

University of Brasília
Institute of Psychology
Department of Basic Psychological Processes
Graduate Program in Behavioral Sciences

SocialPICS: A novel validated database of socioeconomic-content images

by

Ana Beatriz da Silva Mendes Araujo

Thesis Supervisor: Rui de Moraes Jr., Ph.D.

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Luciano Grüdtner Buratto, Ph.D.
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University of Brasília

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List of Abbreviations

ANOVA	Analysis of variance
CFD	Chicago Face Database
DIRTI	DIsgust-RelaTed-Images
IAPS	International Affective Picture System
KDEF	Karolinska Directed Emotional Faces
M	Sample mean
Md	Median
NAPS	Nencki Affective Picture System
p	p-value
PA	Percentage of agreement
R²	R-squared
SAM	Self-Assessment Manikin
SD	Sample standard deviation
SES	Socioeconomic status
SSS	Subjective socioeconomic status
ε²	Eta-squared
ρ	Spearman's ρ
χ²	Chi-square

Abstract

The present study developed and validated an image database, SocialPICS, with information of socioeconomic status (SES) and affective space (i.e., valence and arousal). Images were selected from public-domain websites and a pilot study pre-selected the images to compose the database. A sample of 132 participants responded a questionnaire and rated the SES, the valence, and the arousal of the images displayed. As a methodological outcome, the instrument is validated for the Brazilian context. The image dataset covers a broad range of SES levels in a continuum ranging from lower- to higher-status images and provides subsets of images in a categorical classification (high, medium, and low). It is likely that SocialPICS portrays social differences regarding power, prestige, and control of resources that SES communicates. As a theoretical outcome, we argue that SES images are emotional images. SES images are positively associated to valence, and negatively associated to arousal. SocialPICS is a novel, high-quality resolution, standardized database of 429 SES static images composed of 136 human action images, 157 clothing images, and 136 landscape images. These three subsets comprise stimuli usually employed by researchers in social cognition and neuroscience. Its use should simplify and favor original and replication studies with a higher level of standardization and control over visual SES-content stimuli. Information on physical proprieties are provided for each image. Download SocialPICS: <https://osf.io/3t9r2/>.

Keywords: image database; socioeconomic status; social status; affective visual stimuli; social cognition.

Resumo

O presente estudo desenvolveu e validou um banco de dados de imagens, SocialPICS, com informações de status socioeconômico (SSE) e espaço afetivo (e.g., valência e alerta). As imagens foram selecionadas em sites de domínio público e um estudo piloto pré-selecionou as imagens para compor o banco de dados. Uma amostra de 132 participantes respondeu a um questionário e avaliou o SSE, a valência e o alerta das imagens exibidas. Como resultado metodológico, o instrumento foi validado para o contexto brasileiro. O conjunto de dados de imagem cobre uma ampla gama de níveis de SES em um contínuo que varia de imagens de status inferior a superior e fornece subconjuntos de imagens em uma classificação categórica (alto, médio e baixo status). É provável que o SocialPICS retrate as diferenças sociais em relação à poder, prestígio e controle de recursos que o SSE comunica. Como resultado teórico, argumentamos que as imagens de SSE são imagens emocionais. Imagens de SSE estão positivamente associadas à valência e negativamente associadas ao alerta. O SocialPICS é um novo banco de dados, padronizado, de resolução de alta qualidade, com 429 imagens estáticas de SSE. Composto por 136 imagens de ações, 157 imagens de roupas e 136 imagens de paisagens. Esses três subconjuntos compreendem estímulos geralmente empregados por pesquisadores em cognição e neurociência social. Seu uso deve simplificar e favorecer estudos originais e de replicação com maior nível de padronização e controle sobre os estímulos visuais de conteúdo socioeconômico. Informações sobre propriedades físicas são fornecidas para cada imagem. Para baixar e acessar SocialPICS: <https://osf.io/3t9r2/>.

Palavras-chave: banco de imagens; status socioeconômico; status social; estímulos visuais afetivos; cognição social.

Resumo Expandido

Estímulos visuais e bancos de imagens são amplamente utilizados em psicologia, posto que utilizamos a nossa visão profusamente em nosso cotidiano. Assim, é proeminente a criação e validação do SocialPICS, um banco de imagens com informações socioeconômicas e afetivas. Informações e avaliações de status socioeconômico (SSE) acontecem simultaneamente com o nosso *input* e processamento visual. Entretanto, o SSE é um construto psicológico multideterminado. Quando observamos faces, vestimentas ou ambientes, nossos sistemas visual e social disputam conectividade cerebral e processamento cognitivo. Destarte, o estudo aqui desenvolvido tem o objetivo de desenvolver e validar o banco de imagens SocialPICS, bem como investigar a relação entre SSE e o espaço afetivo dimensional (i.e., valência e alerta).

Método

Foram selecionadas 429 imagens de websites online para compor três categorias no SocialPICS: (1) Ações (i.e., uma ação ou situação, realizada por pessoas em tarefas cotidianas); (2) Vestimentas (i.e., busto, de um manequim cinza e sem rosto, em uma vestimenta); e (3) Paisagens (i.e., espaços sociais, públicos ou privados, que podem conter pessoas, mas estas não estão no foco da imagem). Cento e trinta e dois participantes atribuíram SSE às imagens de cada categoria, bem como informações de valência e alerta. O questionário foi realizado online e presencialmente e teve duração aproximada de 60 minutos.

Resultados e Discussão

Um novo banco de imagens de SSE, validado e de alta resolução foi criado, o SocialPICS. O conjunto de imagens demonstrou validade para o SSE em duas perspectivas: dimensional e categórica. Na análise dimensional, determinou-se que as imagens podem ser distribuídas de alto a baixo SSE, continuamente. Outrossim, os três níveis, alto médio e baixo

SSE, divergem estatisticamente e demonstram que foram contemplados no banco SocialPICS em uma divisão categórica. No que tange a análise de espaço afetivo, os estímulos de informações SSE e as dimensões afetivas estão relacionadas de modos díspares. As imagens de SSE estão positivamente associadas à valência e negativamente associadas ao alerta. Entretanto, é importante ressaltar que a validação de SSE ocorreu no Brasil e que tensões socio-histórico-culturais estão aplicadas ao nosso contexto. Pesquisas futuras devem investigar e validar o banco SocialPICS em outros contextos.

Introduction

We rely on our vision to navigate the world. Like other social animals, we extract information about the people we interact with in everyday life. Our visual system has evolved as an efficient and accurate pattern classifier for facial and corporal cues such as: moving faces, bodies, eye gaze, language, audiovisual combination of speech, identity, race, ethnicity, and emotions, along with social status (Jack & Schyns, 2017; Pitcher & Ungerleider, 2021). When we have a job interview, our evaluation on the facial movements of the recruiter, such as a smile, or a look to our dirty shoes, trigger cognitive processes and behaviors in response to the interaction with the person to elevate our chance of approval for the work position. Our judgment is affected by the target (i.e., the person we are interacting with), by the observer (i.e., ourselves), by the context in which both are inserted, and by their interaction (Hehman et al., 2019; Mattan et al., 2017). Thus, we need to evaluate social information rapidly and accurately. These social evaluations integrate our visual system inputs as well as prior knowledge about the people we interact with, our social organization, and the social position they occupy in that context.

