Conceptual and Visual Representations of Racial Categories: Distinguishing Subtypes from Subgroups

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Abstract

While much of the person perception literature has focused solely on the representation of superordinate social categories (e.g., race and age), these superordinate social categories may be organized into smaller subcategories (i.e., subtypes and subgroups) that can be distinguished by their perceived typicality. Based on the logic that atypical subcategories represent subtypes and typical subcategories represent subgroups, we hypothesized that some subcategory labels would elicit greater perceived stereotypicality compared to others. In Experiment 1, participants listed stereotypic traits and rated the perceived typicality of subcategories of Black and White men. In Experiment 2 we used a reverse correlation image classification procedure to estimate participants' visual representations of the faces of Black and White superordinate category and subcategory members. Results indicated that representations of Black subgroups reflected traits and features more prototypical of Black men compared to representations of Black subtypes. Similarly, representations of White subgroups reflected traits and features more prototypical of White men compared to representations of White subtypes. The current experiments further clarify the nature of subcategory representations as subgroups and subtypes within the superordinate category. Implications for stereotype maintenance and change are considered.

Keywords: person perception; subtyping; subgrouping; social cognition; facial features

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Social psychologists have largely examined the processes that guide social perception and judgment as they relate to the activation of broad bases of social categorization like race, age, and gender. While these categories provide a great deal of explanatory power in describing the bases of person perception (Macrae, Quinn, Mason, & Quadflieg, 2005), explorations of these broad social categories alone may not provide a full understanding of the processes that guide stereotyping, prejudice, and discrimination. Indeed, when forming an impression of a target, perceivers often use information beyond the superordinate category to increase judgment accuracy (Stangor, Lynch, Duan, & Glas, 1992). While much of the public discourse focused on addressing discrimination stays at the level of broad social categories, more nuanced perspectives may be needed to understand and address the variability in the experiences of individuals. Reflecting this recognition are research programs exploring intersectionality (Purdie-Vaughns & Eibach, 2008), phenotypicality bias (Maddox, 2004), and biracial perception (Pauker et al., 2009). With this investigation, we seek to elaborate on research exploring the nature of social category representations with a focus on race.

Social Category Representations

Superordinate vs. Subordinate Categories

After initially categorizing a target, a perceiver may be motivated to gather individuating information that will distinguish the target from other category members (Brewer, 1988; Fiske & Neuberg, 1990). This additional information about a category member may be incorporated into the perceiver's superordinate category representation, contributing to the formation of subcategories (Hewstone & Hamberger, 2000; Maurer, Park, & Rothbart, 1995; Queller & Smith, 2002). Examinations of natural categories suggest that superordinate categories are organized into subcategories (Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). Social cognition researchers have adopted this reasoning, examining how social categories may be organized into smaller groups (Brewer, Dull, & Lui, 1981; Devine & Baker, 1991; Green & Manzi, 2002; Maurer, Park, & Rothbart, 1995). One implication of this framework suggests that categorizing targets at the subcategory rather than the superordinate category level may prove more efficient for the perceiver in a number of ways (Brewer, 1988; Brewer et al., 1981; Fiske & Neuberg, 1990). For example, the category "Black men" can be further divided into more specific subcategories that may or may not share traits typically associated with the superordinate category (e.g., "welfare Black" versus "businessman Black"; Devine & Baker, 1991; Green & Manzi, 2002; McCabe & Brannon, 2004). Therefore, a subcategory representation may more precisely reflect traits of a particular target. In addition, this more precise target-subcategory match may attenuate the need for the perceiver to gather additional individuating information about the target. After sufficient experience with a superordinate category and its underlying subcategories, perceivers may readily represent and automatically access the subordinate groups in memory directly, bypassing superordinate category activation (Pattyn, Rosseel, Van Overwalle, & Van Hiel, 2015). Thus, subcategories may be the default way perceivers represent categories and match exemplars in everyday interactions (Brewer et al., 1981; Pattyn et al., 2015).

Subgroups vs. Subtypes

Maurer and colleagues (1995) explored how perceivers organize the superordinate category using two types of subcategories: subgroups and subtypes. Subgrouped targets represent fairly typical category members with features that largely confirm elements of the superordinate category stereotype, while subtyped targets represent fairly atypical category members with features that disconfirm elements of the superordinate category stereotype (Maurer et al., 1995; for review see Richards & Hewstone, 2001). In the perceiver's representation, subgroups are regarded as typical members of the superordinate category, whiles subtypes are regarded as atypical: they are exceptions to the category rule that are "fenced off" from the superordinate category (Allport, 1954; Maurer et al., 1995; Richards & Hewstone, 2001).

These representations have important consequences for perception and judgment. Examinations of subcategories in the context of a memory confusion task reveal that subtyped targets are more likely to be confused with other subtypes, while subgrouped targets are more likely to be confused with other subgroups (Johnston, Hewstone, Pendry, & Frankish, 1994). The targets associated with these subcategories also exert different influences on superordinate category judgements. The process of re-fencing atypical instances into subtypes has the consequence of increasing perceptions of the superordinate category's homogeneity and stereotypicality while the formation of typical instances into subgroups decreases perceptions of homogeneity and stereotypicality (Maurer et al., 1995; Park, Ryan, & Judd, 1992). Members of subtypes and subgroups can have different implications for stereotype change. For instance, as an atypical member of a social category, a subtyped target who exhibits stereotype-inconsistent behavior is unlikely to elicit superordinate stereotype change. Conversely, as a typical group member, a subgrouped target who displays stereotype-inconsistent behavior is more likely to elicit superordinate stereotype change (Maurer et al., 1995; Richards & Hewstone, 2001; Rothbart & Lewis, 1988). Finally, representations of subgroups versus subtypes have distinct implications for the target. In contrast to subgrouping, subtyping may benefit the target by allowing them to be evaluated largely outside the context of a negatively-stereotyped superordinate category membership (Richards & Hewstone, 2001).

These distinctions lead to predictions about how each subcategory will be represented in relation to the superordinate category and other members of the group. Subgroups will be represented as typical instances of a category, sharing many features with other members of the group, while subtypes will be represented as atypical instances of a category, sharing few features with other members of the group (e.g., Richards & Hewstone, 2001).

Overview: Identifying Subgroups and Subtypes

Park, Wolsko, and Judd (2001) described three measures for establishing that subgrouping or subtyping has occurred: (1) confusion with other subgroup or subtype members, (2) degree of similarity between the target and other individuals in the group, and (3) degree of typicality of the target in relation to the superordinate category. Collectively, these three measures can estimate a target's identity as belonging to a subgroup or a subtype of a superordinate category. Here, by examining category typicality, we aim to address four limitations of previous work exploring subcategory representations. First, examinations of the cognitive processes surrounding subgrouping and subtyping have focused on artificial groups developed to tightly control the variables contributing to these phenomena (Hewstone, 1994; Maurer et al., 1995; Park et al., 2001). While these methods have allowed researchers to carefully examine subcategorization processes, they limit the extent to which conclusions about these processes may be generalized to real social groups. With one exception (McCabe & Brannon, 2004) there is no evidence to date indicating that real-world categories of people are perceived as either subgroups or subtypes of their superordinate category. Without evidence that perceptions of real-world social groups are guided by subcategorization processes, we are limited in the extent to which we can generalize the evidence that subgroups and subtypes influence stereotypic beliefs and judgment. Second, these examinations have focused largely on the consequences of subcategory representations rather than exploring the nature of the representations themselves. By better understanding how subcategories are represented, we can make unique predictions about stereotype application and maintenance as it relates to the real-world experience of people who occupy multiple social categories simultaneously. Third, most prior examinations of how perceivers represent subcategories (e.g., athletes or businessmen) within a real-world group (e.g., Black men) did not consider whether these representations may reflect either subgroups or subtypes (Devine & Baker, 1991; Green & Manzi, 2002). Finally, even investigations that differentiate real-world subgroups from subtypes have relied on explicit ratings of the typicality of a subcategory in relation to the superordinate category (McCabe & Brannon, 2004). While typicality ratings are a reliable measure for distinguishing subgroups versus subtypes, ratings made under these circumstances may unintentionally influence participants' perceptions of the targets in question (Park et al., 2001). Namely, asking a participant to focus their attention on the typicality of a given subcategory may prompt them to subtype a subcategory when they otherwise would not.

