


Influence of Economic Scarcity on Race Perception

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Abstract

Racial socioeconomic gaps are widened in periods of economic recession. Besides social and institutional factors, black people also struggle with many psychological factors. The literature reports racial-biased complex behaviors and high-level processes that are influenced by economic scarcity. A previous study found a bias at the perceptual level: an experimental manipulation of scarcity (a subliminal priming paradigm) lowered the black-white race categorization threshold. Here we present a conceptual replication in a higher ecological setup. In our main analysis we compared the categorization threshold of participants that received the Brazilian government's emergency economic aid in the context of the COVID-19 pandemic ($n = 136$) and

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participants that did not receive the economic aid ($n = 135$) in an online psychophysical task that presented faces in a black-white race continuum. Additionally, we analyzed the economic impact of COVID-19 on household income, and in cases of family unemployment. Our results do not support the claim that perception of race is influenced by economic scarcity. Interestingly, we found that when people differ greatly in terms of racial prejudice, they encode visual information related to race differently. People with higher scores on a prejudice scale needed more phenotypic traits of the black race to categorize a face as black. We discuss the results in terms of differences in method and sample.

Keywords

Prejudice, inequality, face processing, race perception

Introduction

Racial (representative) minorities present worse socioeconomic indexes compared to white people. This is exacerbated in Brazil which, within the boundaries of the American Continent, received the highest influx of enslaved Africans on one hand ([Trans-Atlantic Slave Trade Database](#)), and was the last free country to abolish slavery on the other. In a pre-COVID-19 pandemic scenario, a report presenting 2018 racial-related data from the Brazilian census showed that: black/brown¹ people formed 64.2% of the unemployed, and inequality was maintained even when considering grouping by education level; white employed people had a monthly income 73.9% higher than black/brown employed people; 68.6% of management positions were occupied by white people against 29.9% held by black/brown people; the percentage of black/brown people below the poverty line (<US\$5.50 daily) was 32.9%, which was more than double the percentage of white people, 15.4% (Brazilian Institute of Geography and Statistics – [IBGE, 2019](#)).

These social gaps are widened in periods of economic recession. For instance, due to the COVID-19 pandemic, Brazil reached an unemployment rate of 14.9% in 2020, and the difference between white and black/brown people peaked at the highest historical mark² of 5.9% (the historical series data started in 2012). Altogether, 8.8 million people lost their job between the first and the second quarter of 2020, and non-black/brown people represented 28.6% of the total against 71.4% of black/brown people ([IBGE, 2021a](#)). This phenomenon is usually described as the deepening of many social and institutional structural relations, which results in the economic vulnerability conditions which are pointed out in the beginning of the text. For example, black people tend to have fewer educational opportunities and support. Thus, they usually find space in informal or low-qualified jobs which, in turn, are the first to be cut in moments of economic scarcity.

Besides social and institutional factors, black people also struggle with many psychological factors. The literature has shown the role of economic scarcity on racial-biased complex behaviors and high-level mental processes in a way that facilitates or triggers racial prejudice and discrimination. Classic studies in Social Psychology showed that resources competition and scarcity promoted antipathy, distrust, and discriminatory resource allocation to the out-group (Brewer & Silver, 1978; LeVine & Campbell, 1972; Sherif, 1966). Specifically regarding racial relations, different experimental tasks and paradigms showed a biased allocation of economic resources favoring white people in scarcity conditions. For instance, Krosch and Amodio (2014) assessed mental visual representation of a black person in a race categorization of faces overlaid with different noise patterns under an experimental scarcity condition to create “scarcity faces” (Experiment three) that received less money compared to control faces in an ultimatum game involving dividing a monetary amount (Experiment four).

Such results evidence that economic scarcity plays a role in racial disparity, which may be based not only on higher-order mental processes (e.g., social cognition, attitude and stereotype formation, prejudice, and discriminatory behavior), but also on basic psychological processes like visual perception. It makes sense since race perception is malleable and shaped by psychological, cultural, and social factors, such as anti-egalitarian motives (Krosch et al., 2013), political partisanship (Caruso et al., 2009), and social status (Freeman et al., 2011; Penner & Saperstein, 2008).

Indeed, some studies investigated the role of economic scarcity on visual perception of race. Evidence shows that zero-sum beliefs of white participants regarding socioeconomic development of black people are negatively correlated to the threshold obtained by the frequency data of categorizing a face as black, i.e., the higher the belief in competitions between black and white people, the “blacker” mixed-race faces are seen (Krosch & Amodio, 2014 – Experiment one). The literature also presents direct manipulation of scarcity, seeking its causal role in perception of race. A previous study conducted two experiments in which white participants were previously primed with captioned images of economic hardship (Experiment one) or analogy problems to be completed with resource scarcity words (Experiment two), and then categorized 20 biracial morphed faces as black or white. Results showed a higher frequency of faces categorized as black in the scarcity condition compared to the abundance or control conditions (Rodeheffer et al., 2012). Another experimental manipulation of scarcity could tackle more precisely the perceptual visual processing over category membership using a psychophysical approach. In Experiment two conducted by Krosch and Amodio (2014), participants were nonconsciously primed with words presented for 20 ms before the facial stimulus onset. Faces were presented in five levels of a black-white morphing continua (equal 25% increments) in a race categorization task. Results showed that participants primed with scarcity words had a lower categorization threshold (i.e., mixed-race seen as “blacker”) compared to participants primed with neutral or negative unrelated words. They hypothesize that scarcity modulates visual perception of race in a way that less phenotypic traits are needed to categorize a person

as black. This subtle perceptual shift would unconsciously facilitate discriminatory economic behaviors.

