Original Research Article

Cultural Predictors of Facial Ethnicity Preference in the Miskitu and Mestizos of Rural Nicaragua

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Abstract
Both basic visual experience and cultural associations with race and ethnicity may contribute to the extent observers do or do not favor some facial ethnicity cues over others. Given that visual media contain a highly biased selection of faces, with Whiteness both over-represented and strongly privileged in film and television, communities for whom visual media are relatively novel may experience an additional, pervasive source of attitudes to facial ethnicity markers. In the current research, we compared individuals of Mestizo and Miskitu identities living in communities on the Caribbean Coast of Nicaragua with, and without, regular access to television on their relative preference for facial stimuli manipulated to look more or less White (Black vs White, Black vs Mestizo, Mestizo vs White). Results showed that all communities showed an overall preference for images with lighter skin, although changes in facial shape did not affect preferences. Those who had attended more years of education preferred whiter faces than those with less education, and those who watched more television preferred whiter faces more only where color (rather than shape) had been manipulated. Results are discussed in terms of the broader relations around ethnicity, status, and technological transition in this area.

Keywords
colorism, media, television, Miskitu, Miskito, Garifuna, Mestizo

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Introduction

This work concerns the influence of acculturation, focusing on television exposure, on visual preferences for faces which display more or less White European features, in terms of both facial shape and color, among a rapidly economically developing population in rural Nicaragua. As we discuss below, visual and cultural experience may contribute to how observers cognitively process faces, as well as the value they attach to different kinds of physical features. Here, we use the naturalistic experiment of increasing television access within a geographically remote rural region to examine if and how cultural experience can affect preferences for subtle cues to facial ethnicity among those not typically exposed to European faces and fair skin in daily life.

Research Context

The current study was part of a larger program of research investigating the impacts of television access on appearance ideals and body image in the Caribbean Coast of Nicaragua, specifically in an area of the Southern Caribbean Coast Autonomous Region (RACCS) where television access was rapidly increasing (Boothroyd et al., 2016, 2020; Jucker et al., 2017; Thornborrow et al., 2018, 2020, 2022). For the vast majority of inhabitants in the participating communities, at the time the project commenced, access to visual media was exclusively through television—both broadcast satellite media, and DVDs. In the last 15 years, the government has been extending the electricity grid across the more remote rural areas of the region. As discussed in other publications, televisions and satellite dishes are a common first or second purchase (alongside fridges) once households gain electricity access. As such it becomes possible to compare individuals living in very similar, geographically close communities where the primary difference is that one village has electricity while the other does not. Our previous studies concentrated on preferences for female body size and shape, assessed by asking participants to rate bodies of differing weights and shapes for attractiveness. We found not only that villages with higher access to TV (via electrification) had a preference for slimmer bodies, but that individual differences in amount of TV consumed likely drove much of those village-level differences, likely because of the over-representation and positive presentation of thinner bodies in the media consumed (Boothroyd et al., 2020; Jucker et al., 2017).

Just as the media consumed by these communities is unrepresentative in terms of female body shapes and sizes, so too is it unrepresentative in terms of the race and ethnicity of those on screen. The local population in our research area is ethnically diverse and includes large numbers of people with indigenous Amerindian and African ancestry. Globalized media is, however, dominated by individuals of European descent (see, for example, Smith et al., 2016, who found that 72% of actors in mainstream American films and television were "White" and 6% Hispanic) and fairness of complexion is widely associated with positive traits in media (Ashikari, 2005). This pattern is also reflective of Nicaraguan satellite television. Even where those on screen are Mestizos (i.e., European with some Amerindian ancestry), they tend to be those with more European features. For instance, programs typically favored by our participants include the national news (which by our observation in the field is presented by individuals of overwhelmingly European Spanish ancestry), sports, Mexican and Colombian telenovelas (which have c. 92% "white skinned" actors: Rivadeneyra et al., 2007) and Hollywood action movies (known locally as "Van Dammes" or "fighting pictures"). Increased access to television, therefore, represents a potentially novel form of influence on attitudes and preferences regarding cues to ethnicity (concentrating on facial appearance in the current paper) as well as to body size and shape.

Cognitive Processing and the "Own Race Bias"