We organize, standardize, and share knowledge socially. In the social sciences the concept of social classes originated with the scholars of the 19th century. According to Marx (1867/2004) and the materialist dialectic, capitalists own capital and the means of production, and workers provide the workforce. Such a relation leads to exploitation and social positions determinism. Weber argued that the differences in the relations of power, prestige, and social honor will grant the social position, and therefore facilitate or prevent access to wealth and services (Liberatos et al., 1988). Social status has a difficult unique definition, as it can be granted by financial, fitness, intellectual, and moral elements (Mattan et al., 2017). Therefore, socioeconomic status is conceived in psychology as a multidimensional construct, which might

rely on objective measures. Social class symbolizes prestige, control of resources, power, and was conceptualized in two aspects: socioeconomic status (SES) and subjective socioeconomic status (SSS). The first contemplates relatively objective measures, such as income, wealth, educational level, and occupational prestige. Thus, articles of dress, their possessions, and the place where they are encountered, can be incorporated in an SES evaluation of a person. In contrast, SSS is generally measured by the individual's perception of their own social class, using more qualitative and relatively subjective approaches (Diemer et al., 2013). SSS is a measure of self, and a usual measure is the MacArthur Scale of Subjective Social Status (Adler et al., 2000).

Nonhuman primate social organization is also multidimensionally composed. Dominance, desired mating partners, grooming behavior, coalition formation, network size, and other affiliative tendencies are some factors cited by Mattan et al. (2017) as status components. Macaques also yields evidence of specialization of brain regions in social processing in the superior temporal sulcus in response to eye gaze, head, mouth, hand, and body movements (Gangopadhyay et al., 2020; Pitcher & Ungerleider, 2021; Sadeghi et al., 2022). The equivalent area in humans is also implicated in social perception.

As we process visual percepts such as faces, clothing, and environment information, the sensory and social inputs dispute the brain connectivity and cognitive processes. A specialized neural circuitry is involved in the status-based evaluation and comprises social-selective cortical regions. The hippocampus, superior temporal sulcus, ventromedial prefrontal cortex, superior temporal gyrus, anterior temporal lobe, and ventral striatum are commonly associated with person knowledge evaluations. The amygdala and regions linked to status differentiation, such as the intraparietal sulcus, are commonly associated to perceptual inputs. The insula is reported as an integrator of the sensory and evaluative information, and prefrontal

control regions are usually involved when participants are asked to respond without status-based prejudice (Mattan et al., 2018).

Different theoretical frameworks elucidate SES information processing. A race perception study conducted by Freeman et al. (2011) presented a neural network model of person categorization and the role of high- and low-level inputs in SES categorization. They argue in favor of a continuous back and forth activation of lower- and higher-level input. The model's connectionist pattern suggests that, as the race codification unrolls, there will be activation of two divergent routes composed by activation and restriction flow pathways. For instance, one factor may become more relevant activating one pathway (e.g., social status cues), and restricting the other (e.g., skin color). Moreover, perception can be modulated by high-level cognitive operations. Otten et al. (2017), proposed that priors and likelihood are two top-down streams that influence our perception in multiple hierarchical levels. Memories, goals, emotional states, and other cognitive contexts compose the base priors, while the sensory inputs provide ongoing feedback of the errors and mismatch on the predictive signal sent in any part of the hierarchical level.

Social cues can influence a person's racial classification (Freeman et al., 2011, 2013). For instance, Freeman et al. (2011) demonstrated that race was influenced by the clothing of the face of a graphic model (i.e., a computer-generated face). Low SES attire (e.g., blue-collar outfit) increased the likelihood of categorization as black, while high SES attire (e.g., suit and tie) increased the likelihood of categorization as white. Such influence grew stronger as the race became more ambiguous.

There is also evidence that the landscape (i.e., environmental context) in which a face is presented can influence ethnic categorization, emotional content as well as trustworthiness (Barrett & Kensinger, 2010; Freeman et al., 2013; Keres & Chartier, 2016). Wealthy backgrounds increased the trustworthy, aggression, and attractiveness perception when

wealthy, impoverished, and control environments were combined with trustworthy, and untrustworthy faces (Keres & Chartier, 2016). In another study, faces in a morphing continuum ranging from Asian to White faces were presented to United States and Chinese participants in their home countries. The faces were presented in a typically American, neutral, or typically Chinese landscape, and the participants were asked to judge each face ethnically. A face was more likely to be categorized as Asian or White when in an Asian or US-American context, respectively. The bias of the stereotypical cultural landscape was consistent between the participants of the two nationalities studied (Freeman et al., 2013).

Investigating how social perception, cognition, decision-making, and attitudes occur is relevant insofar as we judge and prejudice others by their social status, skin color, citizenship, and social stereotypes held by observers. For instance, knowing that a person has been arrested, unemployed, impoverished, if their death was caused by a homicide or a disease like cirrhosis, influences the race that a person is categorized (Noymer et al., 2011; Penner & Saperstein, 2008). Stereotype is the cognitive component of the prejudiced attitude, and represents implying characteristics to a person only by their affiliation to a group. While prejudice involves a global evaluative response from a group and its members, stereotyping consists of a more specific descriptive analysis (Bodenhausen & Richeson, 2010).

High social status individuals are commonly more positively perceived (vs. social low-status) in many sceneries. Nevertheless, in situations where status is strictly defined in terms of wealth or power (i.e., control over resources), the hierarchy shifts, and high-status is negatively perceived (Mattan et al., 2017). Thus, further investigation is needed to elucidate the emotional evaluation of SES along the affective dimensions of valence (i.e., negative-positive) and arousal (relaxed-aroused), which are subserved by distinct neural networks (see Wade-Bhleber et al., 2020). Emotional databases describe an inverse relation between valence and arousal in general, i.e., positive evaluated images are commonly categorized as more relaxing,

and negative images as highly arousing (Dan-Glauser & Scherer, 2011; Haberkamp et al., 2017; Marchewka et al., 2014; Redies et al., 2020; for an exception see Lang et al., 2008). In the experimental psychology and cognitive neuroscience fields, there are several databases of emotional images available (e.g., International Affective Picture System – IAPS, Lang et al., 2008; Nencki Affective Picture System – NAPS, Marchewka et al., 2014; Erotic subset for the Nencki Affective Picture System – NAPS ERO; Wierzba et al., 2015; Disgust-Related-Images – DIRTI, Haberkamp et al., 2017), including stimuli with discrete or dimensional emotional states (e.g., FACES, Ebner et al., 2010; Karolinska Directed Emotional Faces – KDEF, Goeleven et al., 2008; Chicago Face Database – CFD, Ma et al., 2015), and highly aroused positive images (e.g., erotic images in IAPS and NAPS ERO). However, to our knowledge, there is no image database that presents socioeconomic validation.

Social neuroscience and cognition studies have been utilizing their own images of landscapes and clothing for their studies (Freeman et al., 2011, 2013, 2015; Oh et al., 2019; Ratcliff et al., 2011). However, there is no open-source, standardized, and validated set of SES images available. The employment of lab-made SES pictorial stimuli hampers the replicability and comparability among studies. In addition, a stimuli set must be tailored for its cultural and economic context, given the high wealth inequality among nations.