Two experiments were designed to address these limitations, using both direct and indirect measures of category representation to establish whether certain subcategories are represented distinctly and spontaneously as subgroups or subtypes of Black and White men. We focused our investigation on one of the subcategorization indices described by Park and colleagues (2001)—category typicality—but extend that work by exploring the utility of trait-category overlap (Experiment 1) and visual representations (Experiment 2). Based on the logic that the most typical subcategories represent subgroups and the most atypical subcategories represent subtypes, we hypothesized that participants would report greater perceived stereotypicality in the context of subgroup labels compared to subtype labels.

Experiment 1: Conceptual Representations of Racial Subcategories

Experiment 1 was designed to replicate and extend earlier investigations of Black male subcategory representations (Devine & Baker, 1991; Green & Manzi, 2002; McCabe & Brannon, 2004) by examining stereotypic trait listings for several potential subcategories of Black men. Further extending that work, we also explored representations of White men and included a measure of perceived typicality for each subcategory.

Method

Participants and design. Participants were randomly assigned to conditions in a 2 (target race: Black or White) × 7 (subcategory: athlete, businessman, doctor, hipster, janitor, rapper, and redneck) mixed model design with repeated measures on the second factor. Prior to initiating data collection, we aimed to recruit at least 50 participants per between-subjects condition, for a total of 100 participants.

Recruitment took place using an Amazon Mechanical Turk (MTurk) Human Intelligence Task (HIT) requesting 100 workers to complete the survey via Qualtrics. Overall, 158 MTurk workers consented to participate in exchange for $0.50 US. After reading detailed instructions about the task, 33 participants discontinued their participation. The remaining 125 participants were then assigned to one of two target race conditions: Black (57 participants); or White (68 participants) and advanced to view the first question. Of these 125 participants who began the experimental procedures, 117 completed the experiment. The overall attrition rate of this experiment was 25.95%, which is similar to attrition rates reported in previous research using an online sample (28.5% to 51.0%; Zhou & Fishbach, 2016). The rate of participant attrition following condition assignment was comparable across the Black (3; 5.26%) and White (5; 7.35%) conditions, χ^2 (1) = 0.012, p = .914.[1]

The final sample included 117 participants[2] (67 women, 32 men, 18 unreported; 74 White, 8 multiracial/multiethnic, 6 Black, 6 Hispanic, 5 Asian, 18 unreported) who completed the entire experiment without missing data ($M_{\text{completion time}}$ ≈ 17 minutes). All participants provided their responses via an IP address from within the United States of America (US). In each of the

[1] Recent research underscores the importance of reporting attrition rates across experimental conditions, especially when conducting research online (Zhou & Fishbach, 2016). We note that any participant attrition is likely non-random, and therefore limits the extent to which we can generalize the conclusions of the current work. Furthermore, because it is unclear whether, across conditions, participants' reasons for discontinuing were the same, the internal validity of the current experiment may be also limited.

[2] The sample exceeded the HIT allocation because 17 MTurk workers completed the survey via Qualtrics but did not return to the MTurk page to submit the HIT and indicate that they had completed the task. When participants failed to submit a HIT, MTurk did not decrement the HIT allocation quota, and therefore recruitment continued until 100 HITs had been submitted, even if the number of complete responses on Qualtrics exceeded the quota.

studies reported in this paper, there were relatively few participants who self-identified a racial group membership other than White. As such, we do not report effects of participant race in our analyses. However, exploratory analyses removing non-White participants did not meaningfully change the results.

Stimuli. Based on a combination of empirical and anecdotal (e.g., internet) sources, we selected subcategories that would reflect a range of possible race-typical and race-atypical subcategories for Black and White men. Some of the subcategories were taken from previous research providing evidence that the categories athlete, janitor, and rapper are perceived as Black-typical, while the category businessman is perceived as White-typical and Black-atypical (Devine & Baker, 1991; Freeman, Penner, Saperstein, Scheutz, & Ambady, 2011; Green & Manzi, 2002). The other subcategory labels (doctor, hipster, and redneck) were added based on considerations of stereotypes of White men and race-related status expectations of certain subcategories in the U.S. (Maykovich, 1971; McCabe & Brannon, 2004). For instance, McCabe and Brannon (2004) provide evidence that two of the most frequently endorsed stereotypes of White men are educated and ambitious. Given these traits, the subcategories of doctor and businessman were expected to be perceived as White-typical. Finally, based on the authors' personal knowledge of social media conversations, we included the subcategories hipster and redneck to examine participants' perceptions of two subcategories that are typically associated with Whites, but may reflect lower status and less favorable groups compared to businessmen and doctors.

Typicality ratings. Participants completed racial typicality ratings for each subcategory label on a scale from 1 (*not at all typical*) to 7 (*very typical*). They were instructed to consider how closely each subcategory aligns with perceptions of White or Black men in the US and to make typicality ratings based on their knowledge of cultural beliefs in the US. All subcategory labels were visible to participants as they made their ratings.

Trait listings. Participants completed trait listings for each of the seven subcategory labels and the superordinate category label, for a total of eight listing tasks. Specifically, participants were instructed to consider a distinction between cultural and personal beliefs of these groups in the US: that we can know of traits, behaviors, and characteristics commonly associated with groups in a culture without necessarily endorsing them personally (Maddox & Gray, 2002). Their task was to list as many of the traits, behaviors, and characteristics that reflect the cultural beliefs about each group that they could. Participants were instructed to place an asterisk next to traits that were consistent with their personal beliefs, providing them with an opportunity to distance themselves from items that they might otherwise fail to list out of desirability concerns. Participants were presented with one subcategory label at the top of the screen. When they were finished writing they could continue to the next screen. Presentation of superordinate and subordinate category labels was counterbalanced within each race condition.

Procedure. Participants completed the typicality rating and trait listing tasks in counterbalanced order. Following completion of these measures, participants answered a series of demographic questions, read a debriefing statement, and were dismissed from the experiment.

Coding scheme. To develop a coding scheme of the trait listing data, we first submitted all free responses to a word frequency query using NVivo 10, a qualitative data analysis software package (QSR, 2014). This query returned a list of words and the frequency counts of those words among all free responses. We specified for the query to group exact word matches and words with the same stem (i.e., athlete, athletes, athletic). The query produced frequency counts of every word listed in participants' free responses, excluding words on NVivo's list of Stop Words (e.g., prepositions and conjunctions) that are not meaningful to this analysis. To determine the specific traits, the first author extracted the most common, unique, descriptive traits for coding, listed in Appendix A. For instance, NVivo produced separate word counts for "smart" and "intelligent". These words were grouped into a single trait, "smart" in the coding list. In another instance, the word "hard" occurred 96 times in participants' free response. Upon closer inspection, the first author determined that the word "hard" co-occurred with "working" in 91 of these 96 instances. Therefore, we included the trait "hard working" in the coding list. This method resulted in a total of 88 unique traits, only 12 of which were revealed in previous studies addressing a similar question (Devine & Baker, 1991; Green & Manzi, 2002). One likely reason we extracted a larger number of trait categories for coding is our inclusion of a wider range of target groups (16: 7 subcategories for each of 2 superordinate categories, plus the 2 superordinate categories). Another likely reason is our use of a data-driven approach, rather than knowledge of group stereotypes, to identify traits for coding. Based on this list of traits, three judges blind to the experimental conditions and hypotheses were instructed to assign each free response to one trait. For cases in which only two out of three judges agreed on a trait, the trait chosen by a majority (two) of the judges was used for this analysis. For cases in which there was a three-way tie (i.e., all three judges disagreed on the appropriate trait) a fourth coder, also blind to the conditions and hypotheses, reviewed the three traits chosen by the first judges and decided which one was most appropriate. This method for handling a three-way tie applied to 338 of a total 3788 (8.92%) free responses.

Results

These analyses examined participants' ratings of typicality and the degree of overlap of the traits most frequently listed with each subcategory relative to the superordinate racial category (Black or White).

Typicality ratings. Participants' typicality ratings were submitted to a 2 (race: Black or White) × 7 (subcategory: athlete, businessman, doctor, hipster, janitor, rapper, and redneck) mixed-model ANOVA with repeated measures on the second factor. Results revealed significant main effects of race, F (1, 115) = 13.25, $p < .001$, $\eta^2 = .03$, and subcategory, F (6, 690) = 16.52, $p < .001$, $\eta^2 = .09$. These main effects were qualified by a significant race × subcategory interaction, F (6, 690) = 96.47, $p < .001$, $\eta^2 = .37$.