Facial preferences are typically assessed by asking participants to rate naturally varying stimuli for attractiveness, or (as in our case) presenting pairs of stimuli manipulated to differ on some

traits of interest and asking participants to indicate which image they prefer in each pair. One route through which media has potential to impact such preferences around facial indicators of ethnicity, is the impact of visual experience on underlying cognitive models of face processing. It has long been argued that visual experience allows us to build models of what faces look like (a "facial prototype") which forms the basis of representation for all those faces we view. There is clear evidence that children and adults have models of faces which are flexible in this way; viewing a series of faces distorted in one way leads to the perception that other faces distorted in that same manner are more "normal looking" and more attractive (Anzures et al., 2009; Bestelmeyer et al., 2008; Rhodes et al., 2003). Importantly for our purposes, it has been suggested that faces which are closer/more similar to our underlying facial prototype (i.e., more "average" relative to the observers own population) elicit more positive affect as they are easier to process (fewer deviations from prototype need to be "coded" by our brain) (Langlois et al., 1994; Rubenstein et al., 1999; Sangrigoli et al., 2005). As such, long term experience with a biased selection of faces from among the total human range of features, could result in processing advantages and preference biases for similar faces (Batres et al., 2017). The tendency to show a processing advantage for own race faces appears in infancy (Burke et al., 2013; Rhodes et al., 2001) and there is clear evidence that it is experience based. For instance, children of Korean background show a processing bias toward European faces when they have migrated to France earlier in childhood, but those who migrated in adolescence showed a processing advantage for Asian faces (Sangrigoli et al., 2005). Similarly, research with White Australians and Japanese participants showed that individuals within these cultural contexts tended to prefer faces of their own ethnicity to faces of the other ethnicity (Rhodes et al., 1989, 2005) (although cf., for example, Burke et al., 2013; Rhodes et al., 2001; Stepanova & Strube, 2018). The evidence for facial ethnicity processing "specialisation" in childhood might lead us to suppose that face preferences in this regard are relatively fixed in adulthood. However, as noted above, experimental studies have shown that there nevertheless remains plasticity in adult participants' general face prototypes and preferences. Furthermore, depending on the duration of exposure and the type of stimuli used (e.g., familiar versus unfamiliar), effects of exposure have been documented to last up to a week post-test (Carbon & Ditye, 2011) indicating that these impacts are not only due to short term visual aftereffects. As such we might predict that extensive novel/increased exposure to other-ethnicity faces in adulthood may yet modulate ethnicity biases developed at a younger age by adjusting the underlying prototype against which each face is coded.

Colorism and Cultural Impacts on Attitudes to Facial Ethnicity

Another dimension to consider in terms of how media may influence attitudes to facial cues to race and ethnicity, is the positive and negative associations made in media with markers of ethnicity. As noted above, Whiteness tends to be positively valenced in globalized mass media. While this partly takes the form of actors and presenters with European appearance being positively presented, it is also reflected in privileging of fairer skin (colorism) and more European/less Black/indigenous features *within* afro-descent and indigenous actors and presenters. Children of all ethnicities internalize a "white is good" stereotype from an early age (for review, see Gastelum et al., 2021) even among Black children in contexts where the majority of their peers (but not necessarily media or cultural status holders) were Black (e.g., South Africa: Shutts et al., 2011). Latino/as living in the United States have also reported negative messaging within their communities around darker skin and indigenous features, including pressure to obscure their own ethnic appearance markers (Gastelum et al., 2021). Within Latin American countries, skin tone has been observed to be linked to socioeconomic status (being a stronger predictor of educational disadvantage than ethnic identity across eight countries: Luján Villar & Luján Villar, 2019; see also Ortiz Hernández et al., 2018) and appearance satisfaction in Mexico was significantly linked to skin tone (Ortiz Hernández et al., 2018).

In Nicaragua, there are multiple aspects in which ethnicity may relate to status. Nationally, those in positions of power and with highest socioeconomic status are Mestizo. Within the Caribbean Coast, Creoles historically had high status due to their closer relationship with (and partial descent from) British colonists, their leadership roles within the coastal region prior to unification with Nicaragua, and their long-running trade relationships with Americans. Some within the region still consider Creoles as wealthier (see, for example, Jamieson, 2003; Ubieta Huerte, 2021)—although it is important to note the distinction sometimes made between lighter skinned Creoles (who, for instance, older Miskitus in the communities where we collected data, might favor as spouses for their offspring) and darker skinned Creoles descended from migrant laborers from Jamaica and the United States in the early C20th (see Gordon, 1998, for a history of Creoles in Nicaragua). However, the (Afro-) Amerindian Miskitu ethnic group had historically also held power in large parts of the coast, and regional government in the modern northern autonomous region has been heavily dominated by the Miskitu (Herrera & Salomon, 2010). Furthermore, in both North and South Atlantic regions, migration of Mestizos to the coast has resulted in increased presence of sometimes high-status Mestizos to mirror the national government (our observations). Although there is recent evidence of a general bias against indigenous and afro-descent communities at a national level (see discussions in, for example, Borracco, 2019) and a belief on the coast that they are considered lower status (see, for example, Narcisso, 2012), informants in locally led research on the coast have also suggested that discrimination occurs among all ethnic groups against others ("hay segregación racial dentro de cada etnia," Ubieta Huerte, 2021) and promoting multicultural understanding and well-being is a particular focus of some local institutions, such as la Universidad de las Regiones Autónomas de la Costa Caribe Nicaragüense (URACCAN).

