g., cross-site and cross-age variation).

Regarding preferences overall (all sites collapsed), we expected to see a general “light-bias” (i.e., more frequent choosing of the lighter individual of each pair; H1), replicating cultural status hierarchies. We also hypothesized a self-similarity bias, such that status-based preferences (light-bias) would be tempered by self-similar color preferences (H3). Self-similarity biases were explored as an interaction between the colors of the target individuals contrasted in a particular trial (e.g., Black-White; Black-Pardo) and the color of the participant (e.g., Pardo; see Procedure below).

Replicating our previous findings, we hypothesized a local accent bias overall (Study 2, H5). We also hypothesized that accent would mitigate the light bias overall (H6), such that participants would choose the darker individual more often when s/he spoke with a local accent (over a non-local accented lighter individual) than when the darker individual spoke with a non-local accent (over a local accented lighter individual). Crucially, we examined whether this tempering of the light bias could be described as "trumping" (i.e., local accent bias overrides light bias). Regarding site-specific patterns, replicating the results of our previous research, we anticipated a stronger accent bias in the multi-accent sites than in the mono-accent sites (H7). Based on these previous results, we expected that any trumping effect of accent would be limited to these sites.

We further hypothesized an effect of race site type (Study 1, H2 and Study 2, H8). Two alternative possibilities were explored. On the assumption that racial variation is more salient and relevant as a social marker in racially heterogeneous (over racially homogeneous) environments, a stronger effect of race and a correspondingly weaker effect of accent would be expected in racially heterogeneous sites. Alternatively, on the assumption that participants' everyday exposure to racial variation can also diminish the perceived relevance and salience of race as a social marker guiding decisions about affiliation and cooperation, we would expect to find the opposite pattern, i.e., a weaker effect of color and stronger effect of accent in racially heterogeneous vs. homogeneous sites (McGlothlin & Killen, 2010). It should be noted that, through general cultural discourse and diverse forms of media portrayal, children at all sites would likely have had some exposure to the status differentials associated with racial variation in Brazil, specifically with the Black, White and Pardo categories used in our study design. Race is an important feature of Brazilian society and culture, even in communities with limited racial diversity (Sacco et al., 2019).

Our analyses also explore effects of age. In Study 1 (color only, no speech), we anticipated changing patterns of response across the wide age range represented (5–10) but we did not have strong prior hypotheses about how the various biases under investigation would play out across this age range and across the sites represented. Insofar as self-similarity biases emerge in participants' social preferences earlier than status-based biases, for example, a three-way interaction effect of participant color, color contrast and age might be expected. Previous research has found mixed effects of age on race preferences in children, with one recent Brazil-based study showing stable explicit race preferences across the age range, contrary to expectations of age-related variation (based on previous North American research; Sacco et al., 2019). In Study 2 (with speech), we anticipated an effect of age and accent site-type (i.e., multi-accent vs. mono-accent) on choices. In line with our previous results (Cohen & Haun, 2013), we predicted that any mitigating effect of accent on color biases would be more pronounced in older children. Analyses included age as a predictor variable to account for such trends.

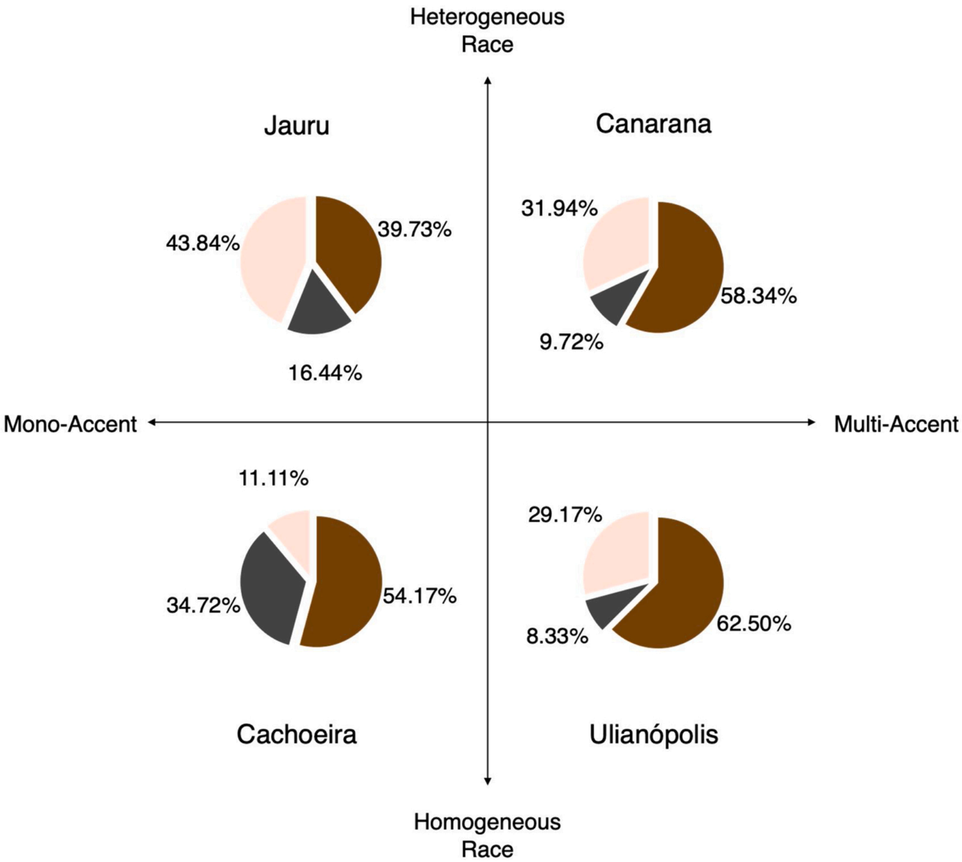

Fig. 2. Participant color data by site (Study 1; Jauru, n =73, Canarana, n = 72, Cachoeira, n = 72, Ulianópolis, n = 72). All participant data are based on allocations by the local researcher into one of three categories, corresponding to the distinguishing features of the White, Pardo and Black target individuals used in the study stimuli. These allocations were intended for use in self-similarity analyses and were based only on each participant's appearance (skin color, hair color and type, eye color). As such, they are not directly comparable with self-report census data.

Finally, although both friendship and sharing behavior are likely underpinned by overlapping affiliative motivations, we speculated that higher status individuals may be seen as valuable potential allies or friends, but as relatively less needy recipients of scarce resources. Therefore, although we expected to observe effects of self-similarity on both friendship and sharing choices, we anticipated a greater light-bias overall in choices about friendship than in sharing decisions (H4). In Study 2, we anticipated that accent would temper racial biases more in friendship decisions than in sharing decisions (H9). In this study, the local, familiar accent was pitted against a non-local unfamiliar accent. As such, we expected decisions specifically about affiliative friendship to be more highly selective of the familiar-sounding individual over the unfamiliar stranger than decisions about resource sharing.

To test these hypotheses, and to further explore interactions among predictor variables, analyses modelled the effects of participants' color/racial category, participants' age, colors contrasted in each trial, race site type (heterogeneous vs. homogeneous) and accent site type (multi-accent vs. mono-accent) as predictor variables, and target-individual color (light bias among the colors contrasted) and accent choice (Study 2) as outcome variables. The research received ethics approval from the Max Planck Institute for Evolutionary Anthropology. Recruitment was through local schools and all participation was with informed signed consent of parents or primary carers, as well as the agreement of the school directors and teachers. Each participant took part in only one study.

2. Study 1: the influence of target-individual color on children's friendship and sharing preferences

2.1. Study 1 research hypotheses

H1. Overall, participants will more frequently choose the lighter colored individual in friendship and sharing decisions.

H2. There will be a significant effect of race site type on choices for the lighter colored individual in friendship and sharing decisions.

H3. There will be an interaction effect of participant color and color contrast (i.e., Black-White, Pardo-White, Black-Pardo) on choices for the lighter colored individual in friendship and sharing decisions, such that self-similarity biases will temper the general light bias.

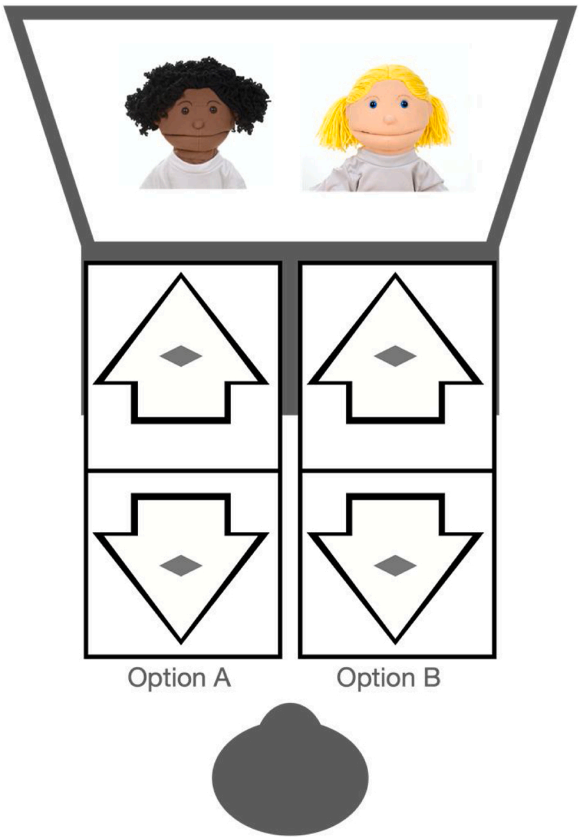

Fig. 3. Schematic diagram of the set-up for the sharing trials. The participant sat in front of the laptop computer, the keyboard of which was overlaid with two separate cards. Each card had two arrows, one on which pointed to the participant and the other to one of the characters on the lap top screen (left or right side). A candy was placed in each arrow (here represented by a diamond shape). The participant indicated their choice by touching one of the cards (here denoted as Option A or Option B).

H4. There will be a stronger light bias overall in friendship decisions than in sharing decisions.

2.2. Method

2.2.1. Participants

Participants were 310 5−10 year old children from the four field sites described above. Participants were predominantly drawn from a single, principal pre-school and school within each site, on account of the wide and varied catchment, capacity to provide research space, and accessibility. Eligible classroom groups were identified based on age and all children in each group were invited to participate. Twenty-one children were excluded from the final analysis due to difficulty in understanding the task instructions as evidenced in repeated failure to accurately answer comprehension check questions (18), experimenter error (1), distractions (1), and shyness/reticence (1). The final number for analysis was 289 (female, N = 143; mean age = 7yrs 11 m; range = 5yrs 0 m – 10yrs 11 m).

Participant color was assessed by a single Brazilian (Pardo) experimenter, who conducted all data collection across studies and sites (Fig. 2). The experimenter identified whether the participant best approximated stereotypical categories of Pardo, White or Black as represented by the appearance of the target puppets used in the study stimuli. Experimenter assessments were used in self-similarity analyses. This standardized approach was favored over solicitation of children's own or parents' assessments in order to avoid confounds associated with participants' variable interpretations of the terms of the question (e.g., age-wise variations in the case of the children, and differing implicit or explicit racial biases on the part of parents). No additional data on children's (or their parents') color or racial identity were collected. Full sample details by site, sex, age and color are given in the SOM.