Despite the magnitude of the relevance of such findings, priming experimental paradigms has serious limitations in ecological validity and are hardly replicated (Cesario, 2014; Chivers, 2019; Doyen et al., 2012; Harris et al., 2013; Shanks & Vadillo, 2021; Sherman & Rivers, 2021), especially unconscious subliminal stimulations (Meyen et al., 2022; Schnepf et al., 2022). In addition, results of race perception literature (as well as in broad psychology literature) are biased by the studies' samples, which in general are from western, educated, industrialized, rich, and democratic (WEIRD) societies (Henrich et al., 2010; Rad et al., 2018; Roberts et al., 2020; and for a discussion in the Neuroscience field, see Abiodun, 2019). In the present study, we conducted a conceptual replication of previous studies that investigated the influence of economic scarcity on race perception adding higher ecological validity in a culturally diverse sample.

We designed this study in a moment that Brazil was facing an economic crisis due to the COVID-19 pandemic, political instability, and rising inflation (Harris, 2021). Many Brazilians suffered an income decrease or lost their jobs. The Brazilian government granted people in economical vulnerability situations with emergency economic aid and set objective criteria for its eligibility. Therefore, we ran a race categorization task to faces in a black-white continuum and compared the categorization threshold from people that received and did not receive the emergency aid in our sample. Additionally, the slope calculated from the psychometric curves was also analyzed. We also compared these parameters (threshold and slope) in participants that reported unemployment in the family or decrease in the household income during the COVID-19 pandemic. In line with the literature, we expected lower categorization thresholds for people in economic scarcity condition.

Furthermore, the effect of scarcity on racial cognition and behavior is influenced by other variables. A study that aimed to investigate psychological underpinnings of the rule of hypodescent primed white participants with the idea that black people represent a socioeconomic threat. This was implemented with a measure of realistic threat (Experiment one) and vignettes (Experiment two) before participants indicate the race of a biracial morphed target on a seven-point scale. Both experiments showed that economic competition manipulation influenced perception of race for individuals with high social dominance orientation (+1 SD) but did not for those with low social dominance orientation (-1 SD; Ho et al., 2013). The study conducted by Krosh et al., (2017) also used an extreme group design and found that participants with low internal motivation to respond without prejudice (-1 SD) allocated fewer resources to black people compared to white people in experimental conditions of economic scarcity. This result was not observed for participants with high internal motivation to respond without prejudice (+1 SD).

Therefore, the present study additionally explored possible: (1) associations between race perception and race-related psychosocial constructs, and (2) interactions between economic scarcity and race-related psychosocial constructs on race

perception. The following constructs were investigated: subjective social status, racism, beliefs regarding resources competition between Blacks and Whites, and internal and external motivation to respond without prejudice. We generally hypothesized that measures related to negative attitudes, prejudice, and discriminatory behavior would result in a lower categorization threshold. In contrast, measures related to internalization of egalitarian values and beliefs would result in higher categorization thresholds.

Method

Participants

Since the study that motivated the present work (Krosh and Amodio, 2014 – Experiment two) did not report the effect size, we estimated the sample size with a power of .90 and a significance level of .05 (two-tailed) to detect a minimum Cohen's d of .40 using the *jpower* module of the *jamovi* program (The *jamovi* Project, 2021). This analysis considered the main comparison between two groups (individuals who were vs. individuals who were not in a situation of economic scarcity) and estimated 133 participants per group. All 271 participants in the final sample were Brazilian and 50.2% of the total ($n = 136$) received emergency economic aid from the Federal Government of Brazil due to the COVID-19 pandemic. Table 1 summarizes the characteristics of the sample. All participants read and agreed to the informed consent form approved by the Human and Social Sciences Research Ethics Committee of the University of Brasília (CAAE: 30539820.9.0000.5540).

Racial Categorization Task

Stimuli. 16 frontal images of white faces with neutral expression (8 men and eight women) taken from the DeBruine and Jones database (2021) were used to create realistic computer models of the faces using FaceGen Modeller 3.1 (Singular Inversions Inc, Toronto, Canada). The same program was used to modulate phenotypic characteristics and skin pigmentation to create a black-white racial continuum with 11 linearly spaced levels (Figure 1). Thus, 176 faces were produced for the experiment, which were presented in a quadrant of 400×400 pixels filled in black. The width of the faces comprised approximately 4.7 degrees of visual angle when considering a 13.3-inch screen 40 cm away from the participant.

Experimental Design. We used PsychoPy 3 (Peirce et al., 2019, 2022) to present the stimuli and collect the responses from the participants. The experimental task was performed online on Pavlovia (<https://pavlovia.org/>) and the instructions emphasized the importance of performing the task in a quiet location. Each trial started by pressing the spacebar on a start screen (i.e., self-paced trials) that triggered a central fixation point that was displayed for 500 ms, and that in the last 100 ms changed its color and shape (warning cue). A facial stimulus was then presented for 750 ms and the

Table 1. Sample ($n = 271$) Characterization Regarding Sociodemographic Variables.

Sociodemographic Variable	<i>n</i>	%
Gender		
Male	102	37.6
Female	168	62.0
Other	1	.4
Age ($M = 32.6$; $SD = 12.0$)		
≤ 24	89	32.8
25–34	88	32.5
35–44	52	19.2
45–54	18	6.6
55–64	19	7.0
≥ 65	5	1.8
Race		
Black	23	8.5
Brown	85	31.4
Indigenous	1	0.4
White	153	56.5
Yellow	9	3.3
Country region		
Midwest	93	34.3
North	4	1.5
Northeast	44	16.2
South	19	7.0
Southeast	111	41.0
Education level		
Uncompleted elementary school	4	1.5
Elementary school	9	3.3
Uncompleted high school	7	2.6
High school	42	15.5
Undergraduate	85	31.4
Graduated	124	45.8
Family per capita income (in brazilian real)		
Up to R\$ 500	25	9.2
R\$ 500–R\$ 1000	47	17.3
R\$ 1000–R\$ 2000	65	24.0
R\$ 2000–R\$ 4000	71	26.2
More than R\$ 4000	63	23.2
Unemployment in the family during COVID-19 pandemic		
Yes	106	39.1
No	165	60.9