In light of the growing field of the social cognition and neuroscience, here we provide a high-quality static image database with information of SES and affective space (i.e., valence and arousal), the SocialPICS database (available at <https://osf.io/3t9r2/>). We built and validated 429 images with SES information in three categories: Actions (i.e., an action or situation, performed by people in everyday tasks); Clothing (i.e., torsos with attire in the focus of the image, with a faceless gray manikin); and Landscapes (i.e., places of social spaces, public or private, especially buildings in urban spaces, which may contain people, but these are not in the focus of the figure). SocialPICS covers a broad range of SES levels in a continuum ranging

from lower to higher-status images, and also provides subsets of images in a categorical classification of SES (high, medium and low) for Actions, Clothing, and Landscapes. In addition, we provided stimuli's physical main proprieties for the users.

The present study is divided into two parts: (1) development and validation of SocialPICS, and (2) investigation of the association between SES and the affective space. As a methodological outcome, the instrument is validated for the Brazilian context. As a theoretical outcome, we argue that SES images are emotional images. SES images are positively associated to valence, and negatively associated to arousal.

Method

Stimuli

Images were selected from online websites or shot by the authors. The images were selected to compose three main categories (i.e., image subsets): Actions, Clothing, and Landscapes. On the selection of stimuli, high, medium, and low SES were considered and categorized by the authors. To compose the database in the Landscapes category, the keywords *skyscraper, urban, warehouse, parking, living room, poverty, favela*, and others were used in the searches of the images on the Internet. The Actions keywords were *industrial, homeless, sweeper, business, cooking*, and others. Clothing keywords were *overalls, t-shirts, jacket, suit, formal wear, jacket, polo shirt, plaid shirt, uniform, blazer, overcoat, tank tops*, and others.

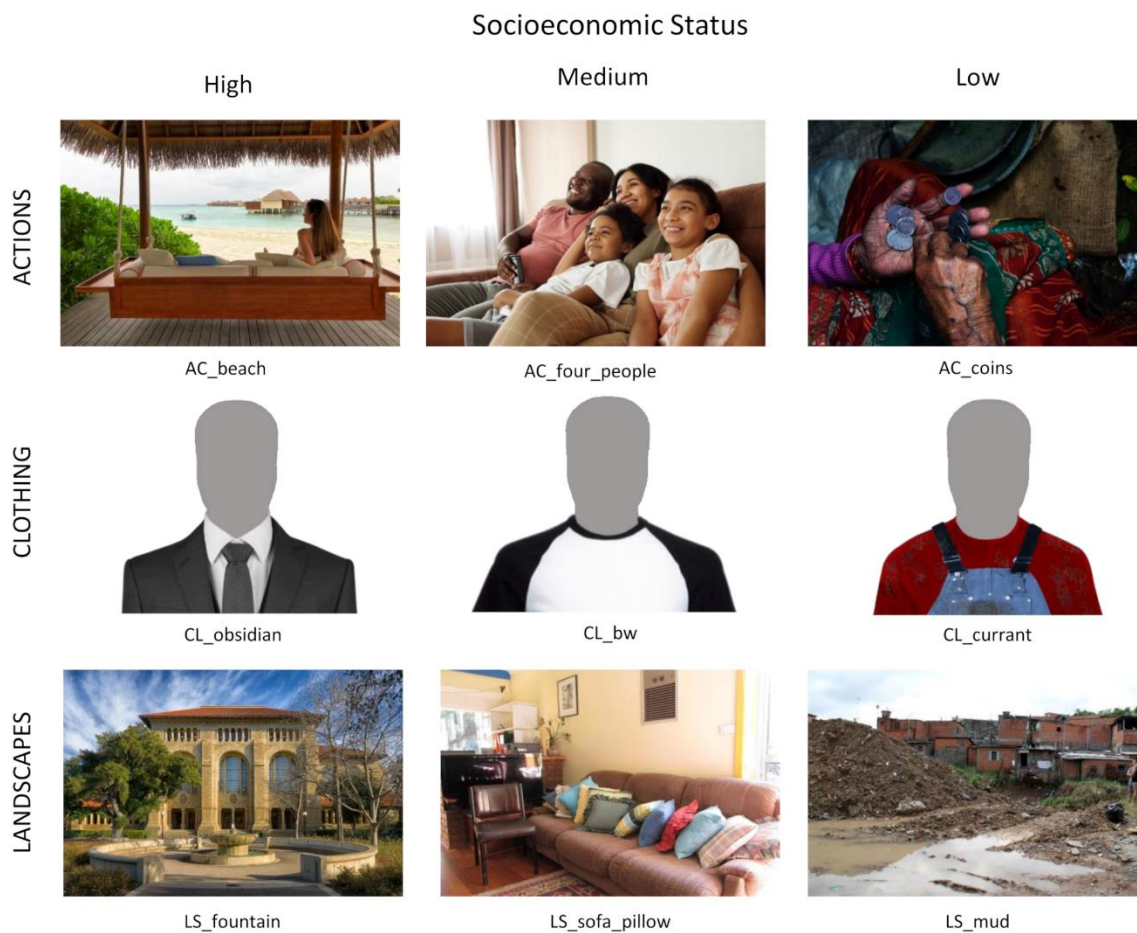
We selected 585 images from our search in 10 public-domain websites, (*pixabay.com, pexels.com, unsplash.com, morguefile.com, picjumbo.com, imagebase.net, freepik.com, pngwing.com, pngpix.com, dlpng.com*). As selection criteria, the images should contain: (1) little or no writing/alphanumeric inscriptions; (2) little or no geographic cues; and (3) little or no advertisement or logos. To fit the criteria, some images were edited using Photoshop (Adobe

Inc., San José, EUA). Due to difficulty in finding culturally matched Landscape images of medium SES, the authors shot photos in the Brasília area (Federal District, Brazil) and selected 26 images to compose the image set. All selected Actions and Landscape images are horizontally oriented with a resolution of 1920×1280 pixels (some images were edited to fit the height and width by adding a gray frame). For the elaborations of the Clothing subset, the images were selected if they meet two additional criteria: (1) they should be frontal; and (2) the view of the collar and shoulders should be free of logos, hair, accessories, or other objects. Some of the images were edited by adding socioeconomic cues arranged on the garment (e.g., stains or small logos of a truck or broom). These symbols were taken from the same websites as the garments and were not associated to any brand or company. Clothing images are vertically oriented with a resolution of 581×563 pixels.

The final and validated dataset (see Results) comprises 429 socioeconomic images (Actions = 136, Clothing = 157, and Landscapes = 136). For each image we provide median ratings of SES, valence, and arousal. SocialPICS also provides stimuli's physical proprieties for those interested or in need of low-level visual information: mean channel values in CIE L^*a^*b color space, grayscale luminance, grayscale contrast, and .JPEG file size (as a measure of complexity). In addition to the original database, SocialPICS is also available in a grayscale version with normalized luminance and contrast. Figure 1 exemplifies images of the three categories (Actions, Clothing, and Landscapes) in the three levels of SES (high, medium, and low). All images and their information are available and can be downloaded from <https://osf.io/3t9r2/>.

Figure 1

Examples of high, medium, and low socioeconomic status images from SocialPICS.