2.2.2. Procedure

Data collection took place in local schools at each site. Each participant was led by the Brazilian experimenter to a quiet room, where they were seated in front of a laptop with 19-inch screen. The experimenter sat either to the left or right of the child (counterbalanced across participants) and presented the task instructions. In each trial, the participant viewed two adjacent static images of puppet heads/faces and made forced-choice selections between the two target individuals. There were two blocks of six trials: one block of Friendship trials and one block of Sharing trials. Block order was counterbalanced across participants. In the Friendship trials, participants were asked to point to the individual they would like to have as a friend. In the Sharing trials, participants selected from two options for the allocation of candies. The task followed the same procedure as described in Cohen and Haun (2013) (derived from Fehr, Bernhard, & Rockenbach, 2008). Two white cardboard trays holding candies were placed side-by-side in front of the screen (covering the keyboard and aligned with each of the two puppets; see Fig. 3). Trays were divided equally width-wise and each half contained a black arrow - one pointed to the participant, who was seated in front of the computer, and the other pointed to the screen (the away-facing arrow on the leftmost tray pointed to the target individual on the left of the screen and the away-facing arrow on the rightmost tray pointing to the target individual on the right of the screen). One candy was placed on each arrow. Children could choose one of the two trays, indicating their choice by touching the tray. Both options returned one candy to the participant, but either selection entailed that one of the target individuals also received a candy while the other target individual received nothing. The two decision options were explained and demonstrated, with comprehension questions to assess understanding (e.g., if you choose this option, who will receive a candy?). Each decision across trials was also accompanied by a comprehension question to confirm the participant's understanding of how the candies would be allocated. Instructions were repeated to participants who did not answer the initial comprehension questions correctly. Those who answered comprehension questions incorrectly after this point were excluded from analysis (see SOM for further details).

In each block (Friendship and Sharing), there were two trials each of all three color combinations: Black-White, Black-Pardo, Pardo-White. Target individuals were depicted by puppets, all of which were unique, but similar in style and with salient variation on the relevant dimensions (i.e., lighter, medium, dark skin tone, blond/brown/black hair, brown/blue eyes; see SOM for images). Puppets were preferred over photographs of real people for reasons of experimental control and comparability with previous research (see also General Discussion). Puppets and similar animated characters are widely used with children in educational and other contexts (e.g., television, church). Six puppets were female and six were male. Within each block, three male pairs and three female pairs were shown. In each trial a new pair of puppets was shown, matched on sex and all distinguishing features (e.g., expression, hairstyle, t-shirt) except for skin, hair and eye color. Pairings were held constant across all participants, and appeared in random order. Target individual side (which color was on the left or right) was counterbalanced within participants across trials.

2.2.3. Analysis

To investigate the hypothesized determinants of choosing the lighter colored individual (hereafter "Lighter"), we ran a Generalized Linear Mixed Model (GLMM; Baayen 2008) with binomial error structure and logit link function for each of the dependent measures: Friendship and Sharing. We included race site type (heterogeneous/homogeneous), participant color (Black, Pardo, White), participant age, color contrast (Black-Pardo, Black-White, Pardo-White), block order (control) and sex (control) as fixed effects and participant and site as random intercept effects. Block order was included as a check on possible effects of the order in which dependent measures were presented (Friendship block vs. Sharing block).

To examine the possibility that color preferences differ along theorized dimensions of the predictors, we included three three-way interactions: 1. race site type, participant age, color contrast; 2. race site type, participant color, color contrast; 3. participant color, participant age, color contrast) as higher-order fixed effects in the model. As an overall test of the effect of the predictors we used a likelihood ratio test (LRT) comparing the full model with a null model (Forstmeier & Schielzeth, 2011) comprising only the fixed effects of block order and sex and the same random effects structure as the full model (R function "anova" with argument "test" set to

"Chisq"). To test the significance of the fixed effects (alpha level of 0.05), we compared the full model's deviance with that of corresponding reduced models not comprising the respective predictor (R function "drop1" with argument "test" set to "Chisq"; Dobson & Barnett, 2008). Lower-order effects (e.g., main effects) were tested without the respective higher-order terms (i.e., interactions) included in the model. Models were highly robust against sequential subject omission (with replacement), see SOM Section 3.

Lastly, to investigate whether decision type (Friendship or Sharing) influenced the probability of choosing Lighter, we ran a further GLMM with binomial error structure and logit link function, with color choice (see below) as the dependent variable. Decision type was therefore entered as an additional fixed effect in the model as specified above.

2.3. Results

2.3.1. Friendship

All participants (N = 289) were given a color choice score, calculated as the frequency of choices made for Lighter (the lighter-colored individual) across trials. The overall mean frequency of choices for Lighter was 65.39 % (SD = 20.97; 1-sample *t*-test against 0.5 chance level, $t = 12.473$, $df = 288$, $p < .001$), suggesting a significant overall preference for lighter-colored individuals. The mean color choice score ranged from 62.50 % ± 20.89 (n = 72) in Ulianópolis to 70.83 % ± 19.53 (n = 72) in Cachoeira (Canarana: 63.15 % ± 19.92, n = 72; Jauru: 65.07 % ± 22.76, n = 73).

Overall, the full model was significant compared to the null model (likelihood ratio test: $\chi^2 = 49.86$, df = 29, $p = 0.009$). None of the three-way interactions between race site type, participant color, age and color contrast significantly predicted participants' color choice, nor did any of lower-level two-way interactions (see Table 1) or control variables (Block order: estimate ± SD = -0.019 ± 0.112; Sex: estimate ± SD = -0.191 ± 0.115; see Table 1 for results).

Color choice was significantly dependent on the colors contrasted in the trials ($\chi^2 = 20.20$, df = 2, $p < 0.001$). Participants were more likely to choose Lighter in the Black-White trials ($M = 71.28$; $SD = 32.09$) compared to the Black-Pardo trials ($M = 65.92$; $SD = 34.70$; $p = 0.046$) and the Pardo-White trials ($M = 59.00$; $SD = 35.43$; $p < 0.001$). Participants were also more likely to choose Lighter in the Black-Pardo trials compared to the Pardo-White trials ($p = 0.013$). Nonetheless, within each color contrast, participants chose Lighter significantly more frequently (1-sample *t*-test against 0.5 chance level; all $p < .001$). Race site type ($p = 0.388$) and participant color ($p = 0.244$) did not significantly affect participants' choices (see Table 1 for more details). Age trended toward significantly predicting participants' color choice, such that older participants were less likely to choose Lighter (across all color contrasts) than younger participants (Estimate ± SD = -0.107 ± 0.055; LRT: $p = 0.053$).

These results reveal an overall bias toward choosing the lighter colored individual. This bias is robust across sites and participant variation, though shows a diminishing trend with age. It was strongest when Black and White were contrasted and weakest when Pardo and White were contrasted, suggesting that both preference for lighter colored individuals and dispreference for darker colored individuals guided participants' choices about friendship.

2.3.2. Sharing

As above, participants were given a color choice score, calculated as the frequency of choices made for Lighter across trials. The overall mean frequency of Lighter choices was 60.38 % (SD = 22.22; 1-sample *t*-test against 0.5 chance level, $t = 7.942$, $df = 288$, $p < .001$), again suggesting a significant overall preference for the lighter colored individuals. The mean color choice score ranged from 58.33 % ± 18.97 ($n = 72$) in Ulianópolis to 62.73 % ± 21.58 ($n = 72$) in Cachoeira (Canarana: 61.34 % ± 25.91, $n = 72$; Jaurú: 59.13 % ± 22.06, $n = 73$).

Overall, the full model approximated a significantly better fit to the data as compared to the null model (likelihood ratio test: $\chi^2 = 40.25$, df = 29, $p = 0.079$), which we deemed sufficient to inspect the model output in further detail. The three-way interaction between color contrast, participant color and age was the only interaction term significantly predicting participants' color preferences;

Table 1
GLMM output, single term deletions, for the interaction and main effects on participants' preferences for Lighter in the friendship trials (significant effects highlighted in bold).

Predictor	Df	LRT	Pr(Chisq)
color.contrast:site.race:participant.color	4	7.191	0.126
color.contrast:site.race:age	2	1.788	0.409
color.contrast:participant.color:age	4	1.016	0.907
color.contrast:site.race	2	1.493	0.474
color.contrast:participant.color	4	5.670	0.225
color.contrast:age	2	2.774	0.250
site.race:participant.color	2	0.787	0.675
site.race:age	1	0.045	0.832
participant.color:age	2	1.046	0.593
color.contrast	**2**	**20.20**	**<0.001**
site.race	1	0.743	0.388
participant.color	2	2.821	0.244
Age	1	2.146	0.053
Sex	1	2.741	0.098
block order	1	0.029	0.866

the effect of age on the preference for lighter colored individuals depended on the particular colors contrasted and the participants' own color ($\chi^2 = 10.22$, df = 4, $p = 0.037$, see Table 3 and Fig. 4). Most strikingly, within the trials in which the colors Black and White were contrasted, Black children's ($n = 50$) light preference increased more with age than it did for the Pardo children ($n = 155$), for whom there was a decreasing trend with age (Estimate ± SD = 0.529 ± 0.259, $p = 0.041$; overall means ± SDs: for black children, 67.0 ± 29.64 %, for Pardo children, 62.90 ± 36.41 %). Furthermore, for trials that involved a Black-White or Black-Pardo contrast, with increasing age, Black children shared more with the White individual and shared less with the Pardo individual, respectively (Estimate ± SD = 0.570 ± 0.301, $p = 0.058$; Means ± SDs for Lighter preference across ages: in the Black-White contrast, 67.00 ± 29.64 %, in the Black-Pardo contrast, 45.00 ± 36.77 %). Pardo children showed an opposite preference pattern: with increasing age, Pardo children were more inclined to share with the Pardo individual when contrasted with a Black individual (Mean across ages ± SD = 58.71 ± 38.29 %) than with the White individual when contrasted with a Black individual (Mean across ages ± SD = 62.90 ± 36.41 %; Estimate ± SD = 0.438 ± 0.179, $p = 0.014$); i.e. Pardo children increasingly showed a stronger light preference in the Pardo-Black than in the White-Black trials. Therefore, although Black children's frequency of choice for White over Black individuals increased with age, they also increasingly chose the Black over the Pardo individual. White children's preference for Lighter remained relatively high and stable across ages for the Black-Pardo and Black-White contrasts, but, as among the Pardo participants, the light bias diminished with increasing age in the Pardo-White contrast. For Pardo and White children, then, Pardo is increasingly favored over White, suggesting a declining White bias (but only when contrasted with Pardo).