Altogether then, there is evidence that the privileging of European features or whiter skin may be driving biases against indigenous features and darker skin in Latino and Black populations, and that the complex historical relationships between status and ethnicity on Nicaragua's Caribbean coast in particular means that the presence in visual media of unambiguous "White bias" has the potential to exert an additional directional influence on attitudes to facial ethnicity cues in this area.

The Current Study

Our aim therefore was to assess the existing levels of facial ethnicity bias in the coastal region, and to determine whether increased access to television was driving preferences more strongly toward whiter faces. As part of a larger study, we recruited participants from five villages: two Miskitu-dominant villages (one with and one without mains electricity), two Mestizo villages (one with mains electricity and the other with a small number of solar panels only), and a Garifuna village with a large Mestizo minority (which had no electricity at all at the time of testing.) We also tested 40 participants from the Nicaraguan capital, Managua, as a baseline for urbanized Nicaraguan preferences.

While Mestizos have substantial European ancestry, they generally nevertheless remain facially distinct from Iberian Europeans in many countries due to admixture with indigenous groups in the early colonial period. The Miskitu are an ethno-linguistic group specific to Nicaragua and Honduras; they tend to have wide cheekbones, darker skin than Mestizos, and straight or wavy black (or sometimes red) hair. The Garifuna are a linguistic group of African descent with some indigenous admixture and are considerably darker in skin tone than Miskitu or Mestizos. Our study area also has large Creole communities, and residents of the region often marry between ethnic groups, such that the ethnicity with which individuals identify is not always predictive of phenotype. All five communities and the broader ethnographic profile of the

population are described in detail by Boothroyd and colleagues (2020). Extensive discussion of the Miskitu population can be found in Jamieson (2003).

   Because our focus was on the impact of visual media on preferences for "European" features, we focused our analyses on the two ethnic groups for which we had good representation across high and low media environments: the Miskitu and Mestizos. Garifuna residents of village G1 were retained for initial comparison but not included in television analyses. Our participants viewed stimuli which varied in the extent to which they looked Black versus Mestizo, Black vs European, and Mestizo vs European. That is, we selected racial categories representing two of the ethnic groups in the region (one being nominally higher status, and definitely more European-descent than the other) and the White faces dominant in the media. We predicted that Mestizos would prefer more Mestizo/European faces than Miskitu participants, with Garifuna participants showing the weakest preference for European features. We further predicted that those with greater access to television would show stronger preferences for Mestizo over Black faces and European faces over both.

Methods

Ethics

The research was approved by the Durham University Department of Psychology ethics committee (application 13-17). J.-L.J. was a visiting scholar at URACCAN during the project, and although there was no constituted local ethics committee to consult, community members from village M2 gave feedback on methods prior to full scale data collection. Communities were approached for participation through intermediaries and community leaders often facilitated the research, for example, through allowing data collection in a community meeting house. Participants had mixed levels of literacy, and so were given participant information in the form of a scripted verbal explanation. Likewise, consent was taken verbally. At the end of the project participants were verbally debriefed. We recruited participants considered to be adults in their community. This included some individuals considered minors in the UK (it is not uncommon to live independently with a partner and children before 18 in some of these communities); those under 16 or over 75 were tested with a guardian present. Some women also sought permission from their husbands before participating (particularly in village S1).

Participants

192 individuals were recruited from five villages, as summarized in Table 1. Participants were selected through opportunity sampling and word of mouth and were aged 15 to 78 years. All participants were recruited as part of a larger study examining the impacts of television on body ideals. This larger study had a recruitment target of 40 in each location. Participant numbers in the current study reflect exclusion of Creole, Ulwa, and mixed ethnicity participants from that larger sample. Although village G1 also contained a number of Garifuna and (in smaller numbers) Creole residents, there were insufficient numbers of these ethnic groups in our other locations to avoid TV/ethnicity collinearity. Analyses were therefore restricted to Miskitu and Mestizo participants only unless otherwise specified. An additional 40 participants (21 male) were recruited in the national capital Managua and were also included alongside the Garifuna participants in one additional analysis across locations for comparison purposes.

Facial Ethnicity Stimuli

Stimuli were created by manipulating target faces along multidimensional continua representing the shape and color differences between a pair of exemplar faces of differing ethnicity.

Table 1. Profile of Villages.

| Village		N	% female	Mean age	Primary subsistence	Electricity supply
M1	Miskitu	31	55	31.7	Farming	One domestic generator
M2	Miskitu	50	64	24.1	Farming/Fish	Mains (since 2008)
S1	Mestizo	40	52	28.5	Farming	Some solar
S2	Mestizo	36	50	29.8	Farming	Community generator (since 2009)
G1	Mestizo	14	43	31.4	Farming/Fish	None
	Garifuna	21	33	28.1		
Managua	Mestizo	40	48	27.9	Urban industries	

Note. Villages have been anonymised with a letter code indicating the dominant ethnicity in the village and number, where higher numbers within each letter code indicate greater TV consumption within the village. M = Miskitu; G = Garifuna; S = Mestizo/Spanish.