Note. The median image ratings for socioeconomic status (SES), valence (V), and arousal (A) are as follows: AC_beach: SES = 93, V = 96, A = 3; AC_four_people: SES = 55, V = 100, A = 1; AC_coins: SES = 5, V = 7, A = 70; CL_obsidian: SES = 85, V = 51, A = 38; CL_bw: SES = 50, V = 51, A = 39; CL_currant: SES = 18, V = 50, A = 50; LS_fountain: SES = 100, V = 91, A = 14; LS_sofa_pillow: SES = 50, V = 74, A = 19; LS_mud: SES = 1, V = 1, A = 89.

Pilot

In order to exclude images with ambiguous or highly discrepant evaluation of SES, we performed a pilot study to pre-select the images to compose the image database. All 585 selected images were presented to 10 participants [4 females; Mean (M) = 27.9 years, standard deviation (SD) = 3.7]. They had to answer “What level of socioeconomic status do you assign to this image?” using a 9–point Likert scale. All the images were rated for all the participants

and the responses were computed in an .XLS spreadsheet. The selection of images in the pilot was based on: (1) the percentage of agreement (PA; Alexandre & Coluci, 2011), and (2) the SD of the average SES for each image¹.

The first criterion was based on the PA of socioeconomic level. The ordinal responses were categorically transformed to one of the SES levels: high, medium, or low. To establish the status levels, evaluations ranging from 7–9 were categorically defined as a high SES, 4–6 as medium SES, and 1–3 as low SES. The PA was calculated for each image by dividing the response frequency of the most frequent category by the total number of participants and multiplying the ratio by 100 [$PA = (category\ frequency/10) \times 100$]. Images were selected when they reached a minimum PA of 50 %. The second criterion was based on the SD of the average rating of the SES responses. Images were selected if they had an SD lower than two. Thus, 156 images were excluded due to extreme deviation from the average and low PA.

We then created a list of the images classifying the best 50 images (or less, if the category did not reach 50 images that met the two criteria) that best represented the status levels (high, medium, or low) in each category. In all, 429 images were selected (Actions = 136, Clothing = 157, and Landscapes = 136). All data of the pilot study is available in pilot_exclusion_analysis.xls in the Supplementary Material at <https://osf.io/3t9r2/>.

Participants

Volunteers were recruited via online social media, and on message boards of the university facilities. A total of 132 participants ranging from 18 to 64 years old ($M = 24.31$, $SD = 9.36$) took part in the study. Eighty-one were female, 47 male, and 4 other sex identification. Seventy participants were White, one Asian, one Indigenous, 41 Mixed Race, and 19 Black. One hundred one participants took the questionnaire online, and 31 participants performed the study in a laboratory setting. All participants reported normal or corrected-to-normal visual

acuity. 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).

Procedure

All participants and were randomly allocated to one of the following groups: Actions (n = 43), Clothing (n = 45), and Landscapes (n = 44), and rated all the images of their respective category² (approximately 145 images). The PsyToolkit (Stoet, 2010, 2017) presented the images and collected the responses. To better adjust the image display on a variety of monitors in an online setting, stimuli were presented at a resolution of 780 × 520 pixels for Actions/Landscapes images and at a resolution of 581 × 563 for Clothing images. This encompasses 21.2 × 14.4 and 15.7 × 15.2 degrees of visual angle (width × height) for Actions/Landscapes and Clothing, respectively, when considering a 13.3-inch screen 40 cm away from the observer.

After providing informed consent, participants were told that the study was investigating SES and affective aspects depicted in an image. A definition of high, medium, and low SES was presented to the participant based on the MacArthur scale (Adler et al., 2000), and followed by three images illustrating each level of SES. Subsequently, the questionnaire started, and each image was presented one at a time, centered at the top of page, and three 0-100 sliding scales were presented below each image. In the first scale, participants were asked “What level of socioeconomic status do you assign to this image on a scale of 1 (low status) to 100 (high Status)?”. In the second scale, participants were asked to “Complete the sentence ‘When you see this image, you rate it as ...’ (from 1 = unpleasant/negative to 100 = pleasant/positive, with 50 = neutral)”. And in the third scale, participants were asked to complete the sentence: “Confronted with this image, you are feeling: ... (from 1 = calm/relaxed

to 100 = excited/aroused, with 50 = neutral/ambivalent)". In order to respond, the participants had to move a circle over a horizontal axis using the cursor. The first image, along its scales, that was presented right after the instructions was not part of SocialPICS and was used for training purposes. The questionnaire was self-paced and lasted approximately 60 minutes. The detailed instructions are available as Supplementary Material.

Results

No data were lost during data collection or excluded during data analysis. Each image of the dataset was considered as a case in the statistical analysis. On average, each image was rated by 44 participants. No images were excluded from the image dataset after the pilot study. Descriptive statistics for the ratings of SES, valence, and arousal in the three stimuli subsets (i.e., Actions, Clothing, and Landscapes) are summarized in Table 1. Ratings did not fit a normal distribution as evidenced by the Shapiro-Wilk normality test. Data distribution was also checked by density plots, Q-Q plots, and the Anderson-Darling goodness-of-fit test. Thus, the median rating of SES, valence, and arousal were taken as the response variable. All statistical analysis was conducted using Microsoft Excel (Microsoft Corp., Redmond, EUA) and jamovi (The jamovi project, 2021). Raw and processed data, descriptive measures, and statistical analyzes of all the images are presented as Supplementary Material (see <https://osf.io/3t9r2/>). The following analysis describes: (1) the SocialPICS validation, and (2) the association between SES and affective space in the image dataset.

Table 1

Socioeconomic Status, Valence, And Arousal Of The Three Categories Of Images

Stimuli	Socioeconomic Status				Valence				Arousal			
	<i>Md</i>	<i>IQR</i>	<i>M</i>	<i>SD</i>	<i>Md</i>	<i>IQR</i>	<i>M</i>	<i>SD</i>	<i>Md</i>	<i>IQR</i>	<i>M</i>	<i>SD</i>
Actions	53.28	21.11	53.98	15.07	61.71	30.32	61.27	21.17	39.85	33.90	38.64	23.53
Clothing	54.49	27.15	54.55	18.40	50.94	18.64	55.59	20.49	39.50	44.56	33.29	24.19
Landscapes	47.67	17.63	48.64	13.75	49.31	30.31	50.22	20.33	48.80	37.95	48.52	24.40

Note. Median (*Md*), Interquartile Range (*IQR*), Mean (*M*), and Standard Deviation (*SD*) of the three categories integrating SocialPICS, in three ratings: socioeconomic status, valence, and arousal.

Validation

SES measures for each image were calculated by computing the median and the interquartile range. We assumed that images depict highly variable social cues in a spectrum that encompasses images ranging from very low to very high SES. Therefore, we ranked the stimuli by the SES median, from highest to lowest for each stimuli subset. The maximum difference of SES found between one rank and the previous ($rank\ difference = rank_n - rank_{n-1}$) was 5 for Actions, 3 for Clothing, and 10 for Landscapes. The mean difference [$rank\ difference\ mean = \sum (rank_n - rank_{n-1}) / N_{ranks}$] was .67, .53, and .73 for Actions, Clothing, and Landscapes, respectively. Therefore, the dataset present distinct but smoothly spaced levels of SES in the 0-100 rating scale employed for all stimuli categories. Hence, researchers now can employ a fine-grained control over images depicting SES information.