Participants' choice for Lighter was influenced by the sex of the participant ($\chi^2 = 6.44$, df = 1, $p = 0.011$), with females being more likely than males to share with the lighter colored puppet (Estimate ± SD = −0.294 ± 0.116; Mean % preference ± SD: females 63.8 ± 48.1; males 57.1 ± 49.5). However, both males and females showed a choice pattern that was significantly different from chance (one-sample *t*-test against 0.5 chance level; females: t = 7.43, df = 142, $p < 0.001$; males: t = 3.91, df = 145, $p < 0.001$). Similar to the Friendship trials, choosing Lighter in the Sharing trials was also significantly dependent on the colors contrasted in the trials (main

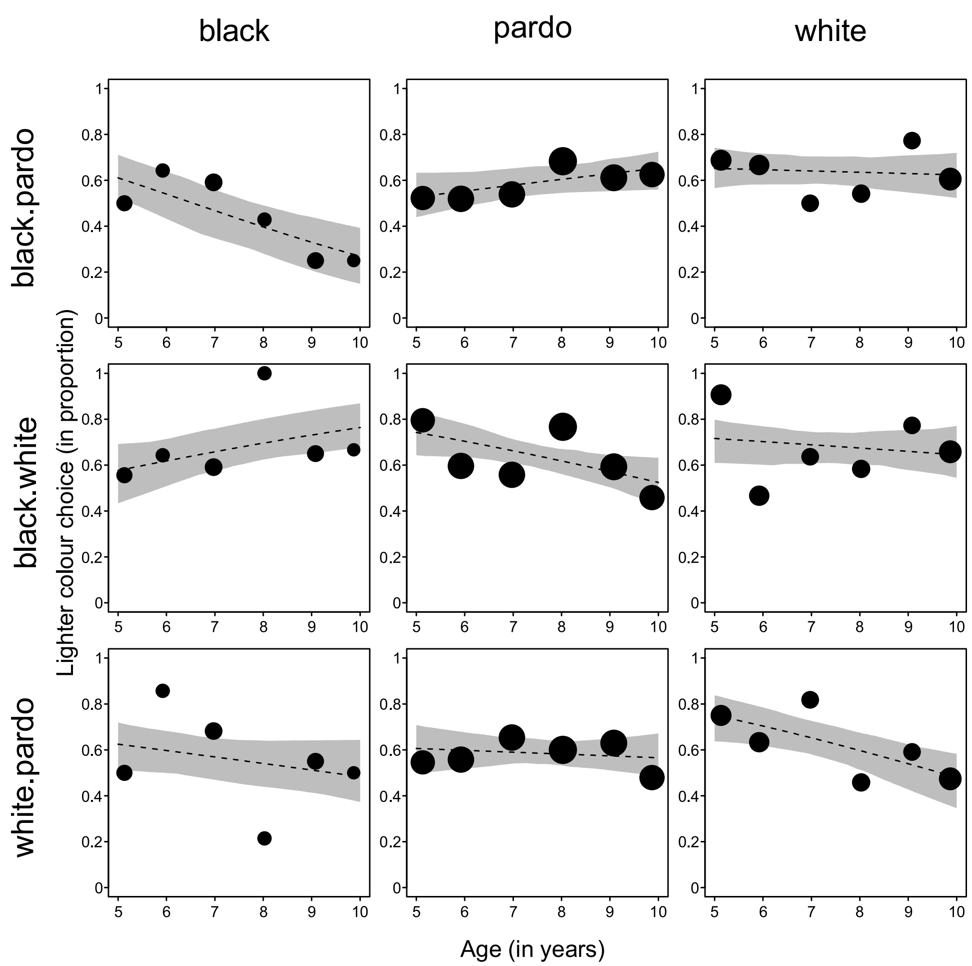

Fig. 4. The three-way interaction between color contrast (across *y-axis*), participant color (across *x-axis*) and age (*x-axis*) significantly predicts participants' color preferences in the sharing trials (*y-axis* indicates the proportion of choices for the lighter color over the darker color). The sizes of the data points are proportional to the number of observations in the respective cells. Dots represent the data, the dotted lines represent the model lines; shaded areas represent the 95 % CIs.

effect: $\chi^2 = 7.86$, df = 2, $p = 0.020$). However, given that the effect of color contrast in the trials was part of the three-way interaction (between color contrast, participant color and age), we refrained from specifying the details of the main effect. None of the other main effects significantly affected participants' choice for Lighter (Table 2).

The GLMM investigating effects of decision type on color choice showed a more pronounced light bias in the Friendship trials than in the Sharing trials (Estimate ± SD: 0.227 ± 0.072, N = 289, LRT: $\chi^2 = 9.80$, df = 1, $p = 0.0017$).

2.4. Study 1 discussion

Study 1 examined 5−10 year old participants' choices about who they would like to be friends with and about sharing across three color-contrast scenarios: Black-White, Pardo-White, Black-Pardo. As predicted (H1), there was an overall preference for lighter-colored individuals in decisions about sharing and friendship. We found no evidence that the light bias varies according to the racial heterogeneity or homogeneity of the wider social environment (H2).

H3 predicted an interaction effect of participant color and trial color contrast, such that self-similarity biases would temper the general light bias, and that this would vary with age. Results suggest a more complex picture. The strength of the light bias diminished with age for some participant categories and in some conditions. In Friendship trials, the light-bias was strongest in the trials where the choice was between White and Black and weakest where the choice was between White and Pardo, suggesting not just a strong bias toward White but also a relatively strong bias against Black. The effect of color contrast did not significantly vary across Black, White and Pardo participants. In Sharing trials, however, there was a three-way interaction of color contrast, participant color and age. As described, Black children's choice of the Black over the Pardo individual increased with age, but they also increasingly chose the White over the Black individual. Pardo children, in contrast, were increasingly likely to share with Black over White individuals but, unlike the Black children, they increasingly favored Pardo over Black individuals. This may indicate that older Black and Pardo children prefer to share with self-similar individuals, at least when contrasted with Pardo and Black, respectively, and that this tempers a more general White, or light, preference. White children showed a persistent and steady light bias in Black-Pardo trials and Black-White trials, but a declining bias toward the self-similar White individual with age when contrasted with Pardo. Overall, this suggests a possible self-similarity effect among older Black and Pardo children in when deciding whether to share with a Black or Pardo individual, but this sits alongside a persistent White bias.

As predicted (H4), the light bias was stronger in the choices about friendship than in the choices about sharing. We also found a main effect of sex in the Sharing, but not the Friendship, trials: girls showed a stronger light bias than boys in sharing behavior.

Overall, the results suggest a robust light-bias across sites, replicating findings from similar studies across a diverse range of cultural settings, and providing a foundation from which to examine the influence of accent on race/color preferences. We discuss the results of Study 1 in full in the General Discussion below, together with the results of Study 2. In Study 2, we used an almost identical experimental paradigm to examine the influence of target individuals' color and accent on friendship and sharing preferences across development and across sites.

3. Study 2: the influence of target-individual color and accent on children's friendship and sharing preferences

3.1. Study 2 research hypotheses

H5. Overall, participants will more frequently choose the local-accented individual in friendship and sharing decisions.

H6. Accent will significantly mitigate the light bias identified in Study 1 (i.e., participants will be significantly more likely to choose the darker individual when he/she speaks with a local accent and the lighter individual speaks with a non-local accent than when there

Table 2
GLMM output, single term deletions, for the interaction and main effects on participants' preferences for Lighter in the sharing trials (significant effects highlighted in bold).

Predictor	Df	LRT	Pr(Chisq)
color.contrast:site.race:participant.color	4	1.848	0.764
color.contrast:site.race:age	2	2.670	0.263
color.contrast:participant.color:age	**4**	**10.22**	**0.037**
color.contrast:site.race	2	0.428	0.807
color.contrast:participant.color	4	5.343	0.254
color.contrast:age	2	1.787	0.409
site.race:participant.color	2	0.389	0.823
site.race:age	1	0.092	0.762
participant.color:age	2	1.146	0.564
color.contrast*	**2**	**7.863**	**0.020**
site.race	1	0.278	0.598
participant.color	2	4.959	0.084
Age	1	3.378	0.066
Sex	**1**	**6.441**	**0.011**
block order	1	0.134	0.714

Table 3
Mean proportions of choice for Lighter in Friendship trials across sites with comparisons between Study 1 (all trials) and Study 2 (mitigating and boosting trials; M *t*-test and B *t*-test, respectively, with Bonferroni-Holm adjustment for multiple testing, Holm, 1979; significant effects highlighted in bold). Asterisks denote where means are significantly different from chance (0.5), one-sample *t*-test ($p < 0.05$). Cachoeira: mono-accent, homogeneous race; Ulianópolis: multi-accent, homogeneous race; Canarana: multi-accent, heterogeneous race; Jauru: mono-accent, heterogeneous race.

Site	Study 1 Means (SD)	Mitigating means (SD)	M *t* -test (*p*-value)	Boosting means (SD)	B *t* -test (*p*-value)
Cachoeira	0.708* (0.195)	0.577* (0.293)	**0.012**	0.700* (0.252)	1.000
Ulianópolis	0.625* (0.209)	0.564 (0.306)	0.684	0.637* (0.286)	1.000
Jauru	0.651* (0.228)	0.498 (0.323)	**0.025**	0.662* (0.316)	1.000
Canarana	0.631* (0.199)	0.429* (0.296)	**<0.001**	0.771* (0.241)	**<0.001**
Overall	*0.654* (0.210)*	*0.516 (0.309)*	***<0.001***	*0.694* (0.279)*	*0.054*

is no speech).

H7. There will be a significant effect of accent site type on sharing and friendship decisions in which the light bias is pitted against the local accent bias (i.e. where the choice is between a local accented darker individual and a nonlocal accented lighter individual), such that accent will temper the light bias more in multi-accent sites. Effect of accent site type will increase with age.

H8. There will be a significant effect of race site type on friendship and sharing decisions in which the light bias is pitted against the local accent bias.

H9. There will be a stronger mitigating effect of accent in friendship decisions than in sharing decisions.