To investigate the nature of the race × subcategory interaction, we conducted post-hoc independent samples t-tests to determine whether perceptions of subcategory typicality varied depending on the racial group in question. Overall, participants rated the subcategories rapper and athlete to be more typical of Black compared to White men, and the subcategories businessman, hipster, doctor, and redneck to be more typical of White compared to Black men (Table 1; Figure 1). The subcategory janitor was rated equally typical of Black and White men.

We also conducted post-hoc paired samples t-tests to compare the typicality ratings of each subcategory pair within a given race. Overall, participants rated the subcategories rapper (M = 5.99, SE = 0.18) and athlete (M = 5.83, SE = 0.17) as being the most typical of Black men. Both subcategories rapper and athlete were rated as more typical of Black men compared to businessman, doctors, hipsters, janitors, and rednecks (Figure 1; see Table 2 for results of all pair-wise comparisons of Black subcategories). Conversely, participants rated the subcategories businessman (M = 5.83, SE= 0.15) and doctor (M = 5.44, SE= 0.19) as being the most typical of White men. Both subcategories businessman and doctor we rated as more typical of White men compared to athletes, hipsters, janitors, rappers, and rednecks (Figure 1; see Table 3 for results of all pair-wise comparisons of White subcategories).

Trait frequencies. We next explored whether stereotypes about these racial subcategories vary in the degree to which they overlap with stereotypes about the superordinate category. As described above, the coding scheme resulted in a list of 88 unique traits used to describe the categories. We calculated frequencies for the number of participants who listed each coded characteristic for a given category (Maddox & Gray, 2002). We limit the current analysis to the top 10 most frequently-listed traits within each superordinate category. Due to a two-way tie in the White condition, we analyzed 11 of the most frequently listed traits for the White categories. We chose to limit the analysis to the top 10 traits because these traits represented over half of participants' free responses for both the Black (61.5%) and White (61.5%) superordinate categories. Though not reported here, performing these analyses based on the top 15 and top 20 traits produced a similar pattern of results.

Due to the categorical nature of the data, we used a non-parametric test to examine whether the proportion of participants who listed a given trait (e.g., athletic) varied depending on the category the participant was responding to within a given race category. Furthermore, given the within-subjects nature of these trait listings, we employed an omnibus Cochran's Q test (rather than a Chi-square test) to conduct this analysis. All omnibus Cochran's Q tests were significant, indicating that for each trait examined, a difference in trait frequency was observed among the subcategories within a given race condition (results of each Cochran's *Q* test are reported in the supplementary materials). Follow-up paired McNemar's tests were used to examine whether a subcategory (e.g., Black athlete) overlapped with a given superordinate category (Black man) along a given trait dimension (e.g., athletic). Trait overlap between a superordinate category and a subcategory is represented by either (a) a non-significant difference in trait frequencies between the two categories; or (b) a significantly larger proportion of frequencies for the subcategory compared to the superordinate category along a given trait. The proportion of participants listing each trait for a given subcategory and the results of the trait overlap assessment are reported in Table 4 (accompanying statistics can be found in the supplementary materials).

An examination of Table 4 provides converging evidence that participants perceive different subcategories to be more or less typical of Black compared to White men. Among the Black subcategories, participants listed the highest percentage of overlapping traits (out of 10) for the rapper subcategory (90%), followed by athlete, janitor, and redneck (80%). Conversely, participants listed the lowest percentage of overlapping traits for the businessman and doctor subcategories (50% each). Among the White subcategories, participants listed the highest percentage of overlapping traits (out of 11) for the businessman, doctor, and athlete subcategories (91%, 82%, and 73%, respectively). Conversely, participants listed the lowest percentage of overlapping traits (out of 11) for the janitor and redneck (45% each) subcategories.

Discussion

In line with previous research, typicality ratings indicate variation in the extent to which participants view various subcategories as aligning with representations of Black and White men. Our exploratory measure of stereotypic trait-category overlap provides some converging evidence. Here we assume that higher typicality ratings or trait-frequency overlap suggest subgroups, while lower values on these indices suggest subtypes. Therefore, these analyses suggest that participants perceive the subcategories rapper and athlete as Black subgroups (and White subtypes) and the subcategories doctor and businessman as White subgroups (and Black subtypes). Aligning with previous work, subcategories perceived as typical of one group (Blacks) are perceived as atypical of a contrasting group (Whites; McCabe & Brannon, 2004).

Non-convergent evidence includes the finding that participants rated janitors as equally typical of Black and White men. However, the trait frequencies suggest a higher degree of overlap for janitors and Blacks versus Whites. This suggests that janitor may not be a subcategory that is meaningfully distinguished by racial group membership. Relatedly, while redneck was rated as the least-typical subcategory for Black men, it was among those subcategories with the highest trait-frequency overlap. This contradiction likely results from the fact that the label "redneck" is typically used *only* for Whites. Therefore, although participants' stereotypic traits of rednecks and Blacks may overlap, the category label is not perceived to apply to Black men. Furthermore, while athlete was rated as relatively atypical for Whites, the subcategory was among those with the greatest trait-frequency overlap for White men. The implications of these findings for perceivers' mental representations of subcategories are unclear but worthy of further investigation. Instead, we next sought to build on the converging evidence across the two tasks to further explore representations of Black and White men.

Experiment 2: Visual Representations of Racial Subcategories

Park and colleagues (2002) argued that although typicality is a reliable indicator of subgrouping and subtyping, it is problematic in its invasiveness—asking participants to rate typicality draws their attention to disconfirming (or confirming) attributes of the target in relation to the superordinate category. Thus, the task itself may be prompting participants to subcategorize in a particular manner, rather than measuring their spontaneous mental processes. In Experiment 2 we sought additional evidence that subcategories of Black and White men can be represented distinctly *and spontaneously* as subgroups or subtypes using a procedure that does not draw participants' explicit attention to the difference between the subcategory and the superordinate category. We used a reverse correlation (RC) image classification procedure to estimate one group of participants' visual representations of the superordinate categories (Part 1a) and subcategories (Part 1b) of Black and White men explored in Experiment 1. We then asked a separate group of participants to make typicality and trait ratings of these representations to examine the degree of objective and subjective overlap with their superordinate categories (Part 2). The RC method has been useful for approximating mental representations of a variety of social constructs. For instance, it has been used to visualize group distinctions based on ethnicity (Dotsch, Wigboldus, Langner, & van Knippenberg, 2008) and ingroup status (Ratner, Dotsch, Wigboldus, van Knippenberg, & Amodio, 2014), and to reflect the primary dimensions of face evaluation: dominance and trustworthiness (Dotsch & Todorov, 2012). This procedure addresses the limitation in prior research described above by divorcing subcategorization processes from typicality ratings, and it permits an investigation of participants' visual representations of racial categories.

Method

Part 1a: Face generation task – superordinate category typicality

Participants and design. Participants were randomly assigned to conditions in a 2 (face race: Black or White) × 2 (typicality judgment: high or low) between-subjects design. Based on previous research using RC to estimate variation in racial phenotypicality (Krosch & Amodio, 2014), we aimed to recruit at least 30 participants per between-subjects condition plus ten additional participants in case of incomplete participant responses, for a total of 130 participants. Recruitment took place using an MTurk HIT requesting 130 workers to complete the survey via Qualtrics. Overall, 189 MTurk workers consented to participate in exchange for $0.50 US and were assigned to 1 of 4 experimental conditions: high prototypical Black (43); low prototypical Black (51); high prototypical White (51); low prototypical White (44). Of these 189 MTurk workers, 130 completed all experimental procedures. The overall attrition rate for this experiment was 31.22%, which is similar to attrition rates reported in previous research using an online sample (Zhou & Fishbach, 2016). The rate of participant attrition within each of the four conditions was comparable (high prototypical Black: 15, 34.88%; low prototypical Black: 16; 31.37%; high prototypical White: 15, 29.41%; low prototypical White: 13; 29.55%), χ^2 (3) = 0.327, p = .955. Data from one participant in the low prototypical White condition were excluded because the participant did not complete all trials, and thus we could not use their data to complete the image generation procedure. Thus, the final sample included 129 participants (78 women, 46 men, 4 unreported, 1 transgender; 96 White, 9 Black, 7 Asian, 6 Hispanic, 8 multiethnic/multiracial, 2 Native Hawaiian/Pacific Islander, 1 Alaskan Native/Native

American) who completed the entire experiment without missing data ($M_{completion\ time} \approx 21$ minutes). All participants provided their responses via an IP address from within the US.