Often researchers also compare experimental conditions of high vs. low SES. Thus, SocialPICS also offers a categorical classification of SES level for practical purposes. In the stimuli subset of Actions, Clothing, and Landscapes, most images were classified as high, medium, and low SES. Two cutoff points divided the stimuli rankings in three terciles: low SES (first tercile), medium SES (second tercile), and high SES (third tercile). We selected the

images that better fit to their level of SES by eliminating 10 images surrounding the cutoff between high-medium SES and 10 images surrounding the cutoff between medium-low SES. Color differentiation of the discrete levels of SES can be seen in the Supplementary Material, see table validation_SES_categorical.xls. Non-colored entries in the table regard stimuli not considered in the discrete classification since they are in the most likely areas of ambiguity for SES categorization. The median rating of images categorized as high, medium, and low SES level for the Action, Clothing, and Landscape subsets of SocialPICS are shown in Figure 2. To assure that high, medium, and low category-labeled images depict different levels of SES, we ran a nonparametric one-way ANOVA (Kruskal-Wallis) for all image subsets. When necessary, Dwass-Steel-Critchlow-Fligner pairwise comparisons were conducted. The significance level was set at 5 % (two-tailed).

In Actions, of the total of the 136 images, we eliminated 10 intersection images between high-medium (5 high images and 5 medium), and 10 images of medium-low intersection (5 medium images and 5 low). Therefore, the high SES category is composed of 40 images, 35 medium, and 41 low. A significant difference was found among SES levels ($\chi^2(2) = 101, p < .001, \epsilon^2 = .89$). In order to identify in which levels the difference was found, pairwise comparisons were carried out between high and low, high and medium, and low and medium SES (all with $p < .001$).

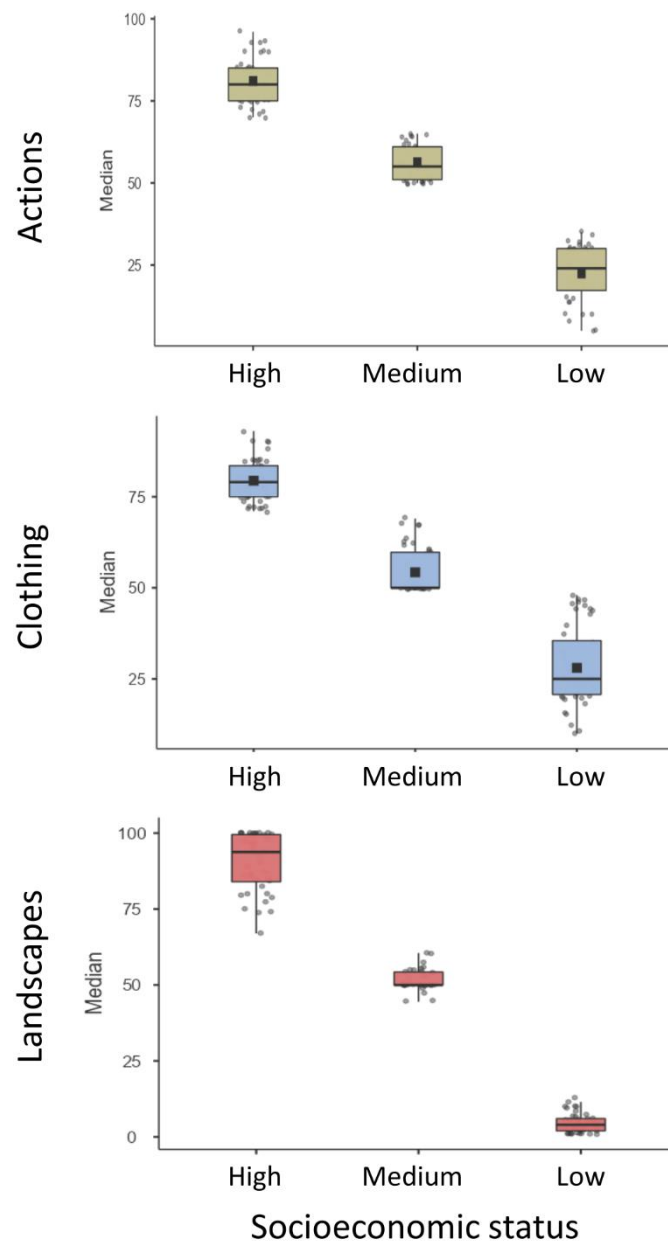
In Clothing, 137 out of the total of 157 images composed the analysis, 47 high SES images, 42 medium, and 48 low, as we eliminated the intersection images. A significant difference was found among SES levels ($\chi^2(2) = 121, p < .001, \epsilon^2 = .89$). Pairwise comparisons were carried out between high and low, high and medium, and low and medium SES (all with $p < .001$).

In Landscapes, 116 out of the total of 136 images composed the analysis, 40 high SES images, 35 medium and 41 low, as we eliminated the intersection images. A significant level

of difference was also found among SES levels ($\chi^2 (2) = 102, p < .001, \varepsilon^2 = .89$). Pairwise comparisons were carried out between high and low, high and medium, and low and medium SES (all with $p < .001$).

Figure 2

Actions, Clothing, And Landscapes Plotted By High, Medium, And Low Socioeconomic Status



Note. Median ratings for each image, compared by three status levels, high, medium, and low.

The results showed that SocialPICS presents valid and diverse images that comprise a continuum in SES. The database also presents a categorical organization of the images; and low, medium, and high SES sets significantly differ from each other.

Affective space analysis

Emotional stimuli are broadly used in neuroscience and cognition research. Appropriate and validated stimuli are required to assess and induce emotional, psychological, and physiological states (Goeleven et al., 2008; Marchewka et al., 2014). Neural regions engaged in affective responses (e.g., amygdala, insula) are also associated in status-based activity that leads to cognitive component changes and potential discrimination consequences (Mattan et al., 2017, 2018). Thus, we conducted regression models to investigate the relationship amid SES, valence, and arousal in Actions, Clothing, and Landscapes subsets (Figures 3 and 4).