(continued)

Table I. (continued)

Sociodemographic Variable	<i>n</i>	%
Impact on household income during COVID-19 pandemic		
0%	94	34.7
Up to -25%	84	31.0
Up to -50%	64	23.6
Up to -75%	15	5.5
More than -75%	14	5.2
Grant of emergency aid in the family (M = 2.9; SD = 3.3)		
0 (no emergency aid)	135	49.8
1-4 months	36	13.3
5-8 months	86	31.7
9-12 months	14	5.2

Note. (1) Participants declared their race based on the race-or-color categories established by the Brazilian Institute of Geography and Statistics – IBGE (IBGE, 2020). (2) Family income levels were established based on nominal monthly household income per capita of the population of the Federal District, Brazil (IBGE, 2021b). (3) According to the exchange rate on the closing date of the manuscript data collection, R\$ 1000 (one thousand Brazilian reais) was equivalent to US\$ 198 (one hundred and 98 US dollars). M = mean; SD = standard deviation.

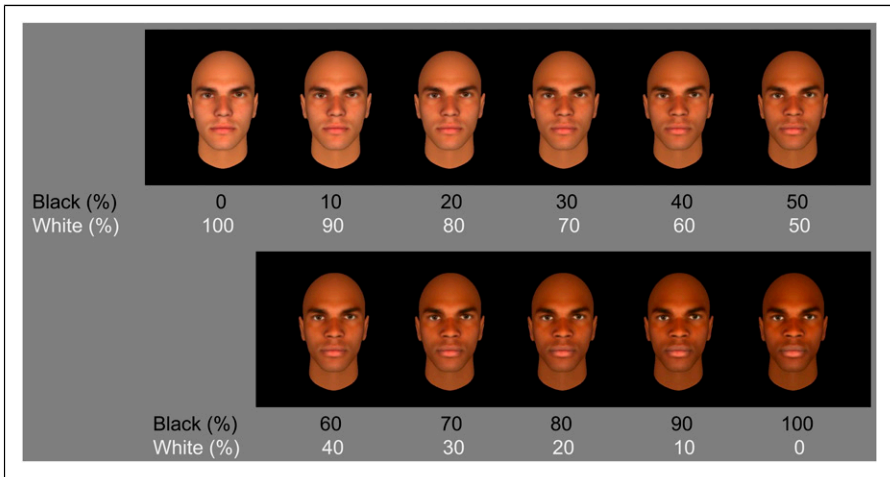


Figure 1. Example of a facial model used in the experiment in the black-white race continuum.

participant had to answer whether the face was white or black by pressing the directional keys “up” or “down”, respectively, using the computer keyboard. When the response was given, or after 5 s after the stimulus offset, the start screen was displayed again. All stimuli from the 16 models in the 11 levels of the white-black continuum

were randomly presented to implement a variation of the psychophysical method of constant stimuli (i.e., the method of absolute judgment; [Wever & Zener, 1928](#)). Before starting the experiment, the participants received on-screen instructions and performed a brief training of 20 trials with faces at the extremes of the racial continuum. Including training, the experimental task totaled 196 trials and lasted approximately 10 min. The stimuli set and the experiment are available on the GitLab platform ([de Moraes, 2021](#)).

Psychometric Instruments

Racism Scale. The self-report instrument was composed of 10 items, and built from the content analysis of real comments published on Internet pages (e.g., “Racism only exists in the minds of people who claim to be victims of it”). The scale has a unifactorial structure, whose dimension is associated with the belief that black people play the victim and are to blame for racism. The scale showed high internal consistency ($\alpha = .91$) and validity in convergent and discriminative analyzes ([Lima et al., 2020](#)). Response is provided on a 5-point scale (1. Strongly disagree to 5. Strongly agree).

Internal and External Motivation Scale to Respond Without Prejudice. The self-report instrument was used assess the motivational factors associated with a non-prejudiced response directed at an outgroup. The scale was developed by [Plant and Devine \(1998\)](#) and adapted to the Brazilian context by [Gouveia et al. \(2006\)](#). The instrument has a two-factor structure: 1. Internal Motivation, with four items (one less than in the original version) related to the internalization of a non-prejudiced view and moderate internal consistency ($\alpha = .55$); and 2. External Motivation, with five items related to a subtle attitude of prejudice, whose expression is regulated by the opinion of others, and high internal consistency ($\alpha = .80$). Response is provided on a 9-point scale (1. Strongly disagree to 9. Strongly agree).

Questionnaire of Beliefs Regarding Resources Competition Between Blacks and Whites. Assesses the degree of agreement with six statements about beliefs related to the distribution of resources between Blacks and Whites (e.g., “When Blacks make economic gains, Whites lose out economically”). The instrument was used by [Krosch and Amodio \(2014\)](#) based on a selection and adaptation of items from a questionnaire that assessed zero-sum beliefs about economic and power gains in immigrants ([Esses et al., 1998](#)). The items were translated into Portuguese and contextualized in the Brazilian scenario. The questionnaire used in this study showed high internal consistency ($\alpha = .95$) in our final sample. The answer is provided on a 7-point scale (1. Strongly disagree to 7. Strongly agree).

MacArthur Scale of Subjective Social Status. A single-item scale to assess how a person perceives their social status (e.g., income, education, employment) in relation to society, and may also include an assessment in relation to their community (or neighborhood). The original version developed by [Adler et al. \(2000\)](#) and its translation and

adaptation for Brazil (Giatti et al., 2012) present the image of a ladder with 10 steps. The participant must choose the step that best represents their social hierarchy, with step 1 indicating a very low social status and step 10 indicating a very high social status. In the present study, we adapted the scale by not presenting any image, and asking the participants to imagine a ladder. The rest of the information, instructions, and the type of response (1–10) were maintained.