Stimuli. In line with a standard RC paradigm (Dotsch & Todorov, 2012), stimuli were created from a base face: a grayscale, emotionally neutral image of a Black or White man superimposed with patterns of random noise. In a deviation from that paradigm, the base face was generated using the computer software, FaceGen Modeller (Singular Inversions) rather than a morph of two photographs of real faces. Our goal was to create a racially unambiguous image that would permit some variability for judgements of typicality. The use of computer-generated images provided us with the methodological precision to select faces at the mid-point of their respective racial phenotypicality scales. Each trial presented two images. One of the images was the base image superimposed with a random noise pattern. The other image was the base image superimposed with the inverse of the same random noise pattern (see Figure 2). The stimulus pairs were displayed in random order, counterbalancing the position (left or right) of each stimulus type (original or inverse noise) on the screen.

Face categorization task. Participants were led to believe they were pretesting stimuli for use in a subsequent face perception study. They then completed 200 trials of a forced-choice face categorization task. On each trial, participants viewed two stimuli, each consisting of 256 × 256 grayscale pixels. Participants were asked to choose the image of the man who appeared more (or less) typically Black (or White; Maddox, 2004). Target race and degree of typicality were randomized between-subjects, so that each participant was asked to make the same typicality judgment on all 200 trials.

Classification image generation. The data from the classification task were used to create a classification image (CI) that estimates the visual representation for each participant. The rcicr package (Dotsch, 2015) was implemented in R version 3.2.0 (R Core Team, 2015) to generate CIs within each experimental condition. To do this, the program averaged the noise patterns chosen on each experimental trial within each condition. Next, the resulting normalized averaged noise pattern was superimposed back onto the original base image. The result was a group of four CIs reflecting the conditions in the experimental design: high-prototypical Black; low-prototypical Black; high-prototypical White; low-prototypical White (see Figure 2). Given the low number of participants who self-identified a racial group membership other than White, we did not generate separate images based on participant race.

Part 1b: Face generation task – subordinate category typicality

Participants and design. Participants were randomly assigned to conditions in a 2 (face race: Black or White) × 4 (subcategory judgment: athlete, businessman, doctor, or rapper) between-subjects design. Consistent with Part 1a, we aimed to recruit at least 30 participants per between-subjects condition. Given that we observed only 1 incomplete response across all conditions in Part 1a, we recruited an additional 2 participants per between-subjects condition, for a total target sample size of 256. Recruitment took place using an MTurk HIT requesting 256 workers to complete the survey via Qualtrics. Overall, 385 MTurk workers consented to participate in exchange for $0.50 US and were assigned to 1 of 8 experimental conditions: Black athlete (55); Black businessman (46); Black doctor (45); Black rapper (49); White athlete (43); White businessman (52); White doctor (53); or White rapper (49). Of these 385 participants, 256 completed all experimental procedures. The overall attrition rate for this experiment was 34.69%, which is similar to attrition rates reported in previous research using an online sample (Zhou & Fishbach, 2016). The rate of participant attrition across each of the eight conditions was comparable, (Black athlete: 16, 29.09%; Black businessman: 16, 34.78%; Black doctor: 16, 35.56%; Black rapper: 16, 32.65%; White athlete: 15, 34.88%; White businessman: 19, 36.54%; White doctor: 17, 32.08%; White rapper: 21, 42.86%), χ^2 (7) = 2.55, p = .923. The final sample included 256 participants (164 women, 84 men, 7 unreported, 1 transgender; 198 White, 19 Black, 15 Asian, 13 multiethnic/multiracial, 8 Hispanic, 2 Alaskan Native/Native American, 1 unreported) who completed the entire experiment without missing data ($M_{\text{completion time}}$ ≈ 22 minutes). All participants provided their responses via an IP address from within the US.

Stimuli. The stimuli were identical to those used in Part 1a.

Face categorization task. We used the same procedure as Part 1a, with two exceptions. First, there was a cover story indicating that previous research has shown that people can reliably detect information about a person's background based on an image of their face. Participants were further told that the study tested whether people can determine a person's background characteristics even if their face is viewed under suboptimal conditions (e.g., appears blurry). Second, on each trial participants were asked to choose the image of the man who occupied a given subcategory (i.e., athlete, businessman, doctor, or rapper). Similar to Part 1a, assignment to target race and subcategory conditions was randomized between-subjects, so that each participant was asked to make the same subcategory judgment on all 200 trials.

Classification image generation. We employed the same image generation procedure as used in Part 1a to generate Black and White CIs of an athlete, businessman, doctor, and rapper (see Figure 2). Again, given the low number of participants who self-identified a racial group membership other than White, we did not generate separate images based on participant race.

Part 2: Face rating task

The purpose of Part 2 was threefold. First, we aimed to establish among an independent sample of judges whether the CIs generated in Part 1a convey the intended levels of racial typicality. Second, we examined whether the subcategory CIs generated in Part 1b vary in perceived racial typicality in a manner that aligns with perceptions of subcategory typicality as expressed in Experiment 1. Third, we explored the extent to which the CIs generated in Part 1a and Part 1b convey the traits and characteristics most frequently attributed to their respective social groups in Experiment 1.

Participants and design. Participants were randomly assigned to conditions of a 2 (CI race: Black or White) × 6 (CI category: high-prototypical, low-prototypical, athlete, businessman, doctor, and rapper) mixed design with repeated measures on the second factor. A power analysis using *G**Power to detect an effect size of $f = .10$ (a small effect size), assuming a .5 correlation between the measures targeted a sample size of 83 participants per cell for 95% power. To account for the possibility of missing data, we rounded up our target sample size to 90 participants per cell, for a total of 180 participants. Recruitment took place using an MTurk HIT requesting workers to complete the survey via Qualtrics. Overall, 208 MTurk workers consented to participate in exchange for $0.50 US. After reading detailed instructions about the task, six participants chose to discontinue their participation. The remaining 202 participants were then assigned to one of two race conditions: Black (93 participants); or White (109 participants) and advanced to view the first question. Of the 202 participants who began the experimental procedures, 180 completed the experiment. The overall participant attrition rate for this experiment was 13.46%, which is lower than other attrition rates reported here and in previous research using an online sample (Zhou & Fishbach, 2016). The rate of participant attrition across conditions was comparable (Black: 7, 7.53%; White: 15, 13.76%), χ^2 (1) = 1.42, p = .234. The final sample included 180 participants (101 women, 68 men, 11 unreported; 143 White, 10 Black, 7 unreported, 5 Asian, 5 Hispanic, 5 multiethnic/multiracial) who completed the entire experiment without missing data ($M_{\text{completion time}}$ ≈ 19 minutes). Because there are relatively few participants who self-identified a racial group membership other than White, we do not report effects of participant race in these analyses. However, exploratory analyses removing non-White participants from this sample did not meaningfully change the results. All participants provided their responses via an IP address from within the US.

Stimuli. Each participant rated traits and features of all the CIs generated within one racial category. Thus, each participant made ratings in response to a total of 6 images: the two images generated in Part 1a (high-prototypical and low-prototypical) and the four images generated in Part 1b (athlete, businessman, doctor, rapper).

Trait rating task. Participants were asked to rate each CI on 30 character traits and 6 physical traits (Appendix B). Traits were taken from the trait listing task in Experiment 1. Consistent with our examination of the top 10 superordinate category traits in Experiment 1, we determined the top 10 most frequent traits listed in response to each of the superordinate race categories (White and Black) and the subcategories within each race category (Black athlete, Black businessman, Black doctor, Black rapper, White athlete, White businessman, White doctor, White rapper). After accounting for duplicate trait dimensions, we were left with a list of 30 unique traits. Participants rated how much the person in the picture appeared to reflect each trait on a scale of 1 (not at all) to 7 (very). Participants completed the trait ratings in random order within blocks (one stimulus per block). Importantly, the CIs were not labeled, so participants were unaware of the race and subcategory constraints under which the images were generated.

Results

Participant agreement. To assess degree of participant agreement within each category of CI, we calculated Intraclass Correlation Coefficients (ICC) on the pixel luminance values of each participant's CI noise pattern (masked to include only the pixels of the face). In this analysis, ICC represents how strongly the pixels of each participants' CI in a given condition (e.g., Black athlete) resemble each other. There was a range of agreement among each participants' pixel luminance values across the given conditions, with ICC values ranging from .158 to .833 (Table 5).