Male and female exemplars of three ethnic groups were utilized, consisting of composites of 20 male (mean age 23 years) and 20 female (mean age 22.6 years) Afro-Caribbean faces drawn from a Jamaican sample (Penton-Voak et al., 2004); 38 male (mean age 20.7 years) and 43 female (mean age 20.5 years) faces drawn from a Salvadoran sample (Batres & Perrett, 2014); and 24 male (mean age 21.1 years) and 26 female (mean age 20.3 years) White British undergraduate students. Composite facial images were created in Psychomorph (Tiddeman et al., 2001). 179 facial landmarks were positioned on each original image; the average x/y coordinates are then calculated for each landmark and once the original faces have been warped into that shape, the average red, green and blue coloration is then calculated for each pixel in the image. The resulting composites thus show the "average" shape and color information for the relevant group of facial stimuli. Transforms are then created by calculating the differences in x/y coordinates (for shape information) and/or coloration between two exemplar composite images, and applying that difference to a specific face. In our case, we use the composites as both the faces to which changes were applied, and the reference points for calculating differences between exemplars.

Black-Mestizo stimuli were created by adding and subtracting 15% of the differences between same-sex Jamaican and Salvadoran composite images from the Jamaican composite. Similarly, Black-European stimuli were created by adding and subtracting 15% of the differences between the Jamaican and British composites to the appropriate sex of Jamaican face, and the Mestizo-European stimuli were created by adding and subtracting 15% of the differences between the Salvadoran and British composites from the Salvadoran composite. This process is further illustrated in the Electronic Supplementary materials. These transforms were performed for just shape differences, just color differences, and for shape and color together. There were thus 18 image pairs in total: three male and three female for each ethnic comparison. All stimuli were masked to show only the face. All pairs of stimuli with shape and color manipulated are shown in Figure 1.

Procedure

Participants were tested alone (unless a guardian was present) and in a quiet location in their village. They first completed a verbal questionnaire in which they reported their ethnicity, years of education, income last year in Cordoba and U.S. dollars (converted to US$ for analysis), whether they had access to a television (in their own home or in a friend's home they visit) and how many hours of television they had watched in the last 7 days. Because TV consumption was highly skewed, the natural logarithm of hours watched was used in the analyses as per Boothroyd et al. (2016, 2020)
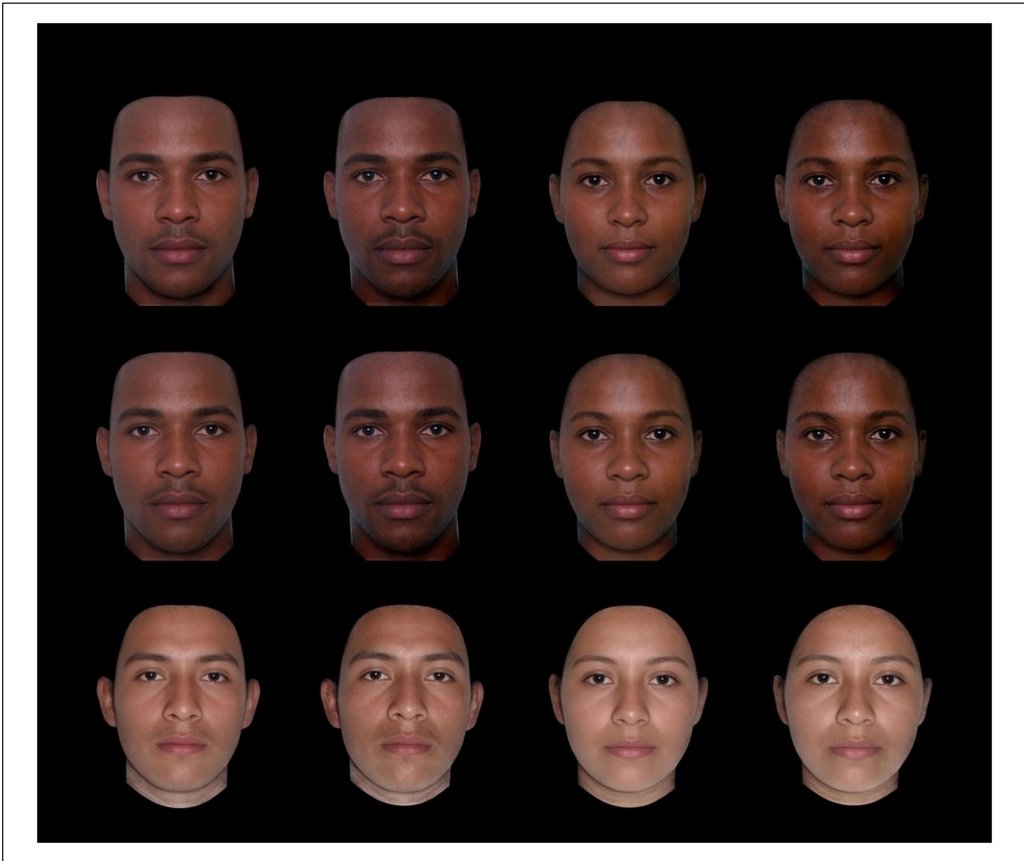
Figure 1. Stimulus Pairs for Jamaican-British Transform (Top Row), Jamaican-Salvadoran Transform (Second Row), and Salvadoran-British Transform (Bottom Row) Showing Combined Shape and Color Manipulations.
*Note.* "Whiter" face is on the left in each pair (for stimuli with just color or just shape manipulated, see Supplementary Material.).