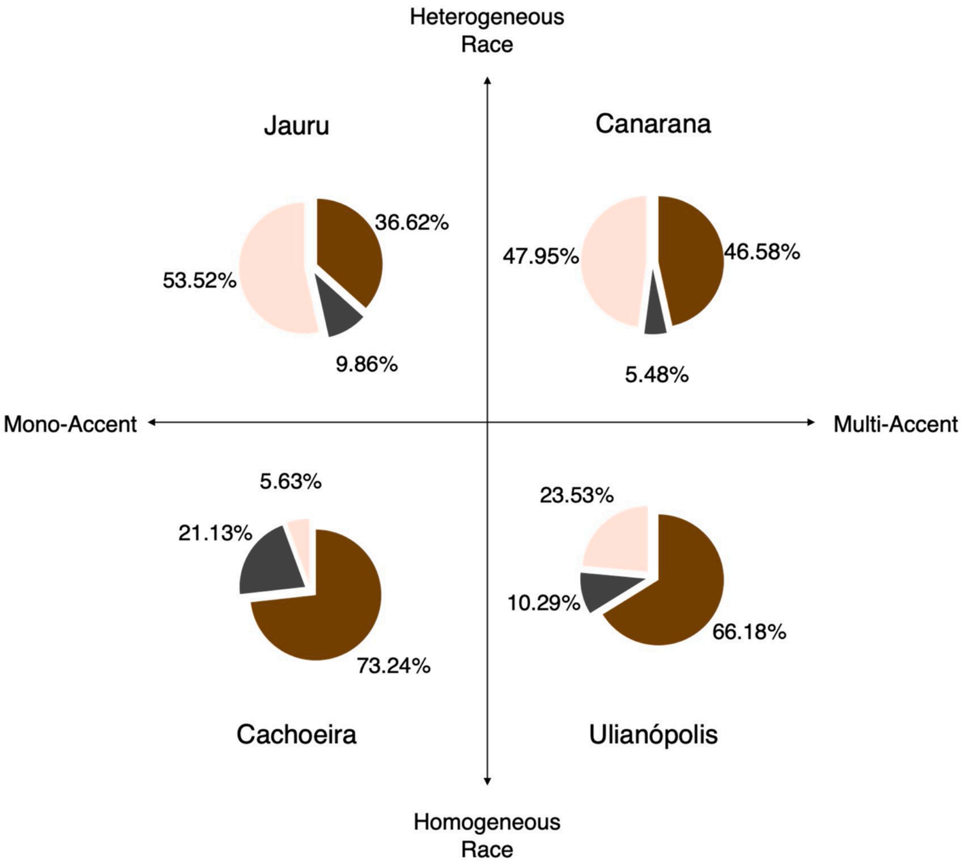

Fig. 5. Participant color data by site (Study 2; Jauru, n =71, Canarana, n = 73, Cachoeira, n = 71, Ulianópolis, n = 68). All participant data are based on allocations by the local researcher into one of three categories, corresponding to the distinguishing features of the White, Pardo and Black target individuals in the study (for use in self-similarity analyses).

3.2. Method

3.2.1. Participants

Recruitment followed the same procedure as in Study 1. Participants were 308 5−10 year old children from the four field sites described above. Twenty-five children were excluded from the final analysis due to difficulty in understanding the task instructions as evidenced in repeated failure to accurately answer comprehension check questions (18), experimenter error (1), distractions (3), shyness/reticence (1), or falling outside the age range at time of testing (2). The final number for analysis was 283 (female, $N = 141$; mean age = 7yrs 11 m; range = 5yrs 0 m – 10yrs 11.5 m). See Fig. 5 for participant color data by site.

3.2.2. Procedure

As in Study 1, participants made forced-choice selections between two puppets across two counterbalanced blocks of six trials; one block of Friendship trials and one block of Sharing trials. Puppets, pairings, and color contrasts were all as described for Study 1. In addition, in each trial and in turn, one puppet spoke with a native local accent and the other puppet spoke with a non-local accent. In the case of multi-accent towns, two local-accent speech varieties predominate among children. Statements were recorded with speakers of both accent varieties and each participant heard the version most similar to their own accent. Participant accents were identified by class teachers. In the case of mono-accent sites, the single predominant accent was used.

Local accented speech was contrasted with unfamiliar, regional accented speech from Madeira (European Portuguese). Three pre-set speech phrases based on those used by Kinzler & Spelke were recorded by Cohen in Portuguese with local 9−10 year old children at each site (e.g., "When I am hungry, I like the smell of food": "*Quando estou com fome, gosto do cheiro da comida*"; see SOM for details). Children from each site read and repeated the phrases until they were comfortable speaking them in a natural manner. The most natural and clearest samples were used as stimuli – two speakers per accent category. Recordings were cleaned of background noise, normalized for volume and the pitch was adjusted to create a 'male' (lower) and 'female' (higher) version of each voice (using the open source software Audacity®). This yielded two female and two male voices per accent. Audio files were matched for sex of puppets in each display file (female voice recordings with female puppets and male voice recordings with male puppets). Each statement was used twice (across the six trials) but never in succession. In each trial, target individuals spoke the same phrase in turn. Puppets were made to appear as through speaking by opening their mouths (while the silent puppet faced away). For the Friendship/Sharing choice phase of each trial, both puppets faced the individual with mouths closed (see SOM Video for an example stimulus video). Children expressed their Sharing and Friendship choice as described for Study 1.

The six possible target-puppet color-accent pairings were counterbalanced within participants across six unique trials (e.g., Black-Local vs. White-NonLocal, Black-NonLocal vs. White-Local), as was speaker order (first-second) and side (left-right). Three randomized orders of the fully counterbalanced trials were also generated, yielding twelve display files per accent category for a fully counter-balanced and randomized stimulus set. Notably, per participant per block (Friendship and Sharing), these counterbalancing measures resulted in three trials in which the lighter colored puppet spoke with the local accent (hereafter "Boosting" trials) and three trials in which the darker colored puppet spoke with the local accent (hereafter "Mitigating" trials). This allowed us to test whether local accent would *boost* or *mitigate* participants' light bias identified in Study 1, respectively. Moreover, in the Mitigating trials, if the choice of darker color/local accent is greater than chance level (50 %), this result could be interpreted in terms of accent preference *trumping* color preference (Kinzler & Spelke, 2007). Our analyses focus in particular on investigating the factors predicting variation in this trumping effect of accent. As studies were conducted approximately concurrently at each site, we did not have any prior hypotheses arising specifically from Study 1.

3.3. Analysis

First, for both the Friendship and Sharing blocks, we calculated participants' choice for Lighter in the boosting and mitigating trials separately and sorted these data by site. We tested whether participants' responses were different from responses that could be expected based on chance (one-sample *t*-test against 50 %). Additionally, we compared the Study 2 responses to the color choice data obtained in Study 1 by means of independent t-tests. This allowed us to observe whether the speech accent of the target individuals influenced participants' choices, relative to the color-only data from Study 1.

Second, to investigate the factors that influenced participants' choices in the Mitigating trials (i.e., darker color/ local accent vs. lighter color/non-local accent), we analyzed all Mitigating trials by means of a GLMM with binomial error structure and logit link function. The model was otherwise constructed identically to Study 1, except the response was set to "local accent choice".

To account for the possibility that local accent choices in Mitigating trials differ along several dimensions of the predictors, we included four three-way interactions as higher-order fixed effects in the model, including the central predictors race site type, accent site type, participant color, age and color contrast of the trial. As an overall test of the effect of the predictors we used a likelihood ratio test, following the same procedure as outlined for Study 1.

Lastly, to investigate whether decision type (Friendship or Sharing) influenced the probability of choosing the local-accented individual (hereafter "Local"), we ran a further GLMM with binomial error structure and logit link function, with the frequency of choosing the local-accented individual as the dependent variable. Decision type was entered as a fixed effect in the model as specified in Study 1. To replicate the finding that light bias is more pronounced in the Friendship vs Sharing trials, we ran the same GLMM as described for Study 1, with accent site type and decision type as additional fixed effects (and color choice score as dependent variable).

3.4. Results

3.4.1. Friendship

All participants ($N = 283$) received a color choice score, calculated as the frequency of choices for Lighter across trials. The mean score was 60.47 % ($SD = 18.92$), showing a significant overall preference for lighter-colored individuals (1-sample *t*-test against chance expectation of 50 %, $t = 9.309$, $df = 282$, $p < .001$). Overall, there was also a significant mean preference for Local (58.87 %, $SD = 22.51$, 1-sample *t*-test, $t = 6.630$, $df = 282$, $p < 0.001$). The mean color choice score across the boosting trials was 69.38 % ($SD = 27.88$, 1-sample *t*-test, $t = 11.696$, $df = 282$, $p <. 001$). The mean color choice score across the mitigating trials was 51.59 % ($SD = 30.89$, 1-sample *t*-test, $t = 0.866$, $df = 282$, $p = 0.39$). For trials in which the local accented individual is also the darker individual (mitigating trials), mean preference does not significantly differ from chance. Therefore, although accent appears to both boost and mitigate the bias toward lighter skin color, local accent preference does not appear to override the light bias, in general.

To further examine the effect of accent on participants' color biases, we compared the results of Study 2 (with speech) and Study 1 (no speech). Mean Lighter choices in the Boosting and Mitigating trials are shown separately per site in Fig. 6 and Table 3, and compared with mean Lighter choice results from Study 1 (indicated by dashed blue lines in Fig. 6), as well as against chance.

Table 3 shows results across sites of the comparisons of mean Lighter choice against chance (one-sample *t*-test) for Study 1 and the mitigating and boosting trials from Study 2. Independent sample *t*-test *p*-values are given also for comparisons between Study 1 and Study 2 means (mitigating and boosting trials).

Across all sites, the light-bias was less pronounced when pitted against local accent (i.e., Mitigating trial means < Study 1 means), with the difference between Mitigating trial means and the corresponding color-only trials from Study 1 reaching significance in three out of four sites (all except Ulianópolis). In Cachoeira (mono-accent, heterogeneous race), the light-bias is significantly mitigated by the local accent alternative, yet the mean remains significantly higher than expected based on chance – here, the lighter color bias overrides the local accent bias. In Canarana (multi-accent, heterogeneous race), the light-bias is also significantly mitigated by the local accent alternative, and here the local accent bias *trumps* the lighter color bias. Canarana is also the only site that shows evidence that local accent significantly increases the frequency of choices for the lighter colored individual (Boosting mean is significantly higher than Study 1 mean). In Jauru (mono-accent, heterogeneous race), the light bias is significantly mitigated by the local accent alternative, but here the mean choice for the lighter colored individual is at chance level – accent cancels out the color bias, but does not override it. In Ulianópolis (multi-accent, homogeneous race), accent neither mitigates nor or boosts the light bias significantly.

To investigate influences of site, participant color, age, and colors contrasted, we analyzed Mitigating trials using a GLMM (see above for model specification details). Overall, the full model was significant as compared to the null model (likelihood ratio test: $\chi^2 = 73.11$, df = 31, $p < 0.001$). The two-way interaction between accent site type (multi-accent or mono-accent) and age was the only interaction term significantly predicting participants' choice for Darker/Local over Lighter/NonLocal (see Table 5). Specifically, in multi-accent sites, the effect of the local accent increased more steeply with age as compared to sites with a single dominant accent ("mono-accent sites"; $\chi^2 = 3.91$, df = 1, $p = 0.0481$; estimate ± SD = 0.321 ± 0.163; see Fig. 7)

In addition to the interaction, there were also main effects of race site type and color contrast. Children in the racially heterogeneous sites were more likely to choose Darker/Local over Lighter/NonLocal as a friend than the children from the racially homogeneous sites (Estimate ± SD = 0.48 ± 0.17, $p = 0.0088$; Means ± SDs = 53.70 ± 31.07 and 42.93 ± 29.83 %, respectively).