Objective similarity. Using masked pixel luminance values, we quantified the degree of similarity between each subcategory CI and the superordinate CI. Stated plainly, we examined the degree of similarity between each subcategory CI and its high-prototypical superordinate counterpart, a parallel strategy to that described in Experiment 1 in which we used perceived typicality ratings to compare subcategories to their superordinate categories. We indexed objective similarity in two ways: pixel luminance correlation and pixel luminance distance.

Pixel luminance correlations. We calculated the correlation between masked pixel luminance values of each CI (e.g., high-prototypical Black) and those of another CI (e.g., Black athlete) within each race condition. We interpret these correlations as measures of similarity

(Dotsch & Todorov, 2012). High-positive correlations indicate that the images are physically similar; high-negative correlations indicate they are physically opposite; zero correlation indicates the images have little in common. These correlations are summarized in Table 6.

In line with our hypothesis, those CIs associated with subcategories that participants rated as most typical of Black men in Experiment 1 (athlete and rapper) were highly positively correlated with the high-prototypical Black CI. On the other hand, those CIs associated with subcategories that were rated as least typical of Black men (businessman and doctor) had weak correlations with the high-prototypical Black CI. Similarly, the CIs generated in the White target condition also aligned with perceptions of typicality expressed in Experiment 1. Subcategories that were perceived as most typical of White men (doctor and businessman) were highly positively correlated with the high-prototypical White CI while those subcategories rated as least typical of White men (athlete and rapper) were weakly correlated.[3]

We note that because pixel luminance correlations reflect relative ranking of each pixel, they may overestimate similarities between faces with different skin tones. That is, if the relative ranking of the pixels in two given CIs is the same between images, the correlation would be perfect even if the superordinate luminance values of the two images are different (i.e., if one

[3] Both low-prototypical CIs were highly negatively correlated with their respective high-prototypical CIs. This pattern suggests that the low-prototypical CIs represent a face that is the *opposite* of the high-prototypical face (e.g., a face that a perceiver would not categorize as Black) rather than a face that would be an atypical member of the superordinate category (e.g., a face that a perceiver would categorize as Black, but is atypical of the category; Dotsch & Todorov, 2012). Therefore, it is difficult to interpret exactly what the low-prototypical face in each condition represents. As such, we focus our subsequent analyses on the high-prototypical CIs and their respective subcategory CIs.

image portrays a darker skin tone than the other). Thus, this correlational analysis is complemented by an analysis of pixel luminance distances.

Pixel luminance distances. We next calculated the masked pixel luminance Euclidean distance from each pixel in the participant's CI to the corresponding pixel in the averaged high-prototypic CI, within each race condition.[4] This resulted in an averaged pixel luminance distance value for each participant in Part 1b. We calculated the superordinate category distance as the average of these differences across all pixels within a given participants' CI noise pattern. We expected that those subcategories perceived as most (compared to least) typical of the superordinate category would have smaller (larger) superordinate category distances.

To test this hypothesis, we conducted a 2 (race: Black or White) × 4 (subcategory: athlete, businessman, doctor, or rapper) between-subjects ANOVA on the superordinate category distances. The ANOVA indicated a significant effect of race, F (1, 240) = 7.42, p = .007, η^2 = .03, with greater distances for Black compared to White CIs. The effect of subcategory was not significant, F (3, 240) = .019, p = .900, η^2 = .002. The race effect was qualified by a significant race × subcategory interaction, F (3, 240) = 3.56, p = .01, η^2 = .04. Follow-up two-sample t-tests examined whether participants generated subgroup CIs that had a smaller superordinate category distance compared to subtype CIs. These follow-up tests did not reveal significant differences across any of the pairwise comparisons within race condition (Table 7).

While we didn't observe statistical significance, the patterns represented in these comparisons are in the expected direction (Table 8). Among CIs generated in the Black

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[4] We would like to thank an anonymous reviewer for the suggestion to conduct this analysis.

condition, those subcategory CIs that represent Black subgroups (athlete and rapper) had shorter superordinate category distance (i.e., were more similar) compared to those subcategory CIs that represent Black subtypes (businessman and doctor). The opposite pattern is observed among the White CIs. Those subcategory CIs that represent White subgroups (businessman and doctor) had shorter superordinate category distance (i.e., were more similar) compared to those subcategory CIs that represent White subtypes (athlete and rapper).

We meta-analyzed the *t*-tests examining whether participants generated subgroup CIs that had a smaller superordinate category distance compared to subtype CIs (Goh, Hall, & Rosenthal, 2016). We first converted our Cohen's *d* values into Pearson correlations and then transformed each correlation into a Fisher's *z* for analysis. Overall, the effect was significant, $M_r = .20$, $Z = 2.48$, $p = .013$, two-tailed, such that subgroup CIs had a smaller superordinate category distance compared to subtype CIs. A fully random effects test of the overall effect was also significant, as indicated by a one-sample *t*-test of the mean effect size against zero, $M_r = .20$, $t(7) = 7.86$, $p < .001$, 95% CI: [0.138, 0.257].

Subjective similarity. Next, we sought convergent evidence that the subcategory CIs varied in the extent to which they reflect features and traits prototypical of their superordinate group. Therefore, we analyzed participants' assessment of racial phenotypicality and superordinate trait stereotypicality.

Racial phenotypicality. For all participants, we computed an overall racial phenotypicality index as the average of participants' responses to the five racial phenotypicality questions such that higher scores reflected higher phenotypicality for the target they rated (Black or White). These average ratings are summarized in Figure 2. We submitted these racial phenotypicality scores to a 2 (race: Black vs. White) × 6 (CI category: high-prototypical, low-prototypical, athlete, businessman, doctor, rapper) mixed-model ANOVA with repeated measures on the second factor. Results revealed the hypothesized race × subcategory interaction, F (3.95, 702.80) = 42.51, $p < .001$, $\eta^2 = .12$. Follow-up comparisons examined whether subgroup CIs were perceived to have higher racial phenotypicality than subtype CIs (see Table 9 and Figure 2). In line with our hypothesis, the CIs generated for the Black-typical subcategories (Black athlete and Black rapper) were rated as representing higher Black phenotypicality compared to the CIs generated for Black-atypical subcategories (Black doctor and Black businessman). Similarly, the CIs generated for the White-typical subcategories (White doctor and White businessman) were rated as representing higher White phenotypicality compared to the CIs generated for the White-atypical subcategories (White athlete and White rapper).

Trait stereotypicality. We next examined the extent to which the subcategory CIs elicited trait ratings consistent with those traits listed as most typical of their respective superordinate categories in Experiment 1. To do this, we calculated a superordinate trait index as the average of the top 10 most frequently listed traits for the relevant superordinate category (Appendix C). For ratings of Black CIs, the superordinate trait index was calculated as the average of participants' ratings on the following traits: aggressive, athletic, criminal, rich (reverse scored), educated (reverse scored), tall, musical, strong, loud, and nice (reverse scored). For ratings of White CIs, the superordinate trait index was calculated as the average of participants' ratings on the following traits: educated, professional, powerful, rich, smart, arrogant, privileged, hardworking, racist, and successful.

We expected that those subcategories perceived as most (compared to least) typical of the superordinate category would receive higher scores on their superordinate category stereotypicality index. We submitted these superordinate trait index scores to a 2 (race: Black vs. White) × 6 (CI category: high-prototypical, low-prototypical, athlete, businessman, doctor, rapper) mixed-model ANOVA with repeated measures on the second factor. Results revealed the hypothesized race × subcategory interaction, F (4.75, 845.22) = 42.51, $p < .001$, $\eta^2 = .08$. Follow-up comparisons examined whether subgroup CIs were perceived to have higher superordinate trait ratings compared to subtype CIs (means and analyses presented in Table 10). In line with our hypothesis, the CIs generated for the Black-typical subcategories (Black athlete and Black rapper) received higher superordinate trait index scores compared to the CIs generated for Black-atypical subcategories (Black doctor and Black businessman). Contrary to our hypothesis, the CIs generated for the White-typical subcategories (White doctor and White businessman) received higher superordinate trait index scores compared to only one of the White-atypical CIs: White rapper, and not White athlete.