with original values of zero mapped onto zero in the transformed data. Participants also completed a measure of acculturation; however, this measure was excluded from analyses as it was essentially a proxy for Mestizo ethnicity (see Boothroyd et al., 2020, for more details on questionnaire measures).

Participants then completed the *Facial preference task.* Participants viewed all ethnicity stimuli in a randomized order on a laptop, and were asked to verbally indicate which face within each pair they found most attractive (Creole: "*better, more attractive, more good looking*"; Spanish: *más atractivo*).

Analyses

Preferences were assessed both in terms of an overall score per participant and at trial level for all images. Overall preference scores were calculated as the proportion of trials in which participants selected the "whiter" face, in each pair for male and female faces separately; these data were analyzed across villages for rural Mestizo and Miskitu participants only, and in an additional analysis including Garifuna participants and urban Mestizos from Managua. Trial level
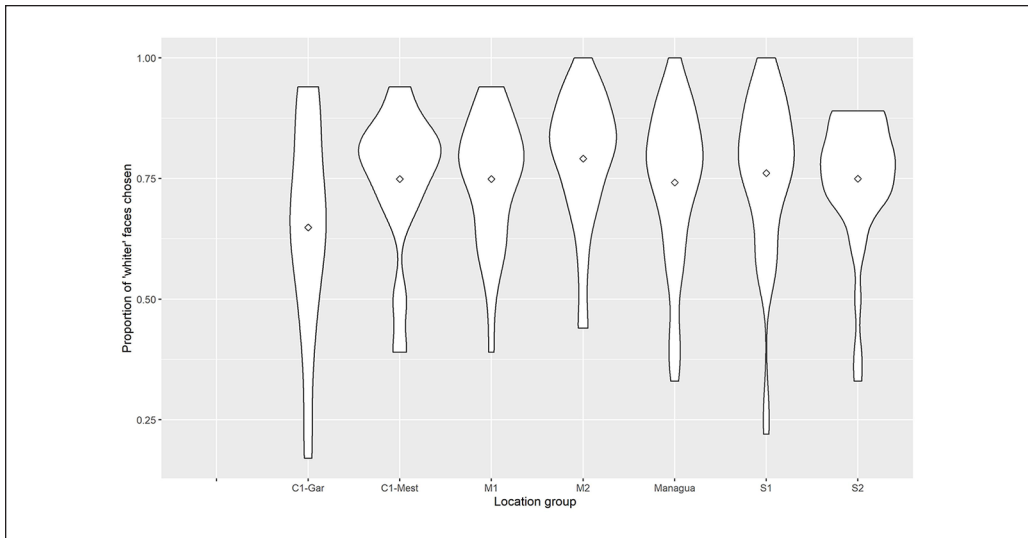
Figure 2. Preferences for Facial Ethnicity Across Communities.
Note. Data from G1 Garifuna residents and Mestizos from Managua are included for comparison. All main analyses concentrate on rural Miskitu (M1, M2) and Mestizo (G1, S1, S2) participants.

scores were a binary outcome of whether the participant chose the "whiter" face or not on that specific trial. Note we use "whiter" here to indicate both color changes, and shape changes, in a more "European" direction (where British > Salvadoran > Jamaican). Although these data showed some skew (see Figure 2), exponentially transformed data yielded the same pattern of results. As such the original scores were retained for ease of interpretation. Trial level analyses were only run with the rural Mestizo and Miskitu participants. Sex of face, sex of participant, ethnicity of participant, and ethnicity of the stimuli were all coded with dummy variables (for sex 0 = male, 1 = female; for participant ethnicity 1 = Mestizo, 0 = Miskitu). For the stimuli, separate dummy variables were created for ethnicity of the "base face" (i.e., the face to which the transform had been applied; Black = 0, Mestizo/Salvadoran = 1) while the "target face" was the whiter face that base face had been manipulated "towards" or "away from" (Mestizo/Salvadoran = 0, European = 1). Main analyses were pre-registered (https://osf.io/49rkc/register/565fb3678 c5e4a66b5582f67; Research Question 3); deviations from pre-registration are identified in text below. Data cannot be published due to risk of participant re-identification in small communities, but analysis code and output is included as supplementary material.