Procedure

The participant sample was reached by convenience using the snowball method. Social networks and communication applications were used as a form of dissemination. By accessing a link, the participant accessed an online form that contained the informed consent form, sociodemographic questions and the psychometric instruments used. The entire form was completed in approximately 20 min. On the same day, the researchers sent an email to the participant, who received a link to access the experimental task and an identification code. The participant was then instructed to carry out an experiment on face perception that aimed to “understand how we perceive ethnic-racial information from people’s faces”. The entire procedure (social form + experimental task) lasted approximately 30 min. Data collection occurred between the months of January and June 2021.

Results

The racial categorization task had an average of only .21% of lost trials ($SD = .53\%$; range = 0%–5.1%). To determine the categorization threshold, we calculated the rate of faces categorized as black at each level of the racial continuum for each participant. We then fitted the data to logistic function models at the individual level. The code written in MATLAB for fitting the curves and calculating the parameters extracted from the psychometric function is available at <https://osf.io/knrys/>. Data showed good adjustment of the psychometric curve at the individual level, as evidenced by the R^2 (mean = .97; range = .83–.98). Therefore, it is possible to affirm that the experimental task provides reliable parameters.

The mean slope was .36 ($SD = .10$; amplitude = .13–.76), which reflects a categorical perception process for the faces presented in the task. That is, even when a linear continuum was presented for the racial dimension, the psychometric function fitted to the categorization frequency data indicated a cognitive process of categorization, as can be seen by the steep slopes obtained, i.e., a sigmoid-shaped curve (Levin & Angelone, 2002). The categorization threshold (the curve midpoint, where the probability to categorize a face as black is equal to 50%) is the main parameter extracted from the experimental task, and obtained an average of 5.91 ($SD = 1.01$; amplitude = 1.7–9.2). This value is close to the value that divides the racial continuum into two halves, i.e., value 5.5 on the black-white racial continuum scale. Only three and two outliers (values above and below 3 standard deviation units from the mean) were observed for

the slope and the categorization threshold, respectively. Since this is expected by chance when we take into account our sample size, these values were kept for the analysis. However, it was verified whether these data points accounted for statistically significant results in all analyses and reported in the text when necessary. The statistical analysis outputs of the dataset without outliers are also available in the supplemental material.

Table 1 presents sociodemographic and economic data related to the COVID-19 pandemic in the participant sample. Descriptive statistics for the categorization threshold, slope, and psychometric instruments are summarized in a table in the supplemental material. All measures except the categorization threshold did not fit to a normal probability distribution function, as evidenced by the Shapiro-Wilk test. Other tools were used to check distribution normality of the data: density plots, Q-Q plot, and the Anderson-Darling goodness-of-fit test. The variance homogeneity was checked using Levene's test.

Considering the likely ordinal nature of the psychometric measures and the non-normal distribution of the slope, we used non-parametric tools for analysis, except for analyzes on the categorization threshold. The significance level was set at 5% (two-tailed). When necessary, we ran Tukey post-hoc tests. All statistical analysis was conducted using jamovi ([The jamovi Project, 2021](https://www.jamovi.org/)). Raw and processed data, and statistical analyzes are available at <https://osf.io/knrys/>. A preliminary analysis found no differences in race, gender, and region of the country for either the categorization threshold or the slope.

We did not exclude the self-declared black/brown people from the analysis because the Brazilian population is characterized by a continuum of phenotypic traits, and not by racial groups more discretely defined. Furthermore, even Blacks develop racial biases since they are part of an environment with the same social norms as Whites which perpetuates negative stereotypes and discriminatory behaviors (see [Telzer et al., 2013](#), who investigated the neural bases of visual information processing of race in a developmental perspective). Nevertheless, we also ran all the analyzes described below considering only the subgroup of white participants and left this filter activated in the statistical databases/outputs available. Results from white participants that were different from the results of the general sample in terms of statistical significance are described in the text.

Race Perception and Economic Scarcity

The primary goal of the present study was to verify whether economic recession contexts can alter racial perception. The study was conducted at a time of economic recession in Brazil, and we investigated the following factors to check their effect on racial perception: (1) receipt of the emergency economic aid granted by Brazil's Federal Government for people in economic vulnerability during the COVID-19 pandemic; (2) negative economic impact of COVID-19 on household income; and (3) family unemployment (people living in the same household) during the COVID-19 pandemic.

Therefore, in our initial analysis we compared mean categorization thresholds of the sample subgroups formed by people who received and who did not receive the emergency aid. When conducting a *t* test, no significant difference was observed

between the mean of the group that received ($n = 136$, $M = 5.89$, $SD = 1.00$) and the group that did not receive the emergency aid ($n = 135$, $M = 5.94$, $SD = 1.03$) for the categorization threshold, $t(269) = -.35$, $p = .727$, $d = .04$. The equivalent non-parametric analysis (Mann-Whitney) was conducted for the slope and no significant difference was observed either, $U = 8946$, $p = .717$, rank-biserial $r = .02$.

This analysis, which takes into account the receipt of the emergency aid granted by the Government during the COVID-19 pandemic, was refined in order to consider the number of months that the participants received the assistance. Figure 2 shows a scatterplot of the number of months the economic aid was granted per categorization threshold (left) or slope (right). We assume that the longer the number of months a person received the aid, the longer the time in a situation of economic scarcity. We observed the categorization threshold mean by dividing the sample among people who received the emergency aid for: 0 months ($n = 135$, $M = 5.98$, $SD = 1.03$), 1–4 months ($n = 36$, $M = 5.95$, $SD = 1.20$), 5–8 months ($n = 86$, $M = 5.92$, $SD = .98$) and 9–12 months ($n = 14$, $M = 5.61$, $SD = .45$). When implementing a one-way ANOVA, no difference was found among the categorization threshold means, $F(3,267) = .45$, $p = .721$, $\eta^2 = .01$. The equivalent non-parametric analysis (Kruskal-Wallis) was conducted for the slope and no significant difference was observed either, $X^2(3) = 1.69$, $p = .638$, $\epsilon^2 = .01$. To avoid information loss due grouping continuous data (i.e., frequency of months), we implemented further analyzes. Firstly, no significant correlation was found between the number of months of emergency economic aid granted for both the categorization threshold ($r = -.04$, $p = .510$) and for the slope ($r_s = .02$, $p = .804$). Then, a multiple linear regression was calculated to predict race perception. Besides the number of months that the participants received the economic aid, the model included the psychosocial variables (i.e., prejudice, resources competition, internal/external motivation to respond without