Exploratory analysis. Finally, we examined the extent to which each subcategory CI elicited trait ratings in Part 2 consistent with those traits listed as most typical of that subcategory in Experiment 1. To do this, we calculated subcategory trait stereotypicality indices as the average of the top 10 most frequently listed traits for each subcategory (Appendix C). For instance, the Black athlete stereotypicality index was calculated as the average of participants' ratings on the traits: athletic, strong, tall, rich, hardworking, aggressive, arrogant, smart (reverse scored), powerful, criminal, disciplined, and successful. Hence, for each Black and White CI we calculated four indices for each of the racial subcategories (athlete, rapper, doctor, and businessman).

Next, we conducted a one-way repeated-measures ANOVA with planned contrasts to examine whether the CIs generated in Part 1b elicited the highest ratings on the combination of traits listed in Experiment 1 for their respective subcategories (Table 11). Overall, category-specific stereotypicality index ratings were higher for the same-category CI compared to mean of the other CIs (within race). For example, the Black athlete CI was rated higher on the Black athlete stereotypicality index (M = 3.89, SE = 0.07) compared to the average of all the other Black CIs (M = 3.72, SE = 0.03), F (1, 85) = 11.98, p = .001, η^2 = .12 (Table 12). This pattern of results was repeated such that each Black CI was rated higher on its corresponding category index compared to the average of all other Black CIs. This same pattern was observed among the White CIs with one exception: the White athlete CI was not rated higher on the White athlete index compared to the remaining CIs.

Discussion

Consistent with the findings of Experiment 1, both objective (pixel luminance distances, pixel luminance correlations) and subjective (phenotypicality ratings, superordinate trait ratings) measures of CI typicality provided largely converging evidence for a subgroup/subtype distinction among participants' mental representations of the subcategories examined for Black and White men. Certain subcategories (athlete and rapper) were perceived as subgroups of Black men and subtypes of White men, while other subcategories (businessman and doctor) were perceived as subgroups of White men and subtypes of Black men.

Some non-convergent evidence was observed. First, the overall analysis of pixel luminance distances did not reach significance. Although a mini meta-analysis of the simple effects was significant for each meaningful comparison, the extent to which we can use the pixel luminance distance analysis to draw conclusions about Black and White subcategories is limited. Second, while the objective similarity measures and the phenotypicality ratings of the White athlete CI suggest its physical characteristics are atypical of the superordinate White man category, the superordinate trait index did not demonstrate converging evidence that athlete is less typical of White men compared to the subgroups businessman and doctor. Furthermore, in the exploratory analysis, participants' ratings of the White athlete CI were not consistent with trait listings for White athletes in Experiment 1. One possible reason the White athlete subcategory did not elicit a consistent pattern of results across our stereotypical trait indices may be that White athletes are represented in memory as a combination of diverse exemplars (e.g., golfers, football players), while Black athletes may be associated with a narrower range of activities. This and other possibilities would benefit from empirical investigation.

General Discussion

This research examined the extent to which subcategories represent subgroups versus subtypes of naturally occurring social categories using both explicit and implicit measures of category typicality. Across two experiments and three independent measures of typicality we found evidence that representations of athlete and rapper subcategories represented subgroups of Black men, but subtypes of White men. Conversely, we found that representations of doctor and businessman subcategories represented subgroups of White men but subtypes of Black men. We also found that stereotypic traits listed about these categories in Experiment 1 were reflected in participants' visual representations elicited in Experiment 2. However, further empirical attention is warranted; these conclusions must be tempered somewhat given that the pattern of results was not uniform across all measures and experiments. For instance, we observed some inconsistent results regarding the typicality of the White athlete subcategory in Experiment 1 (trait frequencies) and Experiment 2 (superordinate trait index), calling into question its classification as a White subtype. Furthermore, while the mini meta-analysis was supportive, our omnibus analysis of CI objective similarity for pixel luminance distances in Experiment 2 did not reach significance, tempering our claim of differences in objective visual similarity among subcategory representations.

Despite these shortcomings, the current studies lend support to the use of novel methods for examining the extent to which categories represent subtypes or subgroups that address limitations identified in previous research. Based on the evidence that typicality is a strong predictor of subtyping (Park et al., 2001), we examined typicality using three different methods: explicit typicality ratings, stereotype content overlap, and typicality of mental imagery. While many methods of identifying category subtypes have been reported (e.g., Park et al., 2001), the current experiments relied heavily on typicality for classifying a category as a subgroup or subtype. Future research that attempts to identify how subcategories are represented as subgroups versus subtypes would benefit from using additional subcategorization measures. These additional measures may also help clarify some of the inconsistency among subcategories explored here (e.g., janitors and redneck in Experiment 1; athletes in Experiment 2). Despite the limitation of using only one measure of subtyping, by examining typicality using conceptual and physical, direct and indirect measures, we measured participants' spontaneous representation of a category in a way that avoids confounds associated with explicitly drawing participants' attention to category typicality.

The current studies highlight the utility of RC as a procedure for examining group distinctions based on subcategory membership and conceptual representations of subcategories within a superordinate category. We also show that RC is useful for uncovering facial information beyond the primary dimensions of face evaluation, such as conceptual stereotypes of a group. This type of task may be used in the future to uncover group stereotypes that participants are unwilling or unable to explicitly articulate. The CIs generated for each social category also revealed distinctions in the degree of racial phenotypicality associated with each group. These results suggest that in addition to a target's behavioral characteristics, racial phenotypicality may function as another factor that prompts a perceiver to subtype (or subgroup) a category member. Future research might further probe the range of characteristics that facilitate the activation and use of subgroup versus subtype representations and their implications for behavior, such as clothing style (e.g., Barden, Maddux, Petty, & Brewer, 2004; Freeman et al., 2011), vocal cues (e.g., Ko, Judd, & Blair, 2006), or linguistic patterns (Gaither, Cohen-Goldberg, Gidney, & Maddox, 2015). It is possible that some of these cues may influence stereotype use by activating associations with a meaningful subgroup or subtype, while others may affect stereotype use more independently. Investigations of this nature might also shed light on the processes that lead to the formation of subcategory representations.

These findings also contribute to our understanding of social category perception more generally. First, we have replicated previous research examining the subcategories of Black men (Devine & Baker, 1991; Green & Manzi, 2002; McCabe & Brannon, 2004). Extending this investigation to an examination of the nature of these categories, we found evidence distinguishing subgroups and subtypes of different racial groups. Currently, the extent to which the subcategories examined in the current research are salient "in the real world" is still unclear. The categories we chose to examine were either based on the researchers' speculation or taken from previous studies (e.g., Devine & Baker, 1991), which also relied heavily on researcher speculation. Future research should empirically examine the subcategories that comprise representations of superordinate social categories, such as those based on race and gender.

Finally, the current work also makes an important theoretical contribution to research examining the role of categorization in person perception. While much of the literature focuses on the role of superordinate category activation, some previous work suggests that, for superordinate categories with which a perceiver has much experience, subcategory (rather than superordinate category) activation may be the default way of processing social targets (Pattyn et al., 2015). The current experiments contribute to this line of work by establishing the nature of these subcategory representations as subgroups and subtypes within the superordinate category. These distinctions are important, as they have implications for stereotype maintenance and change. As fenced-off category members who largely disconfirm the overall stereotype, theories suggest that subtypes are unlikely to affect superordinate stereotypes (Johnston & Hewstone, 1992; Park et al., 2001). On the other hand, as more central, stereotype-consistent category members, subgroups are more likely to effect change to the superordinate stereotype when they present stereotype-disconfirming behaviors. Ultimately, work in this area may begin to leverage the various ways that a target may be represented as a subgroup or a subtype member in an effort to change superordinate category stereotypes.