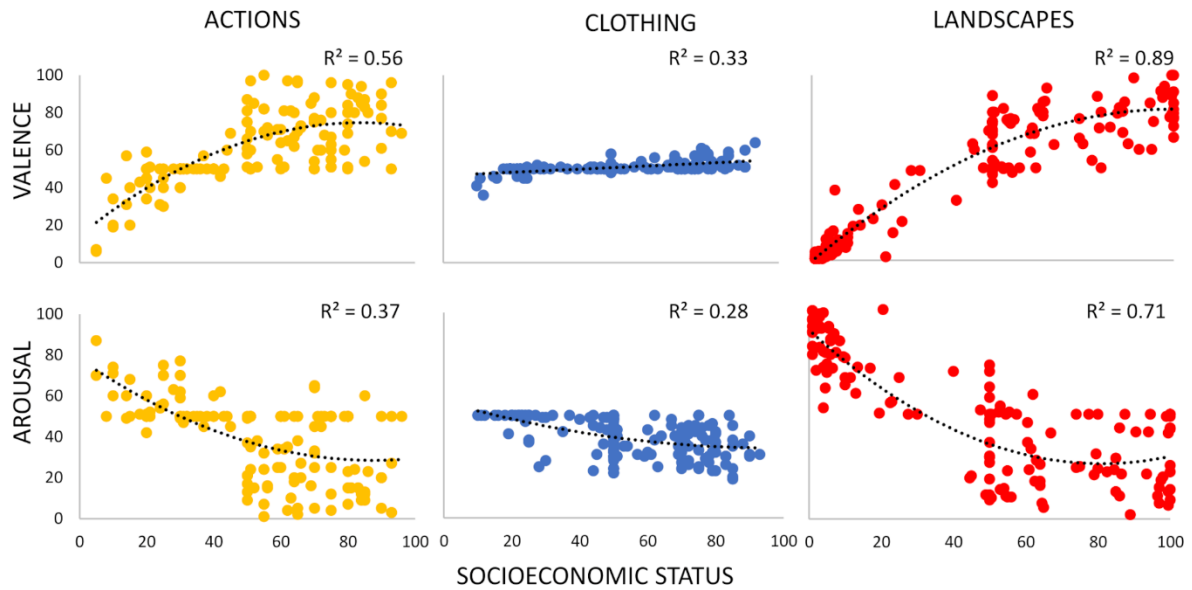
We carried out regression models to analyze the relation between SES and valence for the Actions subset. A better fit of the model was found for a polynomial function, in which a positive moderate relation was found between the measures ($\rho = .71$, $R^2 = .56$). To test if SES and arousal were associated, a fit to a polynomial function was carried out and a negative mild relationship was found ($\rho = -.56$, $R^2 = .34$). A polynomial function also showed a negative strong relationship between valence and arousal ($\rho = -.90$, $R^2 = .78$).

SES and valence had a mild positive relation as shown by a logarithmic function ($\rho = .62$, $R^2 = .33$) for Clothing. A small negative relation between SES and arousal was found when fitting the data in a polynomial function ($\rho = -.54$, $R^2 = .27$). Similarly, a modest negative relation was found when implementing a polynomial function between valence and arousal ($\rho = -.61$, $R^2 = .21$).

Figure 3

Valence, Arousal, And Socioeconomic Status Level Of Actions, Clothing, And Landscapes

Subsets



Note. Ratings for valence (V), arousal (A), and socioeconomic status (SES) in each category. Each dot represents the median rating for a particular image. Their fitted equations follow: Actions: V – SES ($y = -0.0085x^2 + 1.4335x + 14.553$); A – SES ($y = 0.0065x^2 - 1.1322x + 78.084$); Clothing: V – SES ($y = 3.6948\ln(x) + 36.651$); A – SES ($y = 0.0024x^2 - 0.4676x + 56.605$); Landscapes: V – SES ($y = -0.0082x^2 + 1.6414x - 0.5331$); A – SES ($y = 0.0097x^2 - 1.5761x + 90.205$).

When analyzing Landscapes data, a positive strong relation between SES and valence was found as shown by a polynomial function ($\rho = -.88$, $R^2 = .83$). Moreover, we found a strong negative association between SES and arousal when fitting the data in a polynomial function ($\rho = -.76$, $R^2 = .60$). Finally, we showed a strong negative relationship between valence and arousal when conducting a polynomial function ($\rho = -.93$, $R^2 = .87$).

Figure 4

Valence And Arousal Ratings For Actions, Clothing, And Landscapes Subsets



Note. Ratings for valence (V) and arousal (A) in each category. Each dot represents the median rating for a particular image. Their fitted equations follow: Actions: $V - A$ ($y = -0.0052x^2 - 0.2844x + 79.218$); Clothing: $V - A$ ($y = 0.0116x^2 - 2.5259x + 138$); Landscapes: $V - A$ ($y = -0.0037x^2 - 0.6834x + 94.372$).

In summary, results showed that SocialPICS' images convey emotion and are affective visual stimuli in a dimensional approach. In general, SES images are positively associated to valence, and negatively associated to arousal. In addition, our SES-content images present a negative association between valence and arousal.

Subjective social status

In order to explore the relationship of the MacArthur Scale of Subjective Social Status (SSS; Adler et al., 2000) and the SES, valence and arousal ratings of each participant to all the images of their evaluated categories, we conducted Spearman's correlation analysis. For this reason, we here compare the median rating of the participant's SES to all the pictures they rated with the mean of question one and two of the MacArthur scale.

Concerning Actions category, we report a faint relation between SSS and SES ($\rho = .37, p < .05$). We found a soft relationship within valence and SSS SES ($\rho = .34, p < .05$) and no significant association amid arousal and SSS ($\rho = .05, p = .72$). In Clothing, the

relationship between SSS and SES is a marginal relation ($\rho = .30, p < .05$). Between valence and SSS ratings, we outline no correlation ($\rho = .01, p = .94$). Still, amongst arousal and SSS of each participant, no evidence of correlation is established ($\rho = -.01, p = .95$). Nevertheless, within Landscapes, we report no correlation between SSS and SES ($\rho = .13, p = .38$), SSS and valence ($\rho = .14, p = .38$), let alone SSS and arousal ($\rho = -.09, p = .55$).

In outline, results showed little or no relationship among subjective socioeconomic status and objective socioeconomic status. The same marginal effect is observed along with valence and arousal ratings.

Discussion

Here we sought to develop and validate a database of SES-content images, the SocialPICS. We also aimed to investigate the association between SES and the affective space (i.e., valence and arousal). Images of human actions, clothing, and landscapes were selected. The results showed that SocialPICS presents images with distinct but smoothly spaced levels of SES, presenting a continuum of diverse images depicting SES information. The database also presents a categorical organization of the images: low, medium, and high SES-level subsets, which significantly differ from each other. The study showed that the SES level has a positive association to valence, and a negative association to arousal. In addition, a negative association was observed between images' valence and arousal rating in our study.

In our validation study, two systems of classification were proposed, a dimensional approach (i.e., where SES is thought as a low-to-high spectrum), and a categorical approach (i.e., conceived as defined categories of SES: high, medium, and low). Both systems present evidence of validity, and together they are useful for most theoretical frameworks, study designs, and practical issues. It is likely that SocialPICS does exemplify social differences

regarding power, prestige, and control of resources that SES status communicates. As we evolved as a social species, social information activates a specified brain pathway while we perceive a face, body, and body movement relevant to social interaction (Pitcher & Ungerleider, 2021). Moreover, information about a person, a group, priors, and expectations also influence early stages of perception (Otten et al., 2017). These neural and perceptual mechanisms support SES processing when we perceive and evaluate an Actions, Clothing or Landscapes image.

The validation of an image database of SES information is a relevant methodological outcome of the present study. In addition, we contribute to the literature by claiming that SES images are emotional images. SES relates to the dimensional affective space as emotional stimulus: higher SES levels are associated to positive valence and lower arousal; and lower SES is associated to negative valence and higher arousal. This pattern between valence and arousal evaluation was also found in previous studies, which were conducted in the same cultural background (e.g., Ribeiro et al., 2005), and used bipolar semantic scales to rate valence and arousal (Marchewka et al., 2014), in contrast to the Self-Assessment Manikin (SAM) scale. In contrast, our data for the Clothing category showed a weak correlation between valence and arousal. Probably this result is related to image complexity, as the Clothing category differs from the Actions and Landscapes category (see Supplementary Materials) since the images of this subset have no image background.