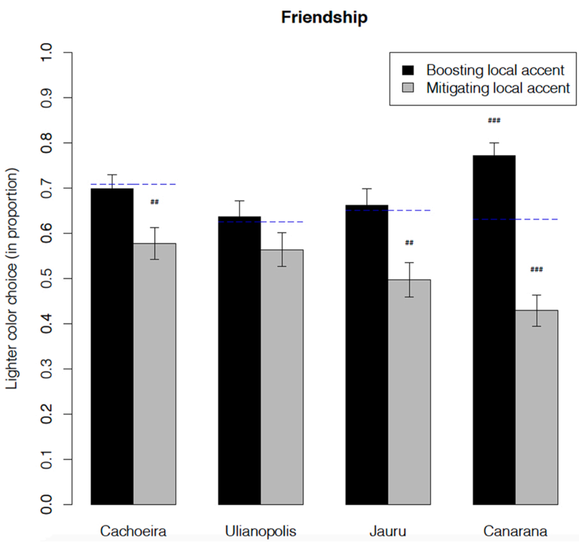

Fig. 6. Participants' choices (in proportion) for Lighter in the Boosting and Mitigating friendship trials depicted by site (higher score corresponds to higher frequency of choices for the lighter individual). Dashed lines indicate mean choices for Lighter from Study 1, for ease of reference. Hashtags indicate significant deviance from the means from Study 1 (See Table 3). Cachoeira: mono-accent, homogeneous race; Ulianópolis: multi-accent, homogeneous race; Jauru: mono-accent, heterogeneous race; Canarana: multi-accent, heterogeneous race.

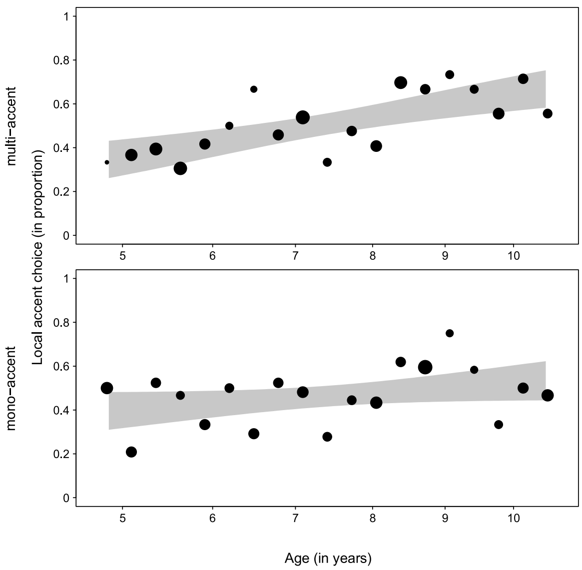

Fig. 7. The choice (Friendship) for the local-accented/darker individual over the non-local accented/lighter individual (y-axis) increased more steeply with age (x-axis) in the sites with multiple accents compared to a single local accent (y-axis). Dots represent the data, shaded areas represent the 95 % confidence intervals.

Regarding the main effect of color contrast on Mitigating trials, choice for Darker/Local was higher (i.e. choice for Lighter/ NonLocal was lower) when Pardo was contrasted with White, than when Black and Pardo were contrasted (estimate ± SD = 0.372 ± 0.177, $p = 0.036$; Means ± SDs = 58.66 ± 49.33 % and 50.18 ± 50.09 %, respectively) and Black and White were contrasted (Mean ± SD = 36.40 ± 48.20 %; estimate ± SD = 0.986 ± 0.184, $p < 0.0001$). Also, choice for Darker was higher in trials that contrasted Black and Pardo than in trials that contrasted Black and White (estimate ± SD = 0.614 ± 0.180, $p = 0.0007$). Overall, this pattern of results suggests that the local accent preference is more effective in mitigating the color preference when the color contrast is less extreme and the local-accented speaker is Pardo, rather than Black. Results by color contrast are displayed in Fig. 8.

In addition to the interaction effect of age and accent site type, there was a main effect of age. With increasing age, children increasingly opted to become friends with the (darker) local accented individual over the (lighter) non-local accented individual (Estimate ± SD = 0.31 ± 0.08, $p < 0.0001$). As noted above, the effect of age was more pronounced in the multi-accent sites.

None of the other main effects significantly affected participants' choice for the local accented individual when contrasted with the lighter, non-local accented individual (Table 4).

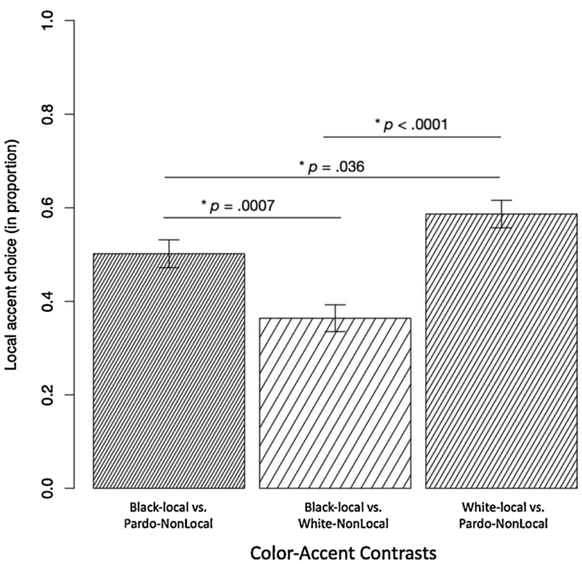

Fig. 8. Proportion of local accent choices for each color contrast (Friendship trials). Error bars display SEM.

Table 4
GLMM output, single term deletions, for the interaction and main effects on participants' local accent preferences in the mitigating trials (Friendship trials; significant effects highlighted in bold).

Predictor	Df	LRT	Pr(Chisq)
color.contrast:site.accent:site.race	2	2.517	0.284
color.contrast:participant.color:age	4	0.482	0.975
site.accent:site.race:age	1	0.069	0.794
site.accent:site.race:participant.color	2	0.016	0.992
color.contrast:site.accent	2	2.335	0.311
color.contrast:site.race	2	1.1866	0.552
color.contrast:age	2	0.409	0.815
site.accent:site.race	1	0.242	0.623
site.accent:age	**1**	**3.908**	**0.0481**
site.race:age	1	0.244	0.621
participant.color:site.accent	2	0.471	0.790
participant.color:site.race	2	3.831	0.147
participant.color:age	2	1.891	0.389
color.contrast	**2**	**31.056**	**<0.0001**
site.accent	1	1.3096	0.2525
site.race	**1**	**6.865**	**0.0088**
participant.color	2	0.6398	0.726
Age	**1**	**15.154**	**<0.0001**
Sex	1	0.412	0.521
block order	1	0.115	0.735

Table 5
Mean proportions of choice for Lighter in sharing decisions across sites with comparisons between Study 1 (all trials) and Study 2 (Mitigating and Boosting trials; M *t*-test and B *t*-test, respectively, with Bonferroni-Holm adjustment for multiple testing; significant effects highlighted in bold). Asterisks denote where means are significantly different from chance (0.5), one-sample *t*-test ($p < 0.05$). Cachoeira: mono-accent, homogeneous race; Ulianópolis: multi-accent, homogeneous race; Jauru: mono-accent, heterogeneous race; Canarana: multi-accent, heterogeneous race.

Site	Study 1 means (SD)	Mitigating means	M *t*-test (*p*-value)	Boosting means	B *t* -test (*p*-value)
Cachoeira	0.627* (0.216)	0.512 (0.318)	0.084	0.568 (0.305)	0.549
Ulianópolis	0.583* (0.190)	0.520 (0.272)	0.528	0.623* (0.325)	0.549
Jauru	0.591* (0.221)	0.531 (0.341)	0.549	0.662* (0.290)	0.528
Canarana	0.613* (0.259)	0.430 (0.317)	**<0.001**	0.689* (0.274)	0.528
Overall	*0.604* (0.222)*	*0.497 (0.314)*	***<0.001***	*0.636* (0.301)*	*0.146*

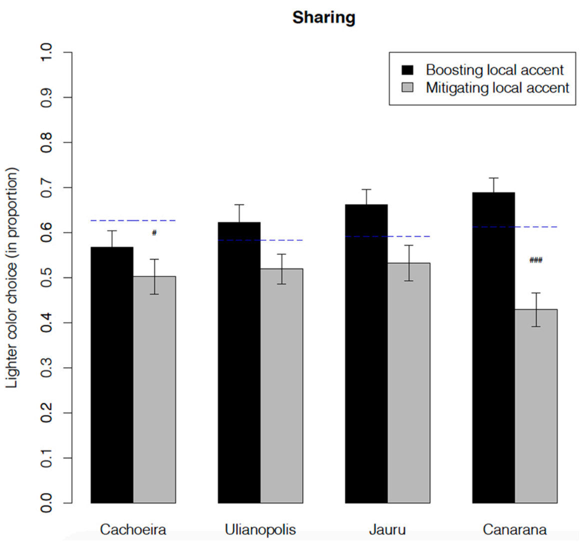

Fig. 9. Participants' lighter color choices (sharing) in the Boosting and Mitigating sharing trials depicted per site. Higher score corresponds to higher frequency of choices for the lighter individual. Error bars display SEM. Dashed lines indicate mean lighter color choices from Study 1. Hashtags indicate significant deviance from the means from Study 1 (see Table 6). Cachoeira: mono-accent, homogeneous race; Ulianópolis: multi-accent, homogeneous race; Jauru: mono-accent, heterogeneous race; Canarana: multi-accent, heterogeneous race.

3.4.2. Sharing

As above, all participants ($N = 283$) were given a color choice score, calculated as the frequency of choices made for Lighter across trials. The mean score was 56.65 % ($SD = 21.51$; 1-sample t-test against chance expectation of 50 %, $t = 5.204$, $df = 282$, $p < .001$, 1-sample t-test against chance expectation of 50 %), showing a significant overall preference for lighter-colored individuals. Overall, there was also a significant mean preference for Local (56.95 %, $SD = 22.00$; 1-sample t-test, $t = 5.317$, $df = 282$, $p < .001$). The mean color choice score across the Boosting trials was 63.60 % ($SD = 30.08$; 1-sample t-test, $t = 7.609$, $df = 282$, $p < .001$). The mean color choice score across the Mitigating trials was 49.71 % ($SD = 31.43$; 1-sample t-test, $t = -0.158$, $df = 282$, $p = 0.87$).

Although accent appears to both boost and mitigate the bias toward lighter skin color, we do not find evidence that a local accent preference overrides a light bias, in general. For trials in which the local accented individual is also the darker individual (Mitigating trials), mean choice does not significantly differ from chance.

To further examine the effect of accent on participants' color biases, we compared the results of Study 2 (with speech) and Study 1 (no speech). Mean choices for Lighter in the Boosting and Mitigating trials are shown separately per site in Fig. 9 and Table 5, and compared with mean lighter color choice results from Study 1 and against chance.

Table 5 shows results across sites of the comparisons of mean Lighter choice against chance (one-sample t-test) for Study 1 and the Mitigating and Boosting trials from Study 2. Independent sample t-test p-values are given also for comparisons between Study 1 and Study 2 means (Mitigating and Boosting trials).

Across all sites, the light-bias was less pronounced when pitted against accent (i.e., Mitigating trial means < Study 1 means). In contrast with the Friendship trials, however, no sites showed a response pattern in the Mitigating trials that significantly deviated from chance. In Canarana (multi-accent, heterogeneous race), the mean lighter color choice is significantly mitigated by the local accent alternative, but there is no evidence that a local accent bias trumps the lighter color bias. There is also no evidence that local accent significantly increases the appeal of the lighter colored individual (Boosting trials, relative to Study 1 means). Overall, accent appears to have a weaker effect on choices about sharing relative to choices about friendship.