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Table 1

Perceived Typicality of Social Subcategories as a Function of Racial Group (Experiment 1)

	Black			White					
Subcategory	*M*	*SE*	95% CI	*M*	*SE*	95% CI	*t*(115)	*p*	Cohen's *d*
athlete	5.83	(0.17)	(5.49, 6.17)	4.56	(0.20)	(4.16, 4.96)	4.89	< 0.001	0.89
business	3.70	(0.17)	(3.37, 4.04)	5.83	(0.15)	(5.53, 6.12)	− 9.49	< 0.001	1.76
doctor	3.19	(0.18)	(2.82, 3.55)	5.45	(0.19)	(5.06, 5.83)	8.52	< 0.001	1.56
hipster	3.54	(0.28)	(2.98, 4.10)	4.84	(0.22)	(4.40, 5.28)	− 3.70	0.003	0.69
janitor	4.41	(0.24)	(3.93, 4.89)	3.79	(0.19)	(3.41, 4.18)	2.02	0.334	2.60
rapper	5.96	(0.18)	(5.61, 6.31)	2.40	(0.18)	(2.03, 2.76)	14.00	< 0.001	0.38
redneck	1.74	(0.20)	(1.35, 2.13)	5.41	(0.20)	(5.02, 5.80)	− 13.25	< 0.001	2.44

Note: *p*-values are Bonferroni-corrected for multiple comparisons

Table 2

Paired t-tests Comparing Black Typicality Ratings for Each Subcategory Pair (Experiment 1)

			95% CI				Cohen's
Comparison groups	M_{dif}	SE_{dif}	LL	UL	$t(53)$	p	d
athlete – businessman	2.13	0.25	1.63	2.63	8.54	<.001	1.73
athlete – doctor	2.65	0.27	2.11	3.18	9.96	<.001	2.05
athlete – hipster	2.30	0.30	1.69	2.91	7.54	<.001	1.35
athlete – janitor	1.43	0.29	0.84	2.01	4.89	<.001	0.94
athlete – rapper	−0.13	0.12	-0.38	0.12	−1.04	1.000	0.10
athlete – redneck	4.09	0.28	3.53	4.66	14.55	<.001	3.04
businessman – doctor	0.52	0.16	0.20	0.84	3.28	.038	0.40
businessman – hipster	0.17	0.31	−0.45	0.78	0.54	1.000	0.10
businessman – janitor	−0.70	0.29	−1.29	−0.12	−2.42	.395	0.47
businessman – rapper	−2.26	0.25	−2.76	−1.76	−9.10	<.001	1.80
businessman – redneck	1.96	0.26	1.45	2.48	7.62	<.001	1.47
doctor – hipster	−0.35	0.32	−0.98	0.28	−1.12	1.000	0.20
doctor – janitor	−1.22	0.31	−1.84	−0.60	−3.97	.005	0.78
doctor – rapper	−2.78	0.27	−3.31	−2.24	−10.42	<.001	2.11
doctor – redneck	1.44	0.26	0.92	1.97	5.56	<.001	1.03
hipster – janitor	−0.87	0.36	−1.59	−0.15	−2.42	.398	0.46
hipster – rapper	−2.43	0.33	−3.09	−1.77	−7.38	<.001	1.42
hipster – redneck	1.80	0.32	1.16	2.43	5.67	<.001	1.01
janitor – rapper	−1.56	0.27	−2.11	−1.01	−5.67	<.001	1.01
janitor – redneck	2.67	0.28	2.10	3.24	9.37	<.001	1.66
rapper – redneck	4.22	0.29	3.63	4.81	14.36	<.001	3.09

Note: dif = difference. p-values are Bonferroni-corrected for multiple comparisons.

Table 3

Paired t-tests Comparing White Typicality Ratings for Each Subcategory Pair (Experiment 1)

			95% CI				Cohen's
Comparison groups	M_{dif}	SE_{dif}	LL	UL	$t(53)$	p	d
athlete – businessman	−1.27	0.18	−1.64	−0.90	−6.90	<.001	0.91
athlete – doctor	−0.89	0.20	−1.29	−0.49	−4.42	.001	0.57
athlete – hipster	−0.29	0.29	−0.86	0.29	−1.00	1.000	0.17
athlete – janitor	0.76	0.24	0.28	1.24	3.19	.047	0.49
athlete – rapper	2.16	0.22	1.71	2.61	9.63	<.001	1.42
athlete – redneck	−0.86	0.25	−1.36	−0.35	−3.39	.026	0.55
businessman – doctor	0.38	0.15	0.08	0.68	2.55	.275	0.28
businessman – hipster	0.98	0.21	0.56	1.41	4.62	<.001	0.66
businessman – janitor	2.03	0.21	1.61	2.45	9.63	<.001	1.49
businessman – rapper	3.43	0.23	2.97	3.88	15.10	<.001	2.60
businessman – redneck	0.41	0.17	0.07	0.75	2.42	.384	0.30
doctor – hipster	0.60	0.27	0.07	1.14	2.26	.579	0.37
doctor – janitor	1.65	0.25	1.14	2.16	6.50	<.001	1.08
doctor – rapper	3.05	0.25	2.55	3.55	12.22	<.001	2.06
doctor – redneck	0.03	0.21	−0.40	0.46	0.15	1.000	0.02
hipster – janitor	1.05	0.26	0.53	1.56	4.07	.003	0.64
hipster – rapper	2.44	0.28	1.89	2.99	8.89	<.001	1.52
hipster – redneck	−0.57	0.22	−1.01	−0.13	−2.58	.257	0.34
janitor – rapper	1.40	0.20	0.99	1.80	6.92	<.001	0.94
janitor – redneck	−1.62	0.22	−2.07	−1.17	−7.25	<.001	1.05
rapper – redneck	−3.02	0.25	−3.52	−2.51	−11.85	<.001	2.01

Note: dif = difference. *p*-values are Bonferroni-corrected for multiple comparisons.

Table 4

Proportion of the Top 10 Superordinate Category Trait Listings for Superordinate and Subordinate Categories (Experiment 1)

Trait	man	athlete	businessman	doctor	hipster	janitor	rapper	redneck
Black								
Aggressive	.37	**.24**	.10	.02	.02	.05	**.32**	**.10**
Athletic	.34	**.73**	.02	.00	.05	.00	.05	.02
Criminal	.32	**.10**	.05	.00	**.12**	**.05**	**.29**	.02
Not educated	.27	.05	.00	.00	.00	**.32**	**.12**	**.29**
Not rich	.27	.00	**.02**	**.05**	**.07**	**.51**	**.10**	**.29**
Tall	.20	**.34**	**.07**	**.07**	**.00**	**.00**	**.02**	**.02**
Musical	.17	**.00**	**.00**	**.00**	**.24**	**.00**	**.17**	**.02**
Strong	.15	**.49**	**.05**	**.10**	**.02**	**.05**	**.05**	**.00**
Loud	.15	**.00**	**.05**	**.05**	**.05**	**.00**	**.27**	**.15**
Not nice	.12	**.05**	**.07**	**.02**	**.15**	**.05**	**.17**	**.00**
White								
Arrogant	.18	**.16**	**.16**	**.25**	**.13**	.00	**.07**	.00
Educated	.29	.05	**.16**	**.42**	.09	.00	.00	.02
Family-oriented	.11	**.04**	**.05**	**.00**	**.00**	**.11**	**.00**	**.04**
Hardworking	.13	**.18**	**.27**	**.24**	**.04**	**.35**	**.09**	**.11**
Powerful	.26	**.18**	**.16**	**.11**	.00	.00	.00	.00
Privileged	.18	**.04**	**.05**	**.09**	**.02**	.00	**.02**	.00
Professional	.29	.04	**.25**	.11	.00	.05	.02	.06
Racist	.12	**.00**	**.04**	**.02**	**.00**	**.00**	**.05**	**.24**
Rich	.28	**.33**	**.53**	**.55**	**.13**	.00	**18**	.00
Smart	.20	**.05**	**.20**	**.65**	**.09**	**.05**	.00	**.02**
Successful	.11	**.09**	**.16**	**.09**	**.00**	**.02**	**.07**	**.00**

Note: Bolding among the subcategory columns in the table indicates stereotype overlap with the superordinate category, defined as either (a) a non-significant difference in trait frequencies between the two categories; or (b) a significantly larger proportion of frequencies for the subcategory compared to the superordinate category along a given trait. Statistical significance is based on the results of Bonferroni-corrected paired McNemar's tests. See supplementary materials for supporting statistics.

Table 5

Intraclass Correlation Analyses Assessing Participant Agreement on Pixel Luminance within Each Category of Classification Image (Experiment 2).

		95% CI				
Classification Image	ICC	LL	UL	*F*	df	*p*
Black						
high prototypical	.833	.830	.836	5.99	(25751, 875534)	< .001
low prototypical	.769	.765	.773	4.34	(25751, 695277)	< .001
athlete	.611	.604	.618	2.58	(25751, 952787)	< .001
businessman	.556	.548	.564	2.26	(25751, 695277)	< .001
doctor	.346	.335	.357	1.53	(25751, 695277)	< .001
rapper	.484	.475	.493	1.94	(25751, 746779)	< .001
White						
high prototypical	.639	.632	.645	2.78	(25771, 747359)	< .001
low prototypical	.595	.588	.602	2.48	(25771, 901985)	< .001
athlete	.529	.521	.537	2.13	(25771, 695817)	< .001
businessman	.572	.564	.579	2.34	(25771, 798901)	< .001
doctor	.544	.536	.552	2.20	(25771, 901985)	< .001
rapper	.158	.143	.173	1.19	(25771, 695817)	<.001

Note: CI = confidence interval; ICC = intraclass correlation coefficient; LL = lower limit; UL = upper limit. Correlations and confidence intervals rounded to three digits in order to reveal actual range in some in confidence intervals.