The Clothing subset also presented low variability in our search. Such a fact may also be related to the weak relationship found between SES and the affective space in this image subset. Free of copyright appropriate stimuli were scarce, and this required more work in the elaboration of stimuli, adding stains and other cues that aided the quality of the stimuli in the dataset. Nevertheless, the clothing category still reported good variability regarding SES. Future studies can implement procedures, such as Torres et al. (2019) that took photographs of

real people, since they portray the reality of a social context and thus present greater ecological validity.

Furthermore, our results support the hypothesis that valence is a unidimensional construct, i.e., positive and negative affects exist on a single continuum (Barrett & Russell, 1998; Russell & Carroll, 1999). Although recent studies are challenging this view to explain complex phenomena as an ambivalent affect (e.g., Vaccaro et al., 2020) and new theoretical-methodological proposals emerge in the emotion field (e.g., Cowen et al., 2019; Shanahan, 2020), valence and arousal dimensions taken together are powerful to predict emotional experiences, especially in contexts of high biological relevance such as physical and social threats (Krosch, 2022).

Emotions can be inducted in many forms (for a review, see Joseph et al., 2020). Pictorial databases supply a vast number of images validated as effective emotional induction (Barrett & Kensinger, 2010; Colden et al., 2008; Ebner et al., 2010; Kim et al., 2018; Marchewka et al., 2014). As SocialPICS could induce emotions, and negative images produce stronger reactions than positive ones (i.e., negativity bias, see Vaish et al., 2008), we suggest that future research using this database should evaluate participants' mood state at the beginning and at the end of the experimental session.

The variability of daily social interactions is vast. Such variance becomes relevant, given that literature is dedicated to investigating differences on SES levels and cultural influences on social encoding (e.g., Freeman et al., 2011, 2013; Torres et al., 2019). For instance, eastern and western cultures are known to think differently. East Asians usually are reported as holistic and collectivist, and United States account as individualist and analytic thinkers (Freeman et al., 2013; Masuda et al., 2008; Oliveira & Nisbett, 2017). Hence, it is important to notice that Brazilians tend to be more holistic than United States and Chinese (Oliveira & Nisbett, 2017), and our social, historical, and cultural atmosphere influence our

social judgements. Therefore, our results on SES validated in a Brazilian sample should be seen as culturally dependent and used with care in other contexts. Cross-cultural studies could favor the understanding of the social phenomenon that occurs in the evaluation of SES in an image. In addition, cultural validations of SocialPICS are encouraged.

Some limitations and cautions must be acknowledged. Not all SES images of SocialPICS depict emotion. As mentioned, we found a weak relationship between SES and the affective space for Clothing images. However, Actions and Landscapes images present a clear correlation of SES, valence, and arousal. In addition, we intended to develop a racially diverse image dataset when portraying individuals, mainly in the Actions subset. However, the free and commercial image databases reproduce inequity in the relation between SES and race found in societies (e.g., Lima & Moraes Jr., 2021). We consider the image curation was well succeeded in our goal of racial variability, but there is still room for improvement. Finally, free of copyright online databases can provide a large pool of images, but there are some staged images that can account as less resembling to reality. On top of that, the questions order of each image could have influence in the valence and arousal ratings, having acted as prime to the other responses. To probe that the order's does not control the affective responses, future research must randomize the question's order.

Research on social perception and cognition should use standardized stimuli databases whenever possible. Researchers usually employ their own lab-made stimuli set, or gather images on the Internet, without standardization and control. The appropriate stimuli selection is fundamental; for instance, physical properties of the images influence the observers' emotional responses (Redies et al., 2020).

The present study developed and validated a socioeconomic-content image database, SocialPICS. Here we also investigated the association between SES and the affective space of the selected images. As a methodological outcome, the instrument is validated for the Brazilian

context. As a theoretical outcome, we argue that SES images are emotional images. SES images are positively associated to valence, and negatively associated to arousal. SocialPICS is a novel, high-quality resolution, standardized database of 429 socioeconomic static images composed of 136 Actions photographs, 157 Clothing, and 136 Landscapes. These three subsets comprise stimuli usually employed by researchers in social cognition and neuroscience. Measures of SES, valence, arousal, and physical properties are provided for each stimulus. The full database, along with raw and validation data, are available for non-commercial use only at <https://osf.io/3t9r2/>. Its use should simplify and favor original and replication studies with a higher level of standardization and control over visual SES-content stimuli.

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Endnotes

¹ Marchewka et al. (2014) performed an assessment of three trained judges to fit the stimuli in five emotional categories and reached 99 % agreement. Ebner et al. (2010), Ma et al. (2015), and Haberkamp et al. (2017) resorted to judges' evaluations but did not report their criteria. Only Marchewka et al. (2014) reported their Percentage of Agreement (PA). In our study, we set a loose PA since SES is a subjective construct and there is no correct category for a dimensional evaluation. Nevertheless, we adopt standard deviation as an additional parameter for stimulus ambiguity.

² In validation studies of datasets containing a large number of images, participants often rate a subset of images: 41 of 490 images in Goeleven et al., (2008), 362 of 1,356 images in Marchewka et al. (2014), 95 of 1128 images in Zamora et al. (2020), 10 of 158 images in Ma et al. (2015), and 200 of 10,696 images in Kim et al. (2018), for example.

Appendix

Appendix A: Approval by the Research Ethics Committee

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PARECER CONSUBSTANCIADO DO CEP

DADOS DA EMENDA

Título da Pesquisa: O status socioeconômico é capaz de afetar a categorização de raça na percepção de faces?

Pesquisador: Rui de Moraes Jr.

Área Temática:

Versão: 3

CAAE: 30539820.9.0000.5540

Instituição Proponente: FUNDACAO UNIVERSIDADE DE BRASILIA

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 4.371.224

Apresentação do Projeto:

Em relação ao parecer substanciado emitido pelo CEP/CHS no dia 11 de junho de 2020, foi acrescentado que, em “função da pandemia de COVID-19, os estudos que utilizam rastreamento do mouse serão postergados dada a dificuldade de sua implementação online. Sendo assim, experimentos online que apresentam os mesmos estímulos e as mesmas condições experimentais serão realizados. Nestes experimentos, será utilizado como dado para a análise apenas a resposta à tarefa de categorização. Um primeiro experimento de categorização racial será realizado sem as pistas visuais socioeconômicas, a fim de ajustes para os experimentos subsequentes. Portanto, pretendemos uma simplificação dos experimentos para sua viabilidade em um cenário de experimentação online”.

Objetivo da Pesquisa:

Em relação ao parecer substanciado emitido pelo CEP/CHS no dia 11 de junho de 2020, foi acrescentado que, nos “experimentos online propostos por esta ementa, mantém-se o objetivo: investigar se informações de status socioeconômico alteram a percepção racial. No entanto, apenas a resposta de julgamento (Branco ou Preto) será utilizada. Medidas psicofísicas como limiares e funções psicométricas serão calculadas. De modo exploratório, um breve questionário contendo questões sobre status social baseado em instrumentos da literatura além de outras informações (e.g., escolaridade; região de residência

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UF: DF **Município:** BRASILIA
Telefone: (61)3107-1592 **E-mail:** cep_chs@unb.br

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Continuação do Parecer: 4.371.224

autodeclaração e atitudes raciais; interação social durante a pandemia de COVID 19) será aplicado aos respondentes dos experimentos online propostos para que possa ser realizada uma correlação entre as respostas sobre status socioeconômico do formulário e os índices psicofísicos da tarefa de categorização racial”.