Results

A mixed analysis of covariance (ANCOVA) (face sex × participant sex × village with age of participant as covariate) of facial ethnicity preference in Miskitu and Mestizo participants from the five communities found no significant overall differences between villages in terms of preferences for "whiteness" in faces ($F_{4,159}$ =.45, p = .78, η = .01) and no other main effects or interactions (all F < 1, all p > .15, all η < .05). An additional analysis including participants from Managua and Garifuna residents of village G1 likewise showed no group differences although the Garifuna participants showed a lower overall mean (see Figure 2).

Despite the similarity across communities, planned correlation analyses with rural Miskitu and Mestizo participants showed that there were associations with ethnicity preferences in at least one sex of face and education (male and female stimuli) and TV consumption (female

Table 2. Zero-Order Correlations (With p Values) Between Predictor and Control Variables, and Facial Ethnicity Preferences, Across All Participants.

	Facial ethnicity preferences, $N = 170$			
	Male faces		Female faces	
	r	p	r	p
Age	−.058	.453	−.102	.184
Education (years)	.180	**.019**	.167	**.029**
Income ($)	.057	.464	−.017	.825
Ln (hours of TV)	.057	.464	.158	**.040**

Note. TV = television. Significant results are indicated in bold.

stimuli only) such that those who had spent more time in education or who watched more TV preferred "whiter" faces. Values can be seen in Table 2.

These associations were further tested in a three-level binomial-logistic random intercept model performed on data at the trial level, with participant and village included as random effects and face chosen ("whiter" vs "less white") as the binary outcome. Maximum likelihood modeling was performed in R 4.0 (R Development Core Team, 2021) using the *glmer* function and Laplace approximation (Bates et al., 2015). Variance partitioning in an initial model which also included stimulus pair as a random effect showed minimal variance at the village level, with the remaining variance at the stimulus and participant level (see Table 3). Village was therefore excluded as a random effect from further analyses. Similarly, because our next model fully described all trials with fixed effects, stimulus was not included as a random effect, in contrast to our pre-registered analysis plan (including it led to singularity effects and poor convergence).

Image characteristics were entered into Model 1 (face sex, ethnicity of base face, ethnicity of target face, and whether shape and color had been manipulated). Of these, only color manipulation was associated with preferences, such that "whiteness" was preferred more often in faces where face color had been manipulated (see Table 3 for model coefficients). Overall, participants selected the "whiter" faces in 86% of trials where color alone had been manipulated, 88% of trials where color and shape had both been manipulated, and only 54% of trials where only shape had been manipulated.

Further models therefore retained a fixed effect to indicate whether or not the stimuli had been manipulated for color but dropped additional image level predictors. Participant age, sex, and ethnicity were entered in Model 2, followed by TV consumption in Model 3. Following suggestions from co-authors made subsequent to analyses pre-registration but prior to analyses being run, the interaction between TV consumption and color manipulation was added as a cross-level interaction in Model 3. Although TV consumption did not significantly predict overall preferences, the slope for the association was significantly stronger where color had been manipulated, as indicated by a significant interaction term. That is, participants were more likely to prefer whiter faces when watching more television, in terms of color, but not shape. We then added education, as this had been a significant correlate of preferences above. Education significantly predicted preferences in Model 5, such that those with more education preferred "whiter" faces more often. Again, however, this was subject to an interaction with stimulus color manipulation, such that the effect of education likely exists for images manipulated in color but not only in shape. Coefficients can be seen in Table 4. We note that models including education produced convergence warnings. However, additional Bayesian analyses using *brms* produced identical estimates (see Supplementary Materials).

Table 3. Mixed Effects Models Showing Variance Partitioning (Model 0) and Stimulus Characteristics (Model 1).

	Model 0			Model 1		
Predictors	Odds ratios	*SE*	*p*	Odds ratios	*SE*	*p*
(Intercept)	3.94	0.22	<**.001**	1.12	.18	.514
Face sex				0.89	.09	.224
Shape manipulated				1.16	.13	.254
Color manipulated				7.3	.12	<**.001**
Base face ethnicity				0.83	.11	.098
Target face ethnicity				1.08	.11	.525
Random effects						
σ^2	3.29			3.29		
$\tau_{00\ participant}$	0.52			0.53		
$\tau_{00\ trial}$	0.82					
$\tau_{00\ village}$	0.00					
ICC	0.29			0.14		
$N_{village}$	5					
$N_{participant}$	173			173		
$N_{counter}$	36					
Observations	3,222			3,222		
Marginal R^2/conditional R^2	.000/.291			.178/.292		

Note. ICC = Intra-Class Correlation. Significant results are indicated in bold.