To investigate influences of site, participant color, age, and colors contrasted, we analyzed Mitigating trials using a GLMM (see above for model specification details). Overall, the full model was significant as compared to the null model (likelihood ratio test: $\chi^2 = 57.5$, df = 31, $p = 0.0027$). A three-way interaction was found between accent site, race site and age ($\chi^2 = 3.85$, df = 1, $p = 0.0496$; see Fig. 10).

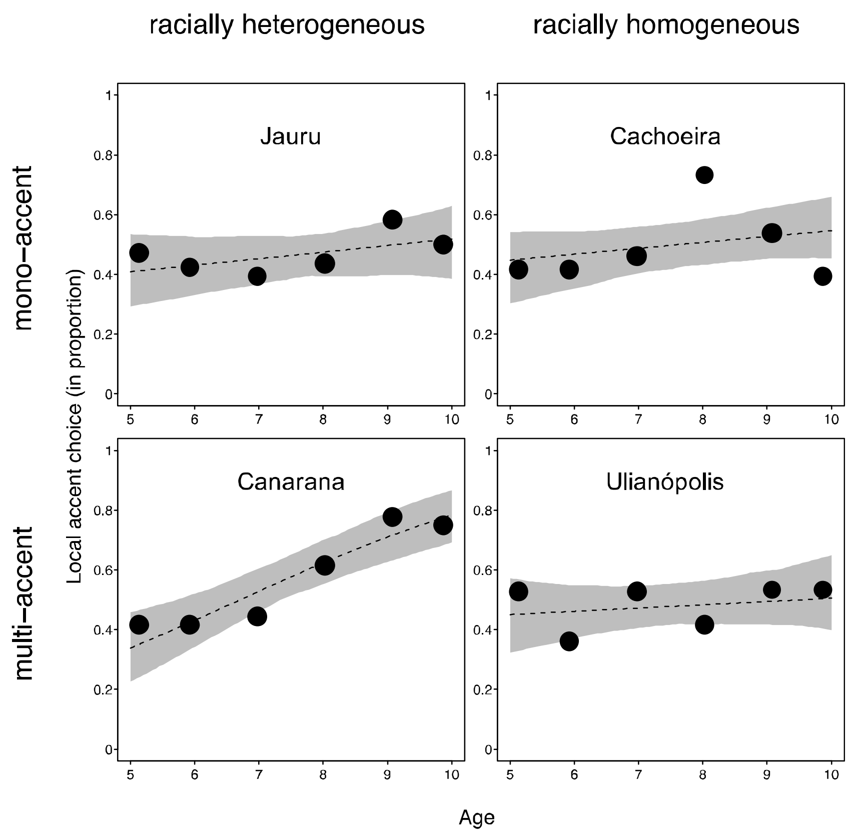

Fig. 10. Participants' local accent preferences in Mitigating trials (Lighter/NonLocal vs. Darker/Local). Accent site type (y-axis) and race site type (x-axis) interact with age (x-axis) such that the trumping effect of local accent increases most in the multi-accent, racially heterogeneous site (bottom left panel). Dots represent the data, the dotted lines represent the model lines, and shaded areas represent 95 % CIs.

For children from the mono-accent sites (Jauru and Cachoeira), there is no difference in the extent to which local accent preferences change with age according to whether they reside in the racially heterogeneous or homogeneous site (Estimate ± SD = 0.011 ± 0.252, $p = 0.966$; Means ± SDs preference for Local in the Mitigating trials across ages: for children from the more racially homogeneous sites, 48.83 ± 31.78 %, for children from the more racially heterogeneous sites, 46.95 ± 34.08 %). For children from the multi-accent sites (Canarana and Ulianópolis), however, the extent to which the preference for Local changes with age significantly varies according whether they reside in the racially more homogeneous or heterogeneous site, with the change across age being more pronounced in the site with greater racial heterogeneity (i.e. Canarana; Estimate ± SD = 0.586 ± 0.212, $p = 0.0058$; Means ± SDs preference for local accent in the Mitigating trials across ages: for children from the racially homogeneous sites, 48.04 ± 27.25 %, for children from the racially heterogeneous sites, 57.08 ± 31.66 %). Similarly, for children from the racially homogeneous sites, the extent to which local accent preferences change with age did not depend on whether they were from mono-accent or multi-accent site (Estimate ± SD = 0.040 ± 0.207, $p = 0.85$). For children from racially heterogeneous sites, however, the difference was such that when the site was also characterized by multiple accents, the change in preference for local accent was more positively pronounced than in the site characterized by only one accent (i.e., Canarana vs. Jauru, respectively; Estimate ± SD = 0.565 ± 0.245, $p = 0.021$). None of the other interactions significantly explained variation in local accent preferences over lighter skin color choice (see Table 6).

As in the Friendship trials, the choice of Darker/Local over Lighter/NonLocal also depended on the colors contrasted in a given trial (a main effect of color contrast). Choice for Darker/Local was higher (i.e. choice for Lighter/NonLocal was lower) when Pardo was contrasted with White than when Black was contrasted with White (estimate ± SD = 0.482 ± 0.178, $p = 0.0068$; Means ± SDs = 52.65 ± 50.02 % and 41.70 ± 49.39 %, respectively). Also, Darker/Local was chosen more in trials that contrasted Black and Pardo (Mean ± SD = 56.54 ± 49.66 %) than in trials that contrasted Black and White (estimate ± SD = 0.653 ± 0.179, $p = 0.0003$). Mean choices for the darker colored individual were not significantly different between the Pardo-White and the Black-Pardo contrast (estimate ± SD = 0.171 ± 0.177, $p = 0.332$). Broadly replicating the results of the Friendship trials, this again suggests that the mitigating effect of accent on color preferences is stronger when the color contrast is less stark. Results by color contrast are displayed in Fig. 11.

In addition to the three-way interaction of age, accent site type and race site type age, there was a main effect of age. Similar to the results from the Friendship trials, with increasing age, children increasingly opted to share with Darker/Local over Lighter/NonLocal (Estimate ± SD = 0.246 ± 0.08, $p = 0.0024$). As noted above, the effect of age was most pronounced in the multi-accent, racially heterogeneous site (Canarana).

None of the other main effects significantly affected participants' sharing choices in the Mitigating trials (Table 6).

We found no effect of decision type (Friendship, Sharing) on choices for Local vs. NonLocal overall (GLMM - Estimate ± SD: 0.082 ± 0.071, N = 283, p = 0.247) or in the subset of mitigating trials (GLMM – Estimate ± SD: 0.087 ± 0.105, N = 283, p = 0.406). As in Study 1, however, there was a more pronounced light bias in the Friendship trials than in the Sharing trials (GLMM - Estimate ± SD: 0.161 ± 0.071, N = 283, p = 0.023).

3.5. *Study 2 discussion*

Overall, participants showed a significant local accent preference, with the addition of speech significantly altering children's social preferences, relative to Study 1. Across sites, we found significant mitigating effects of accent on the light bias, such that darker individuals were chosen more frequently when they appeared to speak with a local accent (vs. lighter individuals who appeared to speak with a non-local accent).

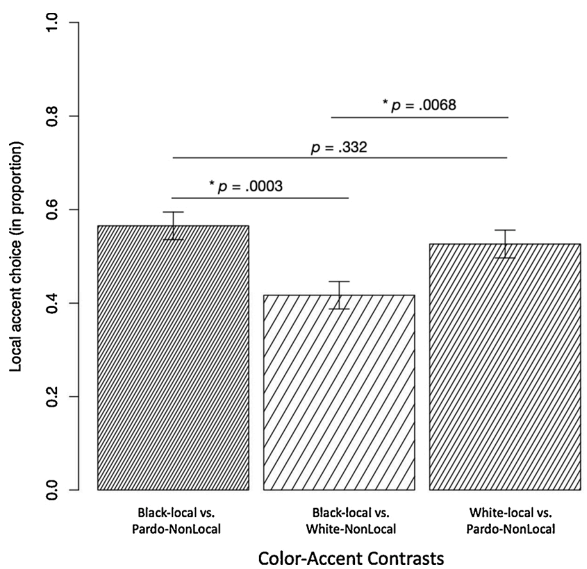

Fig. 11. Proportion of local accent choices for each color contrast (Sharing trials). Error bars display SEM.

Table 6
GLMM output, single term deletions, for the interaction and main effects on participants' local accent preferences in the mitigating trials (Sharing; significant effects highlighted in bold).

Predictor	Df	LRT	Pr(Chisq)
color.contrast:site.accent:site.race	2	4.627	0.099
color.contrast:participant.color:age	4	3.147	0.533
site.accent:site.race:age	**1**	**3.854**	**0.0496**
site.accent:site.race:participant.color	2	2.881	0.237
color.contrast:site.accent	2	0.478	0.788
color.contrast:site.race	2	1.404	0.496
color.contrast:age	2	1.175	0.556
participant.color:site.accent	2	0.082	0.960
participant.color:site.race	2	2.896	0.235
participant.color:age	2	0.798	0.671
color.contrast	**2**	**14.61**	**<0.0007**
site.accent	1	1.417	0.234
site.race	1	0.639	0.424
participant.color	2	0.832	0.660
Age	**1**	**9.230**	**0.002**
Sex	1	0.559	0.455
block order	1	2.165	0.141

Our main analyses focused on responses in the Mitigating trials to help identify those factors predicting variation in the relative effects of color vs. accent on children's developing social preferences. In contrast with Study 1, there was no general evidence of an increasing self-similarity effect of participant color, though arguably a self-similarity or familiarity effect is clear in the overall local accent preference. However, color contrast, site type and age all significantly predicted variation in the frequency with which children overall chose the darker local-accented individual over the lighter non-local accented individual. In general, accent had weakest mitigating effects among children from socially homogenous sites (race and/or accent), and among younger children, and when the local-accented individual was Black and the non-local accented individual was White. We find strongest mitigating – and potentially overriding – effects of local accent on the light bias among the older children from Canarana, our most socially heterogeneous site. These results are discussed more fully in the general Discussion.

To inform our interpretation of these results, we examined children's abilities to discriminate between the local vs. non-local accent varieties presented. Study 3 assessed and analyzed children's accuracy in discriminating the non-local speaker and analyzed results across sites and participant age.

4. Study 3: accent discrimination task

4.1. Study 3 research hypotheses

H10. Ability to discriminate between the local and non-local accent will increase with age.

H11. Accent site type will predict accent discrimination ability. Participants from multi-accent sites will discriminate more accurately, and achieve above-chance accuracy from an earlier age, than participants from mono-accent sites.

4.2. Method

4.2.1. Participants

Participants were 243 5−10 year old children, recruited within schools at the four field sites, as described in Studies 1 and 2. Eight children were excluded from the final analysis due to i) difficulty in understanding the task instructions as evidenced in repeated failure to accurately answer comprehension check questions (5), ii) voluntary withdrawal (1), iii) having already taken part in either Study 1 or Study 2 (1), or iv) falling outside the age range at time of testing (1). The final number for analysis was 235 (female, $N = 125$; mean age = 7yrs 6 m; range = 5yrs 0 m–10yrs 0 m).