Avaliação dos Riscos e Benefícios:

Inalterada em relação ao parecer consubstanciado emitido pelo CEP/CHS no dia 11 de junho de 2020.

Comentários e Considerações sobre a Pesquisa:

A pesquisa é relevante.

Considerações sobre os Termos de apresentação obrigatória:

O cronograma foi corrigido.

O TCLE foi refeito. Entretanto, a recomendação de inserir o texto “Este projeto foi revisado e aprovado pelo Comitê de Ética em Pesquisa em Ciências Humanas e Sociais (CEP/CHS) da Universidade de Brasília. As informações com relação à assinatura do TCLE ou aos direitos do participante da pesquisa podem ser obtidas por meio do e-mail do CEP/CHS: cep_chs@unb.br ou pelo telefone: (61) 3107 1592” não foi atendida.

Ainda no TCLE, a citação à Resolução CNS 466/2012 deve substituir a Resolução CNS 196/1996 (que já não está em vigor), conforme a recomendação explicitada no parecer consubstanciado emitido pelo CEP/CHS no dia 11 de junho de 2020.

Recomendações:

Providenciar as alterações no TCLE.

Conclusões ou Pendências e Lista de Inadequações:

Este comitê reitera o parecer de aprovação emitido no dia 11 de junho de 2020 como forma de resguardar a referida pesquisa quanto a seus aspectos éticos.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_161125_6_E1.pdf	13/10/2020 02:50:00		Aceito
Outros	Emenda.pdf	13/10/2020 02:44:09	Rui de Moraes Jr.	Aceito
Projeto Detalhado	Projeto_02_ATUALIZADO.pdf	15/05/2020	Ana Beatriz da Silva	Aceito

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Continuação do Parecer: 4.371.224

/ Brochura Investigador	Projeto_02_ATUALIZADO.pdf	19:26:15	Mendes Araujo	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE_ATUALIZADO.pdf	15/05/2020 19:25:58	Ana Beatriz da Silva Mendes Araujo	Aceito
Outros	Curriculo_Lattes_Renata_Ramos_de_Souza.pdf	03/04/2020 15:18:49	Ana Beatriz da Silva Mendes Araujo	Aceito
Outros	Curriculo_Lattes_Ana_Beatriz_da_Silva_Mendes_Araujo.pdf	03/04/2020 15:18:32	Ana Beatriz da Silva Mendes Araujo	Aceito
Outros	Curriculo_Lattes_Rui_de_Moraes_Junior.pdf	03/04/2020 15:17:07	Ana Beatriz da Silva Mendes Araujo	Aceito
Outros	CARTA_DE_ENCAMINHAMENTO.pdf	30/03/2020 12:25:23	Ana Beatriz da Silva Mendes Araujo	Aceito
Declaração de Instituição e Infraestrutura	ACEITE_INSTITUCIONAL_FINAL.pdf	30/03/2020 12:24:52	Ana Beatriz da Silva Mendes Araujo	Aceito
Outros	CARTA_DE_REVISAO_ETICA.pdf	30/03/2020 12:24:02	Ana Beatriz da Silva Mendes Araujo	Aceito
Cronograma	CRONOGRAMA.pdf	30/03/2020 12:23:40	Ana Beatriz da Silva Mendes Araujo	Aceito
Outros	JUSTIFICATIVA_PARA_NAO_APRESENTACAO_DO_INSTRUMENTO.pdf	30/03/2020 12:22:55	Ana Beatriz da Silva Mendes Araujo	Aceito
Folha de Rosto	FOLHA_DE_ROSTO_FINAL.pdf	30/03/2020 12:21:58	Ana Beatriz da Silva Mendes Araujo	Aceito

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

BRASILIA, 29 de Outubro de 2020

**Assinado por:
Érica Quinaglia Silva
(Coordenador(a))**

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Telefone: (61)3107-1592 **E-mail:** cep_chs@unb.br

Appendix B: Termo de Consentimento Livre e Esclarecido (TCLE)

Gostaria de convidá-lo(a) a participar da pesquisa “SocialPICS: validação de um banco de imagens com informações sociais” que faz parte de projeto intitulado “O status socioeconômico é capaz de afetar a categorização de raça na percepção de faces?”. Nesta etapa do projeto de pesquisa, buscamos construir e validar um banco de imagens com informações socioeconômicas. Não encontramos na literatura especializada um banco validado de imagens que transmitem informações de condição econômica e social, o que justifica o presente estudo.

A pesquisa não lhe fornecerá benefícios diretos, sejam eles, atuais ou potenciais. Em contrapartida, os resultados da pesquisa podem ser relevantes para a ciência em geral ao: (1) agregar à literatura especializada estímulos validados para conteúdo de status socioeconômico na população brasileira que poderão ser utilizados em investigações científicas; (2) contribuir para compreensão da relação entre estados afetivos e status socioeconômico.

Os requisitos para que você participe desta pesquisa são: (1) ter boa acuidade visual e (2) ser maior de 18 anos.

Todo o procedimento é realizado online e individualmente e tem duração aproximada de 60 minutos (uma hora). Você deverá responder por meio do mouse em uma barra deslizante qual nível de status socioeconômico melhor combina com a imagem apresentada, bem como informações sobre seu estado emocional em respeito a cada figura.

Os procedimentos adotados nesta pesquisa obedecem aos Critérios da Ética em Pesquisa com Seres Humanos conforme Resolução N. 510/2016 do Conselho Nacional de Saúde. Nenhum dos procedimentos usados oferece riscos à sua dignidade. As tarefas a serem executadas não apresentam desconfortos ou riscos previsíveis à integridade de sua saúde física ou mental. É importante que você finalize o experimento; porém, se desejar interrompê-lo ou

encerrá-lo, você assim poderá proceder a qualquer momento, sem qualquer prejuízo ou penalidade.

Não haverá nenhum reembolso de dinheiro, já que com a participação na pesquisa você não terá nenhum gasto. Os dados desta pesquisa serão divulgados em reuniões e publicações científicas, e as identidades dos participantes serão mantidas em absoluto sigilo.

Este projeto foi revisado e aprovado pelo Comitê de Ética em Pesquisa em Ciências Humanas e Sociais (CEP/CHS) da Universidade de Brasília (CAAE 30539820.9.0000.5540). As informações com relação à concordância do TCLE ou aos direitos do participante da pesquisa podem ser obtidas por meio do e-mail do CEP/CHS: cep_chs@unb.br ou pelo telefone: (61) 3107-1592.

Você receberá uma cópia deste TCLE via e-mail. Caso ainda tenha quaisquer dúvidas sobre esta pesquisa, por favor, sinta-se à vontade para solicitar esclarecimentos a qualquer momento. Para isso, entre em contato com os integrantes da equipe de pesquisa listados abaixo.

Rui de Moraes Jr.

Prof. Orientador

rui.moraes@unb.br

Ana Beatriz da Silva Mendes Araujo

Mestranda PPG-CdC

psicologia.anab@gmail.com