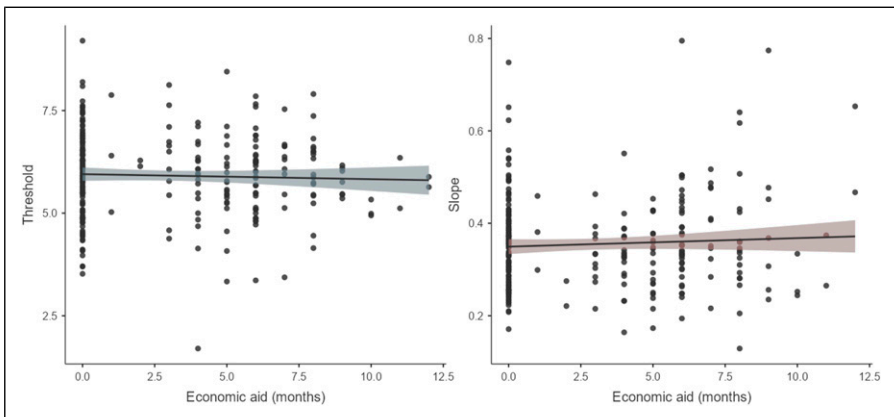


Figure 2. Categorization threshold (left) and slope values (right) obtained from the race categorization task by number of months of emergency economic aid granted to the participants. *Note.* The shaded area represents the standard error of the regression line.

prejudice, and social status). The model explained a low level of variance for both the categorization threshold, $F(6,264) = .901, p = .495, R^2 = .02, R^2_{Adjusted} < .01$, and the slope³, $F(6,264) = 2.27, p = .037, R^2 = .05, R^2_{Adjusted} = .03$. Full regression tables and assumption checks are available in the supplemental material.

Besides the receipt of the emergency aid, we also took the economic impact of COVID-19 on the family household income as a measure of economic scarcity. We assume that the greater the economic impact of the pandemic on household income, the greater the economic scarcity experienced by the participant. We observed the categorization threshold mean of sample subgroups of participants who reported that the COVID pandemic did not negatively affect the household income ($n = 94, M = 5.83, SD = 1.01$) or caused a decrease of up to 25% ($n = 84, M = 6.01, SD = 1.02$), up to 50% ($n = 64, M = 5.99, SD = .89$), up to 75% ($n = 15, M = 6.25, SD = .93$) or more than 75% ($n = 14, M = 5.17, SD = 1.35$) of the family household income. When implementing a one-way ANOVA, a difference was found in the categorization threshold mean as a function of the decrease in family income during the pandemic, $F(4,266) = 2.82, p = .026, \eta^2 = .04$. People who had a reduction of more than 75% of family income had a lower categorization threshold compared to those who had a reduction of up to 75%, 50%, and 25% (all with $p < .044$), except for people who did not have a negative impact of income during the pandemic ($p = .145$). However, only one data point accounted for statistical significance. When the same analysis was conducted by replacing the outliers by the mean of the categorization threshold in the total sample, no significant difference was found $F(4,266) = 1.58, p = .181, \eta^2 = .02$. An ANOVA was then carried out after grouping people who suffered a decrease of up to 75% and more than 75% in family income, given the low number of participants in these two sample subgroups. The result showed that the non-significant differences between the means of the subgroups were attenuated even more $F(3,267) = .495, p = .686, \eta^2 < .01$. The equivalent non-parametric analysis (Kruskal-Wallis) was conducted for the slope and no significant difference was observed, $X^2(4) = 7.26, p = .123, \epsilon^2 = .03$.

Finally, we analyzed differences in the categorization threshold mean between the group of people who faced ($n = 106, M = 5.86, SD = 1.01$) and who did not face unemployment in the family ($n = 165; M = 5.95, SD = 1.02$) during the COVID-19 pandemic. A non-significant difference was observed, $t(269) = .73, p = .468, d = .09$. A Mann-Whitney test for the slope was also conducted and no significant difference was observed, $U = 8248, p = .430, \text{rank-biserial } r = .06$.

In summary, we compared the categorization threshold of sample subgroups that were most likely facing economic scarcity during the COVID-19 pandemic, which was evaluated by (1) receiving the economic emergency aid granted Brazil's Federal Government, (2) unemployment in the family, and (3) decrease in the household income. All tests carried out do not support the initial hypothesis that situations of economic recession modulate the categorization of race at a perceptual level.

Race Perception and Psychometric Measures

A secondary goal of the present work was to verify the relationship of the racial perception measures we investigated (i.e., categorization threshold and slope) and psychometric measures related to racial cognition (i.e., Questionnaire of beliefs about the distribution of resources between Blacks and Whites, Internal and External Motivation Scale to Respond without Prejudice, Racism Scale, and MacArthur Scale of Subjective Social Status). We used the Spearman’s rank correlation coefficient to investigate the association between these psychosocial variables and racial perception. We also conducted an extreme group design (Preacher, 2015) by investigating the difference in the categorization threshold and slope between those who had low and high scores on the psychometric instruments, i.e., scores $\leq Q1$ and $\geq Q3$, respectively.