4.2.2. Procedure

As in Studies 1 & 2, participants made forced-choice selections between two puppets across six trials. The stimuli used were as described for Study 2, but with two identical puppets appearing side by side on the screen. Both puppets were Pardo and were distinguished across successive rounds by t-shirt color. As in Study 2, in each trial and in turn, one puppet spoke with a native local accent and the other puppet repeated the same statement with a native Madeiran accent (European Portuguese). In the case of multi-accent towns, each participant heard the version of the native local accent most similar to their own accent. Participant accents were again identified by class teachers. In the case of mono-accent sites, the single predominant accent was used. Recordings were all as described for Study 2, with each statement used twice across the six trials. Speaker order and side were counterbalanced within participants, as was speaker identity (two speakers per accent). Three randomized orders of t-shirt color were counterbalanced across participants. At the start of each trial, children were instructed to listen carefully to each of the puppets. Then, they were asked to point to the puppet who they thought was "not from around here". The same question was used across all six trials.

4.3. Analysis

Using a similar accent discrimination paradigm, we previously found evidence of increasing accuracy with age, and greater accuracy in the multi-accent over mono-accent sites (Cohen & Haun, 2013). To explore variation along these dimensions, and to account for variation in local accent preference scores by site and age identified in our analyses of mitigating trials in Study 2, we examined effects of age and accent site type on accuracy scores (i.e., number of correct identifications of the individual with the non-local accent). As in Cohen and Haun (2013), we also explored effects by region (i.e., north: Ulianópolis and Cacoheira vs. south: Jaurú and Canarana), in case regions vary in the degree of difference between the local accents and the Madeiran accent. We also examined the age from which children achieve above-chance level accuracy.

We applied a GLMM with binomial error distribution and logit link function in the R statistical environment using the package "lme4" (Bates, Mächler, Bolker, & Walker, 2015; R Core Team, 2020). We modelled the effects of age, sex, accent site and region (North: Canarana and Ulianópolis; South: Cachoeira and Jauru) on the probability of providing an accurate response (yes/no across the six trials). The full model comprised the two-way interactions between age and accent type, and age and region, the main effect of sex, the random intercepts of subject and research site, and the random slope of trial number within subjects (Barr, Levy, Scheepers, & Tily, 2013). The null model was an intercept only model, with the same random effects structure as the full model. Permitted by a significant ($p < 0.05$) full-null model comparison (Forstmeier & Schielzeth, 2011) we inspected parameter contributions with Likelihood Ratio Tests by applying the function "drop1" with argument "test" set to "Chisq" (Dobson & Barnett, 2008). The investigation of above-chance performance per age category was done using one-sample t-tests (against 0.5). For the t-tests, an average accuracy score per individual was calculated by averaging the success of the 6 trials, such that only one score per individual was entered in the analysis.

4.4. Results

The full model provided a better fit, penalized for the number of terms, to the data compared to the null model (Likelihood Ratio Test: $\chi^2 = 68.49$, df = 6, $p < 0.001$). The two-way interactions were not significantly linked to the response (both $p > 0.45$), but accuracy of response was positively correlated with age (main effect: $p < 0.001$; estimate ± SD = 0.313 ± 0.040). Accent site and region did not significantly affect the response (both $p < 0.13$). Lastly, there was a trend indicating higher accuracy among females than males ($p = 0.090$; estimate ± SD = 0.226 ± 0.133).

Given the absence of research site effects on the accuracy scores, we tested whether children of different ages scored better than expected based on chance (0.5) across all sites. As of age 9, children scored better than expected based on chance (see Table 7).

4.5. Study 3 discussion

From 9 years old, children can reliably identify non-local individuals based on accent (though a trend can be detected from age 8, *p*-unadjusted = .03). It is possible that younger children can discriminate between the accents based on perceptual (acoustic) properties, and that social preferences for accent in young children are not necessarily guided by an understanding of geographical provenance but rather in terms of speech accents that sound most familiar vs. least familiar (Kinzler et al., 2007). However, our question specifically asked children to identify which individual "isn't from around here", tying the distinction to a potentially more advanced understanding of the association between speech accent and geographical locality/origin (see McCullough, Clopper, & Wagner, 2019). This was to reduce the number of potential parameters of discrimination (e.g., pace, pitch) that would have been introduced via a more general question (e.g., "which speaker sounds most/least like you?" or "which speaker sounds most/least familiar?"). Contrary to our previous findings (Cohen & Haun, 2013), there is no evidence that children's accuracy varies by site. Differences in study method potentially account for this. The results suggest that differing abilities to distinguish between the local and non-local accent, at least in the terms of our explicit question, do not explain site-wise variation in children's social choices in Study 2. Although there were main effects of age on accent choice scores (Mitigating trial subset), these interacted with accent site type (in Friendship trials) and race site type (Sharing trials). These findings suggest that, although participants across sites discriminate equally well between non-local and local accent from around the same age, factors beyond perceptual discrimination account for the differential effects of color and accent

Table 7
Proportions (± standard deviations) of correct identifications of the individual with the non-local accent per age class, including statistics for two-tailed one-sample *t*-tests against chance (0.5) level (with Bonferroni-Holm adjustment for multiple testing).

Age	Means ± *SD*	*t* statistic	*df*	*p*-adjusted value
5	0.47 ± 0.51	−0.32	37	1.00
6	0.45 ± 0.50	−0.64	37	1.00
7	0.55 ± 0.50	0.63	39	1.00
8	0.67 ± 0.48	2.26	41	0.116
9	0.74 ± 0.44	3.44	38	0.007
10	0.76 ± 0.43	3.77	37	0.003

on children's social preferences across sites (see SOM 2.1 for analyses of local accent choice by accent site type and age across all Friendship and Sharing trials).

5. General discussion

In this study, we conducted the first systematic comparison of 5−10 year old children's developing social preferences in relation to race (here operationalized as color) and speech accent across socio-environmental contexts differing in racial and linguistic homogeneity/heterogeneity. Overall, children's sharing and friendship preferences were guided by both color and accent. Color preferences are modulated, even neutralized, but not overridden by accent preferences. Analyses identified significant variation by age, site, participant color or color contrast, however, and these effects differed between friendship and sharing decisions. Below we summarize and discuss the results of both studies in relation to our stated hypotheses and the existing literature. First, we consider factors associated with variation in participants' 'baseline' color biases before moving on to consider the relative influence of accent and factors associated with variation in the apparent relevance of accent for decisions about friendship and sharing.

The results of Study 1 support our hypothesis that participants would more frequently choose the lighter colored individual overall in friendship and sharing decisions. However, contrary to expectation, there was no evidence that the light bias varied across sites characterized by more vs. less racial diversity. It is possible that our selected sites did not vary as much as we had anticipated based on prior census data. Our own participant data lend some support to this possibility. Although there was considerable variation between Jauru (defined as heterogeneous) and Cachoeira (defined as homogeneous) in the distributions of Black, Pardo and White participants, the distributions at Canarana and Ulianópolis were very similar (defined as heterogeneous and homogenous, respectively).

Overall, the light bias was most pronounced when the color contrast was starkest. For Friendship, there was no evidence that the light bias was mitigated by self-similarity biases, paralleling evidence from other cultural contexts showing more favorable attitudes among children from low-status, intermediary or non-dominant groups toward higher-status 'outgroups' (e.g., Newheiser, Dunham, Merrill, Hoosain, & Olson, 2014). In Sharing trials, however, a color contrast effect occurred in interaction with participant age and color. The strongest evidence potentially consistent with a self-similarity effect was found among older Pardo and Black participants when faced with a choice between sharing with a Black or Pardo individual. Intriguingly, Pardo children show a diminishing preference for White when contrasted with Black, but not when contrasted with Pardo, while Black children show a diminishing preference for Black when contrasted with White, but not when contrasted with Pardo. Both Black and White children show an increasing preference for Pardo when contrasted with White.

These results suggest that numerous factors coalesce in guiding children's social preferences. With increasing age, children are more frequently exposed to explicit discourse and cultural norms concerning acceptable attitudes to racial diversity, discrimination and equality, including via school-based education programs. We witnessed evidence of such exposure across the schools in which we carried out the research, where, for example, class art projects on race and equality were displayed on the walls. Previous research has also interpreted increased aversion to inequality among older children in terms of alignment with acceptable cultural discourse and social norms (Charafeddine et al., 2016; Fehr et al., 2008; Olson, Dweck, Spelke, & Banaji, 2011). While our study design cannot directly examine concern for fairness and equality, we find that, across participants, the light bias appears to diminish only for some contrasts and some participants with increasing age. Notably, Black children showed an age-wise *increase* in preference for the White individual when contrasted with Black. Overall, however, the evidence here suggests that cultural norms and discourse of racial equality, perhaps alongside relatively more frequent interaction with Pardo individuals than with Black individuals, guide age-wise patterns of preference across the different color contrasts.

As predicted, there was also a more pronounced light bias in decisions about Friendship than in decisions about Sharing. We tentatively interpret this finding in terms of the greater appeal of higher status (vs. lower status) individuals as friends who can better afford opportunities for access to social and instrumental benefits, and the lower perceived need of higher vs. lower status individuals in the allocation of unequal resources. This is not to suggest that Sharing decisions are uninfluenced by affiliative motivations and that they exclusively reflect need-based allocation. Rather, both factors may be at work (see Renno & Shutts, 2015b). More research is required to tease out effects of perceived relative status (dominance and majority), self-similarity and explicit equality norms on children's developing social-cooperative preferences, and to understand why decisions about cooperative behavior (sharing) vary more across participant categories and target contrasts than decisions about friendship.

Finally, analyses revealed a main effect of gender: compared to boys, girls showed a stronger light bias in decisions about Sharing. No such effect of gender was revealed in choices about Friendship. Although earlier work has explored gender differences in prosociality, with mixed results boys (e.g., Cowell et al., 2017; Kärtner, Keller, & Chaudhary, 2010; Köster, Cavalcante, Vera Cruz de Carvalho, Dôgo Resende, & Kärtner, 2016), we are not aware of any work to date suggesting that females exhibit a stronger light bias than males, specifically in relation to resource sharing (but not friendship) decisions, and we did not have a prior hypothesis of sex differences. Relevant prior research examining children's resource allocation decisions in settings involving unequal wealth or dominance among targets found no effects of gender (Charafeddine et al., 2016; Olson et al., 2011; Paulus, 2016). Further research is required to determine whether the differences reported in the current study are robust.

We now turn to discuss the effects of accent on the light bias identified in Study 1. Accent significantly modulated the light bias. Further, participants more frequently chose the darker, local-accented individual over the lighter individual with a non-local accent: accent significantly mitigated the light bias. Accent did not completely override the light bias overall, however; the overall pattern of choices for Lighter/NonLocal over Darker/Local reduced to just below chance levels. An overall 'trumping' effect would have resulted in a mean frequency significantly below chance. Analyses revealed effects of trial color contrast on the mitigating effects of accent. Accent had less success in mitigating the light bias when the Local speaker was Black or when the non-local speaker was White (irrespective of participant color). This confirms the results of Study 1 regarding the relative strength of biases across color contrasts, reflecting again the status hierarchy of Black, Pardo and White racial/color categories generally.