Discussion

Our key prediction was that increased access to, and consumption of, visual media through television would be associated cross-sectionally with a preference for whiter faces. Although we had a strong hypothesis that over-representation of Hispanic/Mestizo and European faces on Nicaraguan television and in movies would lead to an increased bias in favor of whiter faces when participants watched more television, there were no overall differences between locations in facial preferences despite documented differences in television access between those locations. In individual level analyses, TV consumption predicted preferences for "whiter" faces where color had been manipulated but not where shape alone had been manipulated. Thus, although previous studies have suggested that facial ethnicity processing may be predominantly driven by early experience (Sangrigoli, 2005) we do find suggestive evidence that attitudes to skin color specifically may remain subject to visual cultural influence in adulthood. This is consistent with our other data showing that body weight preferences in this population are subject to influence by visual media and suggests that multiple aspects of appearance ideals may be changing during the current period of technological transition and increasing connectivity.

 We also found that education was a significant predictor of preferences for whiter faces both in the initial correlations and in the final models. Our observations in the field were that although the printed materials used in local schools were modest in number (most students shared textbooks), illustrations in the books were entirely composed of Mestizo and European individuals. This is not surprising as all materials are produced and chosen by the Mestizo-majority central education ministry. More pertinently, however, when we questioned participants in G1 and S1, in a later round of data collection for a related study (Boothroyd et al., 2020, Study 2) many of those who had completed higher levels of education (i.e., past age 12) did so at least in part by traveling to larger towns and cities (common locations for high school included the regional capital Bluefields and the town Rama) and staying with relatives during their studies. Similarly, before the opening

Table 4. Mixed effects models showing effects of color manipulation and participant level predictors.

Predictors	Model 2			Model 3			Model 4			Model 5			Model 6		
	Odds ratios	SE	p	Odds ratios	SE	p	Odds ratios	SE	p	Odds ratios	SE	p	Odds ratios	SE	p
(Intercept)	1.53	0.24	.079	1.25	0.27	.413	1.51	0.28	.139	0.91	0.31	.756	1.23	0.32	.512
Color manipulated	6.73	0.1	**<.001**	6.73	0.1	**<.001**	4.59	0.13	**<.001**	6.74	0.1	**<.001**	3.61	0.16	**<.001**
Age	0.99	0.01	.144	0.99	0.01	.285	0.99	0.01	.315	—	0.01	.589	1 —	0.01	.613
Sex (female)	1.11	0.15	.496	1.11	0.15	.484	1.1	0.15	.511	1.13	0.14	.382	1.13	0.15	.398
Ethnicity	0.98	0.14	.888	0.99	0.14	.952	0.98	0.15	.9	1.08	0.15	.587	1.08	0.15	.61
Ln (TV hours)				1.1	0.06	.113	0.95	0.07	.493	1.03	0.06	.638	0.95	0.08	.499
Education										1.04	0.02	**.037**	1.01	0.02	.707
Color × TV							1.35	0.08	**<.001**				1.19	0.09	**.039**
Color × Education													1.08	0.02	**.004**
Random effects															
σ^2	3.29			3.29			3.29			3.29			3.29		
τ_{00}	0.51			0.50			0.53			0.51			0.49		
ICC	0.14			0.13			0.14			0.13			0.13		
N	173			173			173			173			173		
Observations	3,222			3,222			3,222			3,222			3,222		
Marginal R^2/conditional R^2	0.178/0.289			0.181/0.290			0.197/0.308			0.212/0.319			0.185/0.290		

Note. Significant results are indicated in bold.

of a high school in village M2 in 2012, high school education required travel to Pearl Lagoon town or Bluefields, and participants in all communities who had studied beyond 18 needed to travel to do so. A common limitation on education in the area is whether relatives exist in larger communities, and for university, how long parents can afford to pay for board. It is thus possible that our education measure is in fact picking up past exposure to printed materials featuring individuals of European ancestry (see, for example, presentation of indigenous vs White cultures in Mexican textbooks, Corona Berkin & Le Mûr, 2017), and to television, through travel to larger towns for schooling. Indeed, education may be a better measure of acculturation than our actual acculturation index. Just as in Mexico, the observation of the authors is that Nicaraguan educational materials (which, as noted, are distributed centrally) do not discuss coastal historical figures, or Black or Indigenous people in general but instead concentrate on light skinned European-looking individuals and (in Nicaraguan history/current topics) Mestizo figures of significance.

Another possibility is that increased education was exacerbating existing concerns around race/ethnicity and economic prospects. As noted above, those on the coast believe that they are considered of lower status, that their languages are discriminated against (namely Creole, see Narcisso, 2012), and like many post-colonial regions, a historical bias toward Whiteness continues to be culturally transmitted (see below for some examples of this). Because increased education opens further opportunities for economic advancement, awareness of the hypothetical importance of Whiteness in achieving that economic success may become more acute. This interpretation, based on the auto-ethnographic observations of author WB, warrants further study.