Table 2 summarizes the results that relate the categorization threshold and slope with psychometric measures related to racial cognition. A significant correlation was observed between the slope and the racism scale⁴ ($p = .046$) and between the slope and the MacArthur scale of social status ($p = .026$). However, the correlation coefficients were weak ($-.12 < r_s < .14$) and do not allow establishing a satisfactory association between the measures. The analysis by extreme groups found only one significant difference: when dividing the dataset by quartiles, the sample subgroup that had high scores on the racism scale ($Q3 \geq 26$; $n = 71$) obtained a higher categorization threshold mean compared to the sample subgroup that had low score on the racism scale ($Q1 \leq 12$; $n = 83$), $t(152) = -2.35$, $p = .020$, $d = .38$. The mean categorization threshold was 6.05

Table 2. Extreme Groups Analysis and Correlation Between Race-Related Psychosocial Measures and the Parameters Calculated from the Race Categorization Task.

Correlation	Threshold		Slope	
	Spearman’s rho	p-value	Spearman’s rho	p-value
Resources competition	-.01	.861	-.04	.531
Internal motivation	-.01	.833	.03	.635
External motivation	-.06	.310	.03	.584
Racism scale	.11	.074	-.12	.046*
MacArthur scale	.05	.390	.14	.026*

Extreme groups	Threshold		Slope	
	t-score	p-value	Mann-whitney U	p-value
Resources competition	-.49	.625	5895	.523
Internal motivation	-.73	.466	5606	.668
External motivation	1.27	.206	2497	.930
Racism scale	-2.35	.020*	2443	.068
MacArthur scale	-.98	.330	2656	.064#

Note. * – $p < .05$; # – result after removing a single data point that was responsible for a significant p -value.

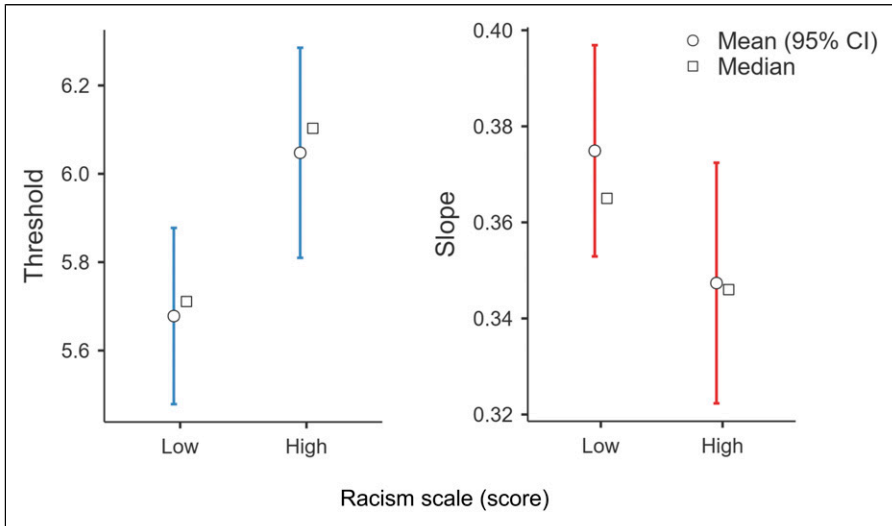


Figure 3. Mean and median of the categorization threshold and the slope obtained from the race categorization task in the sample subgroups of participants with low and high scores on the racism scale. *Notes.* Low and high racism are based on quartile cutoffs ($\leq Q1$ and $\geq Q3$, respectively) obtained from the sum of items of the Racism Scale. Bars indicate 95% confidence interval.

(SD = 1.02) for the group that scored higher and 5.68 (SD = .93) for the group that scored lower on the racism scale (Figure 3, left half). The inverse occurred for the slope, although the difference did not reach statistical significance, $U = 2443$, $p = .068$, biserial-rank $r = .17$ (Figure 3, right half).

The results showed that when people differ greatly in terms of racial prejudice, they encode visual information related to race differently. People with a high level of prejudice need more phenotypic traits of the black race to categorize a face as black.

Interaction Between Economic Scarcity and Psychometric Measures in the Perception of Race

We also wonder whether the investigated psychosocial variables (i.e., prejudice, resources competition, internal/external motivation to respond without prejudice, and social status) could modulate a possible effect of economic scarcity on racial perception. Likewise from the literature in the area (e.g., Ho et al., 2013; Krosh et al., 2017), we again use an extreme groups analysis.

Therefore, we conducted factor analyzes (ANOVA) 2×2 for each psychometric measure, one of the factors being the condition of economic scarcity (yes/no) and the other factor related to the score-based extreme groups (high/low score). Three types of dichotomous groupings were considered to assess the economic condition: (1) the

receipt of emergency economic aid granted by the Government to people in situations of economic vulnerability during the COVID-19 pandemic; (2) economic impact of COVID-19 on household income; and (3) family unemployment during the COVID-19 pandemic. The results did not show any statistically significant interaction, $F_s \leq 1.87$; $p_s \geq .173$.

However, when we filtered the extreme groups to include only white participants, a significant interaction between internal motivation and economic scarcity was observed for the categorization threshold, $F(1,122) = 4.53, p = .035, \eta_p^2 = .04$ (Figure 4). Among those who did not receive the emergency aid, participants with low internal motivation to respond without prejudice ($n = 24, M = 5.39, SD = 1.07$) had a lower racial categorization threshold than those with high internal motivation ($n = 48, M = 5.39, SD = .88; p = .028$).