Preference patterns varied across sites, with strongest effects of accent in the multi-accent, racially heterogeneous site (Canarana). In the Friendship trials, the Cachoeira data showed a significant mitigating effect of accent on that site's relatively strong light bias, but the preference for the lighter individual remained significantly greater than chance. In Ulianópolis, the mitigating effect was not significant, albeit the significant light bias was eliminated (chance-level response). In Jauru, accent significantly mitigated and eliminated the light bias. Finally, Canarana showed not only a significant mitigating effect but also a significant overriding effect of accent on the light bias – children in this site, on average, preferred the darker, local-accented individual over the lighter individual with a non-local accent. In contrast, in the Sharing trials, the bias was eliminated across all four sites and accent significantly mitigated the light bias Canarana (most heterogeneous). However, there is no evidence in any site that accent preferences trump color preferences in children's decisions about sharing. Overall, these findings replicate site-wise differences in accent bias previously shown (Cohen & Haun, 2013), with the strongest accent bias in the most heterogeneous site.

In this context, we note that, although the accent heterogeneity of the adult population is readily apparent in this site, our Canarana participant sample is dominated by a single accent variety (see SOM Table S4). Given the wide catchment of the schools in which we recruited, we see no obvious source of sampling bias. One intriguing possibility is that this reflects a longer-term inter-generational process of accent homogenization, which might also be relevant to understanding this site's relatively stronger accent bias (Roberts, 2008).

Our main analyses of the subset of Mitigating trials offered further support for our hypothesis that the mitigating effects of accent on the light bias would vary between multi-accent and mono-accent sites and between racially heterogeneous and homogeneous sites. In the Friendship trials, the mitigating effect of local accent on the light bias increased more with age in the multi-accent sites as compared with the mono-accent sites. Moreover, compared to children from the racially homogeneous sites, children from the racially heterogeneous sites significantly more frequently chose the Darker/Local individual over the Lighter/NonLocal individual. In the Sharing trials, analyses identified a significant interaction of both race site type and accent site type with age. This effect was primarily driven by pattern of results in Canarana (the multi-accent, racially heterogeneous site). Here, the older children show a stronger mitigating effect of local accent on light bias, with 8, 9 and 10 year olds apparently exhibiting a preference for the local-accented individual (i.e., a trumping effect). These results suggest that, although no effects of race site type were identified at baseline (Study 1), the light bias is less robust in the face of a competing local-accent preference among children who have been exposed to greater racial heterogeneity in their community. They also point to an interesting contrast in the effects of exposure to racial variation on the light bias vs. the effects of accent variation on local accent preferences. Whereas exposure to racial variation appears to reduce the robustness of the light bias, accent variation appears to increase the strength of the local-accent bias.

This suggests that factors alongside mere exposure reduce social biases (e.g., wider social attitudes), or that different factors promote race or status biases as compared with parochial accent or familiarity and self-similarity biases. Alternatively, methodological factors might have contributed to the apparent contrast. In the current study design, whereas the Black-Pardo-White color contrasts presented corresponded to familiar and local color categories, only one of the accents was familiar (i.e., Local) while the other accent was unfamiliar. This aimed to maximize acoustic difference within native-language speech, to ensure as close to equivalent baseline discrimination between accents and between colors as possible. We know of one previous study that compared race preferences across children from more and less racially diverse regions of Brazil, finding a stronger light bias in the more diverse (and predominantly Black and Pardo) site than the less diverse (and also predominantly White) site (Sacco et al., 2019). This variability in results stresses the need for further research across different diversities, and across different but related dependent measures of social preference, behavior and attitude. Most importantly, future research should examine how the cultural significances of – and not just the differences between – locally relevant social categories influence social preferences.

Contrary to our hypothesis, children were no more likely to choose the local-accented individual in the Friendship trials than the Sharing trials. In other words, although children overall preferred the local accent, the biases guiding this preference were not differently influenced depending on whether an affiliative relationship or a resource allocation opportunity was at stake. This potentially suggests that the familiarity and similarity factors that are thought to have primacy in guiding preferences for local accent do not distinguish between affiliation and resource sharing in the same way as we have argued for status-based preferences (reflected in the light bias). Our hypothesis assumed the familiarity or similarity of the local vs. non-local accent would more strongly predict Friendship decisions than Sharing decisions, potentially via inferred traits linked to affiliative bonding (e.g., kindness; Santhanagopalan et al., 2021). This potentially underestimated the relative importance of familiarity/similarity or in-group(local)/ out-group (non-local) bias and overestimated the relative importance of non-affiliative cooperative motivations in sharing decisions. Ultimately, our evidence suggests that accent importantly guides preferences in both domains.

The results of Study 3 offer mixed support for our hypotheses. Although we do find support for the prediction that children's ability to discriminate between the local and non-local accent increases with age (see also McCullough et al., 2019), there was no evidence that abilities varied by site, and there was no significant interaction of age and site type. Thus, although these results go some way to explaining the increasing local accent preference with age in general, they offer no further insight into the interactions of age and site type in children's accent preferences. This suggests that the cross-site variation in children's social preferences is not determined by differences in discrimination ability, but rather by divergent developmental experiences and significances of accent and color/race in children's daily lives (Cohen & Haun, 2013).

The results reported here represent a significant contribution to the study of children's developing social preferences for race and accent. They amplify the scope of research to include understudied populations beyond the typical participant samples from which our understanding of social-psychological development are drawn (Amir & McAuliffe, 2020). In so doing, the research identifies significant and systematic variation along a number of parameters, including the racial and accent diversity of the social environment in which children grow up, the social behavior under study (here, friendship and sharing), the color category of the participant vis-à-vis the color categories of the target individuals, and participant development (age).

The results overall support the view that social preferences develop flexibly and sensitively according to locally relevant parameters. This suggests a much more complex picture than has typically been offered by evolutionarily informed accounts of the primacy of linguistic – and particularly accent – variation over racial variation as a guide to children' social and cooperative preferences. Irrespective of the relative salience and importance of linguistic vs. racial variation in guiding cooperation in human evolution, modern societies may have harnessed the signaling potential of both. Accent and race can serve as more or less salient and useful guides to similarity, familiarity, cultural group or social status depending on the local history, demography and social norms of the particular community. We therefore suggest that, rather than a phylogenetically specialized priority for accent in the cooperative preferences from early-to-middle childhood, children's cooperative sociality toward strangers is conditioned upon those observable characteristics (in addition to any person-specific traits) that best track potential costs and benefits of cooperation *in that social context* (Cohen, 2012). An understanding of the significant variation in children's social preferences for race and accent can have valuable applied utility for educational programs and efforts to reduce the pernicious consequences of discriminant preferences that prejudice and harm individuals from particular groups.

Our results must be considered in light of the study's limitations. First, we pitted three locally salient and familiar racial categories against two accent varieties, one of which was familiar and one of which was unfamiliar. This aimed to maximize children's potential to discriminate accent within native speech varieties, and replicated previous research contrasting race and accent, albeit familiar native vs. unfamiliar foreign, in the same design (Kinzler et al., 2009). Arguably, pitting familiar accent variations and familiar racial variations against one another in the same paradigm would produce different results. Further research is needed that goes beyond comparing generic social traits, such as race, accent, gender, and age, under the assumption that these dimensions carry the same meanings across socio-cultural contexts. We must also look beyond mere exposure effects to explore how local meanings tied to accent and color/race influence children's developing preferences.

Second, a number of methodological aspects of this study that were designed primarily with experimental control in mind potentially compromise applicability to real-world social decision scenarios that children regularly face. In the absence of a validated stimuli set, we used two sets of puppets, each of which varied on hair type and skin and eye color only. That the status-based differentials evidenced in Brazilian society generally were replicated give us confidence that our stimuli successfully elicited children's real-world biases. The children in our sample would have been familiar with puppets (and similar such representations, e.g., cartoon characters in television animations) and we do not believe that they would have found them strange in the context of our study. However, for better applicability of study results to real world social situations, future research should use more ecologically relevant stimuli sets, such as the recently developed BIC-Multicolor, a White, Pardo, and Black children picture set (Sacco, Couto, & Koller, 2016). The use of photographic images would also enhance comparability with closely related previous research on which our study design is based (Fehr et al., 2008; Kinzler et al., 2009), and enable a wider spectrum of racial/color categories to better capture the range represented among our participants. This could also help to elicit meaningful subjective identifications of self-similarity to target individuals among even very young children (rather than relying on experimenter identification or reasoning about self in relation to a limited set of abstract categories).

Finally, our study also used a forced-choice design. Supplementary observations of children's behaviors in freeplay situations and their actual friendship networks could explore whether the biases we identified in the forced-choice scenario are also apparent outside of the controlled experimental setting. Participant color was also identified by the experimenter in terms of only three categories – Black, *Pardo* and White - and in relation to the target stimuli. Future research could more sensitively probe effects of children's developing self-identification with a wider range of color or race categories and how this is influenced by background and experience.

6. Conclusion

This research supports an account of social preferences for race and accent emerging through ontogenetic specialization. We suggest that through the course of their development, children learn to evaluate others as cooperative partners in terms of similarity to self and familiarity as well as status and prestige, among many other person-specific traits, and they learn how these parameters are associated with locally salient social markers. As argued previously, both color/race and accent are hard to hide and hard to fake and, as such, may have an advantage over other markers of cooperative potential (e.g., in-group conventions, affiliation-related behaviors) that can be easily copied and displayed or discarded at will. Further research is required to explore whether a more general sensitivity to the reliability of social markers may have been selected in human evolution and whether this contributes to children's early emerging language and race preferences in cooperation. We hope that this research will motivate further investigation across a much wider range of contexts to better develop our scientific understanding of the dynamic interplay among evolution, ontogeny and social environment in human cooperative sociality.

Data statement

Due to concerns about participant anonymity and confidentiality (due to small subsamples of participants across categories for analysis, e.g., site, color and age), the dataset for this research has not been made available in an online data repository. However, we strongly support open science data-sharing for collaboration - requests for data and code can be made directly to the authors.

Author contributions

EC: Conceptualization, Methodology, Project Administration, Investigation, Writing – original draft; EJCvL: Formal Analysis, Writing – review and editing; AB: Investigation; DBMH: Conceptualization, Writing – review and editing

Acknowledgements

We thank all participating schools across our sites for assistance with data collection. For contributions to preparation of materials and for field assistance, we thank Glaciele Ferreira de Abreu, Antonio Aroca, Darlice Ribeiro da Costa, Juliane Dauksch, Jan Keil, Sandy Kennert, Vanise Muribeca, Sylvio Tüpke and Luisa Soares. E.C., E.J.C.v.L., A.B., and D.B.M.H. were supported by the Max Planck Society for the Advancement of Science. E.J.C.v.L. was furthermore supported in part by the ERC (grant agreement no. 609819, project SOMICS) and the Research Foundation Flanders (FWO).

Appendix A. Supplementary data

Supplementary material related to this article can be found in the online version, at doi:https://doi.org/10.1016/j.cogdev.2021.101111.

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