Although we did not set out to explicitly test own-race bias, we also note that there was no difference between Miskitu and Mestizo participants in their ethnicity preferences, despite Miskitu typically being darker and less European-looking than Mestizos. Of course, we did not include Miskitu images in the data reported above. We had collected Miskitu facial images on a pilot phase trip to village M2 in 2009, however due to lack of facilities to ensure high-quality, standardized images, the resulting stimuli were of low quality and following initial data collection were subsequently not considered. Analysis of these images, however, still fails to show any own race bias among Miskitu vs Mestizo participants (Supplementary Materials). Indeed, all Miskitu and Mestizo participants showed a strong preference for Whiter faces and were consistent with the preferences of fully urbanized residents in Managua, despite all our rural participants typically seeing darker faces than Managua residents on a day-to-day basis—in part due to the ethnic diversity in the region and in part due to outdoor work meaning that Mestizos are typically very tanned in this area.

Only the subsample of Garifuna residents in village G1 showed a weaker preference for Whiteness. As Garifuna are typically those with the darkest skin tones in the area, this may reflect early experience with particularly dark faces, and as such it may be that had we tested more acculturated Garifuna on the face preference task, we might have observed stronger impacts of television and/or education. Alternatively, there was increasing tension between the Garifuna and Mestizo residents of village G1 at the time of our data collection (see also discussion of Mestizo migration impacts by Solis & Ana, 2011), which may have biased responses in those Garifuna in particular.

As noted above, our participants only showed a preference for "whiter" faces where color had been manipulated; there was no effect of ethnicity in terms of shape. On one hand, this may be because the differences in shape were harder to perceive than the color differences, and we would have been better served by including stimuli where shape was manipulated to a larger degree than color. Certainly, the cultural insight provided by author WB includes indigenous facial features as among those subject to negative stereotypes in Nicaragua in general. Alternatively, distinct local attitudes to ethnicity vs skin color may explain our results—that is to say that attitudes to color specifically may supersede other ethnicity markers via being a more general focus of status beliefs. For instance, J.-L.J. and T.T. qualitatively observed little overt racism amongst the

indigenous and African-descent communities during fieldwork (in contrast to informants in research cited above), and community members were fiercely proud of their ethnic heritage. However, many residents of this region explicitly regard paleness as aesthetically and socially desirable. For instance, multiple informants in our research and in the coastal region in general commented that it is better to marry lighter skinned partners so that children will "come more white." This bias toward desiring lighter skinned children is normative in the region. It is also not limited to those of afro-descent and indigenous ethnicities; soaps are sold in local towns which claim to make skin lighter and are bought by Mestizos as well as other ethnic groups. Mestizos also engage in hair lightening to adopt the appearance of more White-looking figures in high status positions. Being called dark was considered a particularly cutting insult by those on the receiving end of such comments and in related pilot work for another project, we found that school children often cited skin color as a common source of appearance bullying (publication in preparation). As discussed above, previous ethnographers have observed that Whiteness (or sometimes lighter-skinned Creole appearance) is associated with higher status amongst the Miskitu in particular (Jamieson, 2003) and broader Nicaraguan population in general. As such for our stimuli at least, color may have been the most salient status cue available.

One weakness of our study is that it is correlational, and we have not directly tested whether preferences for facial ethnicity can be experimentally manipulated or change longitudinally. We did attempt to research preference change longitudinally as television became more common. However, as documented previously (Boothroyd et al., 2020), this research was disrupted by delays in electrification in our target village, and poor participant retention. While we were able to partially compensate for this in our previous body preference analyses with additional time point data, we had no additional data for facial preferences. We would therefore recommend such research be attempted in the future, and also that experimental studies further explore whether media can directly impact preferences and attitudes to ethnicity in rapidly developing contexts. This future research should also consider a broader range of ethnicity cues, including hair, and a wider range of visual media. Although at the time of data collection, TV was the only reliable source of external visual media in the communities, mobile internet is now increasingly ubiquitous.

In conclusion, the pattern of our results strongly suggests a widespread general preference for paler over darker skin among this population, in keeping with other ex-colonial regions, which may be especially magnified in those with higher levels of education, for reasons we cannot yet fully determine, and those with greater access to globalized forms of media. Other aspects of facial ethnicity cues, however, do not necessarily influence perceptions of those faces in the same way. This research highlights the need to better understand how cultural factors may influence ethnically-linked appearance pressures, especially in ethnically diverse, rapidly globalizing populations.

Author Contributions

Original study design: L.B., M.T., D.M.B., M.J.; Refinement of design: L.B., J.-L.J., M.T.; Stimuli creation: C.B., I.P.V., L.B.; Data collection: J.-L.J., T.T.; Data analysis: L.B.; Interpretation of results: L.B., J.-L.J., T.T., W.B.; Drafting of manuscript: L.B., J.-L.J., with input from W.B.; Editing and approval of manuscript: All authors.

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Supplemental Material

Supplemental material for this article is available online and at https://osf.io/a7x24/.

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