Discussion

The present study investigated whether people who are facing economic scarcity encode racial visual information differently to those who are not under scarcity. The context of economic recession experienced in Brazil allowed this investigation to be carried out in a natural setting with high ecological validity. We took as grouping variables: (1) the receipt of emergency economic aid granted by the Brazilian Federal Government; (2) the impact on family income due to the COVID-19 pandemic; and (3) family unemployment during the COVID-19 pandemic. Racial perception was

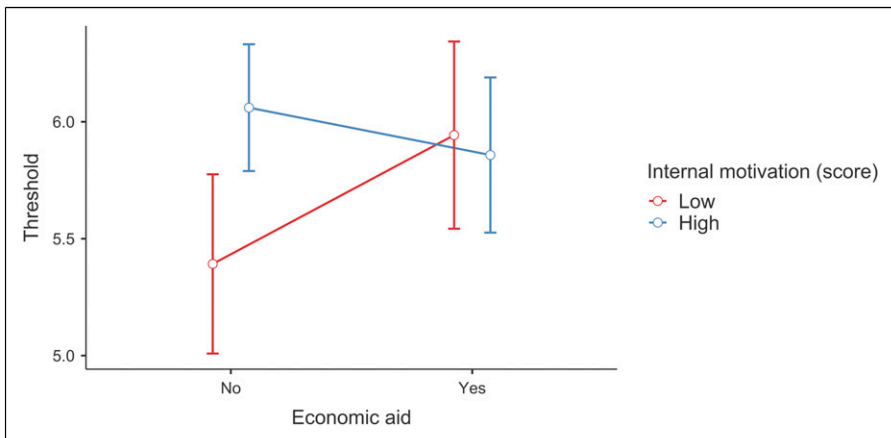


Figure 4. Categorization threshold means in the sample subgroups of white people grouped by receipt of emergency economic aid and internal motivation to respond without prejudice. Notes. Low and high internal motivation are based on quartile cutoffs ($\leq Q1$ and $\geq Q3$, respectively) obtained from the sum of internal-motivation items of the Internal and External Motivation Scale to Respond without Prejudice. Bars indicate 95% confidence interval.

investigated in a categorization task of mixed-race faces, and we took as dependent variables the categorization threshold and the slope. The results do not support the hypothesis that moments of economic recession alter racial perception.

Therefore, our results do not support the findings of previous studies (Ho et al., 2013; Krosch & Amodio, 2014; Rodeheffer et al., 2012). The receipt of emergency aid granted by the Brazilian government established an objective criteria to select people who were in a situation of economic vulnerability during the COVID-19 pandemic, and therefore, served to guide the analysis on the effect of the economic recession. In some situations however, people who received the emergency aid were already living under economic restrictions before the pandemic. Therefore the self-reported information on unemployment and decrease in household income during the pandemic complemented and reassured the results obtained from the initial analysis.

Parallel analyzes performed only with white participants on the relationship between economic scarcity and racial perception did not differ from the whole-sample analysis. This provides evidence that the Brazilian sample of Whites did not favor the own race in the facial categorization task. That is, white participants in conditions of economic scarcity did not lower the categorization threshold in order to make the faces “blacker” and, consequently, increase the differences from the out-group.

Task-related factors may have influenced the result differences found in our study. For instance, the racial continuum used in previous studies was created by morphing pairs of real photographs of black and white faces. Thus, facial stimuli involved not only the race category, but also the identity category, which can influence responses and strategies in a race categorization task. Therefore we preferred to modulate racial phenotypic traits in realistic faces created computationally. Another factor may be related to the sensitivity of our task. The racial continuum of the task we built had 11 levels (16 stimuli per level), whereas the study we were based on (Krosch & Amodio, 2014 – Experiment two) implemented a racial categorization task with five levels.

A difference that characterizes our study is that economic scarcity was investigated in a natural environment, which ensures ecological validity. However, given its observational nature, causal relations cannot be drawn. In addition, a participant that is experiencing a situation of economic scarcity (as in our study), does not necessarily process scarcity-related information during the experimental task (as it was programmed in the priming studies). This may explain our results, since scarcity demands and alters mental functions (de Bruijn, Antonides, 2022; Mani et al., 2013; Shah et al., 2012) that can compete with and impair those cognitive resources that exert executive control on racial biases (see Kubota et al., 2012; Richeson et al., 2005; Zhou et al., 2020). However, there is evidence that economic scarcity reduced cognitive ability in field studies. Farmers evaluated before and after harvest, i.e., in times of scarcity and economic prosperity, respectively, had worse cognitive performance before harvest (Mani et al., 2013). Thus, it would be interesting to carry out a follow-up experiment that induces scarcity using primes in a Brazilian sample to have a better understanding of the results.

Executive control on racial biases occurs in a neural network of executive control and is associated with prejudice and stereotype formation. It is easier to promote changes in this network, unlike the network of detection and affective signaling, which is more associated with perception (Kubota et al., 2012; Mattan et al., 2018). Recent studies show the role of learning in brief training sessions in reducing the facial stereotype of personality traits, without changing what is perceived (Chua & Freeman, 2021, 2022). These interventions act on this network of executive control. Our study focused exclusively on race perception, which activates more the network of detection and affective signaling and did not focus on higher-level processes or tasks (e.g., allocation of financial resources).

In addition to the stimuli, the task, and the design, the present study differs from the previous ones (i.e., Ho et al., 2013; Krosch & Amodio, 2014; Rodeheffer et al., 2012) by its sample. Past results were limited to the US population and here we report data from another American country, but from the Global South. Brazil is characterized by a more linear and continuous spectrum of skin tones which is not associated with nationalities, ethnicities, or ghettos, as in some countries. It is possible that racial categorization is different in Latin America/Brazil when compared to North America/United States.

Beyond phenotypic differences, the Brazilian population has deep cultural, social, and political idiosyncrasies. Brazil is historically marked by a generalized miscegenation, wherein social inequality between black, brown, and white people is supported by the idea of a difference of class and culture, and not of race, creating a myth of “racial democracy”. In the United States, in contrast, racial differences produced a more rigid racial hierarchy, making the socioeconomic differences between Whites and Blacks more explicit (Da Silva, 1998). The myth of racial democracy was the dominant view among intellectuals and materialized itself in the work of Freyre (1933/2022). It was strongly leveraged by state policies that aimed to erase the historical inequalities of the black people in Brazil, as well as by the forms of racism that are socially permeated in the social interactions of individuals. Thus, Brazil developed a “cordial racism”, more hidden and subtle, without however, renouncing violence in its various forms (Lima & Vala, 2004; Turra & Venturi, 1995).

The way the racial issue is constituted in Brazil may explain why people with high scores on the racism scale had a higher categorization threshold (i.e., mixed-race faces seen as “whiter”). Such a result does not support the literature and our hypothesis, since it was expected that people with a high level of prejudice would present a lower categorization threshold (i.e., mixed-race faces seen as “blacker”), which would be reflecting a facilitation process of discrimination. However, Brazilian racism carries the ideal that Brazil has a mixed race, Whites and Blacks are equal, there is no racial hatred, and therefore, the existence of racism is denied (Mayorga, 2017). Furthermore, black people who emphasize the idea of the Blacks as part of a diasporic people, and who manifest themselves in favor of historical reparation and racial injustices, are criticized for playing the victim.⁵ The prejudiced discourse asserts that the allegation of prejudice in Brazil is an instrument for black people to achieve social or economic positions or

justify why they do not achieve them (Michael, 2017). The racism scale used in this study measures precisely this victimizing dimension that is contextualized to the current scenario of Brazilian racism.

In short, from 1930's to the present day, racism in Brazil is masked in the idea of a racial democracy. Therefore, it is possible to assume that people with exacerbated racism need more phenotypic traits of the black race and more skin pigmentation to categorize someone as black. It would be a way of denying the injustices or rights of black people since "everyone is equal". Thus, in the US, a low categorization threshold would facilitate non-consciously discriminatory behavior, as it redefines and exacerbates the out-group members. In Brazil, a high categorization threshold would facilitate discriminatory behavior in an unconscious way, as it does not recognize the black race and racial injustices.

This result is part of the analysis we performed when we related race perception with race-related psychosocial constructs. Another interesting result within this scope is the absence of correlation between the categorization threshold and the score in the Questionnaire of beliefs regarding resources competition between Blacks and Whites. This result does not support Experiment one conducted by Krosh and Amodio (2014). It is possible that the questionnaire is very reactive to Brazilian respondents, and the difference of only two points that divide the first and third quartiles in the instrument may be seen as evidence.

Results of the present study also verified that the investigated psychosocial variables (i.e., prejudice, resources competition, internal/external motivation to respond without prejudice, and social status) did not modulate any effect of economic scarcity on racial perception (i.e., categorization threshold, and slope). However, when analyzing data only from white participants, it was observed that among those who did not receive the emergency aid, participants with low internal motivation to respond without prejudice had a lower racial categorization threshold than those with high internal motivation. It is possible that different groups in a society process racial visual information in a different fashion. Perhaps white Brazilians with low internal motivation to respond without prejudice that do not face economic scarcity during a period of economic hardship encode race information similarly to US white participants. Notably, this result must be interpreted with care since it is limited by the subgroup sample size.

Racial bias operates implicitly, being difficult to detect and control. Visual perception underpins higher-order processes (e.g., attention, memory, attitude formation, stereotypes, and prejudice). The results presented here are relevant insofar as the literature shows that reflection about racial biases increases pro-racial equality attitudes in internally motivated people (Cooley and Ellerkamp, 2018). However, the main reflection is not at the individual level since racism is structural in society. Therefore, this study is important in seeking to understand how social and economic aspects can interact with perceptual processes. Revealing how these factors and processes interact can serve as a knowledge framework for public policies aiming at striking racial inequalities. Despite advances in affirmative action policies from the 1990's onwards, we see an increase in racial intolerance in Brazil, especially with the advance of

conservative narratives from the extreme right-wing. And we can also add the economic crisis and political instability as worsening factors.

In summary, we investigated the influence of economic scarcity on race perception in a natural context, and in a culturally diverse sample. A race categorization task was implemented using mixed-race faces in a black-white continuum. Based on the literature, we initially hypothesized that scarcity-grouped participants would perceive mixed-race faces as “blacker”. However, our results do not support the claim that perception of race is influenced by economic scarcity. Some factors may offer an understanding: (1) differences in stimuli set, task, and study design from previous studies; (2) scarcity information processing during the task; and (3) the racial characteristics of the Brazilian population. Interestingly, we found that people with higher scores on a prejudice scale needed more phenotypic traits of the black race to categorize a face as black. As a consequence of the ideal of a racial democracy socially spread in Brazil, a high categorization threshold could unconsciously facilitate discriminatory behaviors in order to not legitimize the black race and racial inequality. We conclude that scarcity does not modulate race perception in Brazil, but fully experimental-design investigations could test this claim. In addition, our study suggests that race perception operates in different ways depending on how racial issues are developed within groups and societies.

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Author’s Contributions

R.M.J. Contributed to the conceptualization, supervision, project administration, and resources. L.G.B. and R.M.J. Contributed to the investigation. L.G.B. and R.M.J. Contributed to the experimental design. E.S.G. and R.M.J. Contributed to the experiment programming. J.G.S.C. R.A.A. and R.M.J. Contributed to data curation. I.B.S.G. L.G.B. and R.M.J. Contributed to the formal analysis. R.M.J. Contributed to visualization. R.A.A. and R.M.J. Contributed to writing (original draft). All authors contributed to writing (review and editing).

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Notes

1. The Brazilian Institute of Geography and Statistics defines the following color-or-race categories: black, brown, indigenous, white, and yellow. White and brown/black people accounted for 43.1% and 55.8%, respectively, of the total Brazilian population in 2018.
2. This percentage dropped to 3.1 in the third trimester of 2021. However, the apparent reduction of racial difference is due to a faster informal employment recovery, and results in lower income, worsening of job quality, and informality increase.
3. Despite the slope did not fit a normal distribution, violations of normality assumption do not impact results when running linear regression models in samples of considerable size (Schmidt & Finan, 2018).
4. This correlation between the slope and the racism scale was not significant when only data from white participants were analyzed, $r_s = -.12, p = .131$. In either case, no conclusion can be drawn due to the weak association.
5. This phenomenon is very similar to the criticism of “political correctness”, constantly present in the US political scene in recent years and which was imported by the Brazilian far-right politics (Michael, 2017).

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