Table 6

Objective Similarity Between the Subcategory Classification Images Quantified as Correlations Between Classification Image Noise Pattern Pixel Values (Experiment 2)

Classification Image	1	2	3	4	5
Black					
1. high prototypical					
2. low prototypical	−.83				
3. athlete	.64	−.64			
4. businessman	.18	−.09	.31		
5. doctor	.19	−.20	.32	.53	
6. rapper	.62	−.68	.54	−.04	.16
White					
1. high prototypical					
2. low prototypical	−0.53				
3. athlete	0.26	0.15			
4. businessman	0.51	−0.40	0.31		
5. doctor	0.59	−0.22	0.42	0.59	
6. rapper	−0.08	0.12	0.10	−0.13	−0.26

Note: For all r values, df = 25770 and $p < .01$ using the Bonferroni method to adjust for multiple comparisons.

Table 7

Pairwise Comparisons of Subcategory to High-prototypical Pixel Luminance Distances (Experiment 2)

Classification image comparisons	M_{dif}	SE_{dif}	95% CI LL	95% CI UL	t	df	p [a]	Cohen's d
Black								
athlete-businessman	−.027	.014	−.055	.000	−2.00	64	0.15	0.50
athlete-doctor	−.019	.015	−.049	.010	−1.30	64	0.59	0.32
rapper-businessman	−.021	.015	−.051	.010	−1.34	56	0.56	0.35
rapper-doctor	−.012	.017	−.045	.021	−0.75	56	1.00	0.20
athlete-rapper	−.007	.013	−.034	.020	−0.52	66	1.00	0.13
businessman-doctor	.008	.017	−.026	.042	0.48	54	1.00	0.50
White								
athlete-businessman	.028	.015	−.001	.057	1.93	58	0.17	0.13
athlete-doctor	.013	.013	−.013	.040	1.00	62	0.96	0.25
rapper-businessman	.034	.013	.008	.060	2.58	58	0.04	0.67
rapper-doctor	.019	.012	−.004	.042	1.62	62	0.33	0.41
athlete-rapper	−.006	.015	−.037	.025	−0.38	54	1.00	0.10
businessman-doctor	−.015	.011	−.037	.007	−1.35	66	1.00	0.33

Note: dif = difference. *p*-values are Bonferroni-corrected for multiple comparisons

Table 8

Subcategory to High-prototypical Pixel Luminance Distances (Experiment 2)

	Black			White		
Subcategory	*M*	*SE*	95% CI	*M*	*SE*	95% CI
athlete	.632	.009	(.615, .650)	.635	.012	(.611, .660)
businessman	.660	.011	(.637, .682)	.601	.009	(.589, .625)
doctor	.652	.013	(.625, .678)	.622	.007	(.608, .636)
rapper	.639	.011	(.618, .661)	.641	.010	(.621, .661)

Table 9

Subcategory-Comparisons of Perceived Racial Phenotypicality within Race Condition (Experiment 2)

Classification image comparisons	M_{dif}	SE_{dif}	95% CI LL	95% CI UL	*t*	df	*p*	Cohen's *d*
Black								
athlete-businessman	0.99	0.10	0.80	1.18	10.35	85	<.001	1.23
athlete-doctor	0.65	0.09	0.47	0.82	7.38	85	<.001	0.81
rapper-businessman	0.94	0.07	0.79	1.10	12.16	85	<.001	1.17
rapper-doctor	0.60	0.08	0.45	0.75	8.10	85	<.001	0.75
athlete-rapper	0.05	0.08	−0.10	0.19	0.63	85	1.000	0.06
businessman-doctor	−0.34	0.07	−0.50	−0.19	−4.53	85	<.001	0.41
White								
athlete-businessman	−0.51	0.11	−0.73	−0.29	−4.59	93	<.001	0.56
athlete-doctor	−0.58	0.10	−0.78	−0.39	−5.91	93	<.001	0.69
rapper-businessman	−0.25	0.11	−0.43	−0.07	−2.72	93	.047	0.29
rapper-doctor	−0.32	0.09	−0.51	−0.13	−3.37	93	.006	0.41
athlete-rapper	−0.26	0.09	−0.48	−0.03	−2.26	93	.157	0.30
businessman-doctor	−0.07	0.10	−0.26	0.11	−0.77	93	1.000	0.09

Note: dif = difference; LL = lower limit; UL = upper limit. *p*-values are Bonferroni-corrected for multiple comparisons.

Table 10

Pairwise Comparisons Among Subcategories of Mean Ratings on the Superordinate Category Trait Index within Race Condition (Experiment 2)

Classification image comparisons	M_{dif}	SE_{dif}	95% CI LL	95% CI UL	*t*	df	*p*	Cohen's *d*
Black								
athlete-businessman	0.38	0.08	0.21	0.55	4.50	85	<.001	0.50
athlete-doctor	0.25	0.08	0.09	0.41	3.18	85	.012	0.32
rapper-businessman	1.00	0.08	0.82	1.18	11.24	85	<.001	1.37
rapper-doctor	0.87	0.08	0.70	1.05	10.03	85	<.001	1.18
athlete-rapper	−0.62	0.09	−0.78	−0.47	−8.01	85	<.001	0.82
businessman-doctor	−0.13	0.09	−0.29	0.03	−1.59	85	.693	0.17
White								
athlete-businessman	0.03	0.09	−0.15	0.21	0.29	93	1.000	0.03
athlete-doctor	−0.03	0.10	−0.22	0.16	−0.27	93	1.000	0.03
rapper-businessman	−0.44	0.09	−0.62	−0.26	−4.84	93	<.001	0.52
rapper-doctor	−0.49	0.08	−0.64	−0.33	−6.29	93	<.001	0.61
athlete-rapper	0.46	0.09	0.29	0.64	5.29	93	<.001	0.53
businessman-doctor	−0.05	0.08	−0.21	0.11	−0.65	93	1.000	0.06

Note: dif = difference; LL = lower limit; UL = upper limit. *p*-values are Bonferroni-corrected for multiple comparisons. Refer to Appendix C, "Man" columns for list of trait ratings used to calculate the Superordinate Category Trait Index means.

Table 11

Subordinate Category Stereotypical Trait Index ANOVAs (Experiment 2)

Subcategory index	*F*	*df*	*p*	η^2
Black				
Athlete	25.90	(3.83, 325.28)	<.0001	0.23
Businessman	20.23	(3.64, 309.17)	<.0001	0.19
Doctor	44.27	(4.43, 376.86)	<.0001	0.34
Rapper	32.27	(4.52, 384.52)	<.0001	0.28
White				
Athlete	7.06	(4.45, 413.95	<.0001	0.07
Businessman	11.58	(4.37, 406.18)	<.0001	0.11
Doctor	42.92	(4.60, 428.22)	<.0001	0.32
Rapper	3.57	(4.63, 430.55)	<.0001	0.04

Note. Refer to Appendix C, for list of trait ratings used to calculate the respective Subcategory Trait Index means.

Table 12

Subordinate Category Stereotypical Trait Index Contrast Results (Experiment 2)

	Subcategory		Other		Contrast				
Subcategory index	*M (SE)*	95% CI	*M (SE)*	95% CI	*F*	*df*	*p*	η^2	Cronbach's α
Black									
Athlete	3.89 (0.07)	(3.75, 4.03)	3.72 (0.03)	(3.65, 3.79)	11.98	(1, 85)	.001	.12	0.68
Businessman	3.70 (0.09)	(3.53, 3.88)	3.43 (0.04)	(3.34, 3.51)	12.71	(1, 85)	<.001	.13	0.80
Doctor	4.16 (0.08)	(4.00, 4.32)	3.80 (0.04)	(3.72, 3.88)	36.74	(1, 85)	<.001	.30	0.77
Rapper	4.35 (0.10)	(4.18, 4.52)	3.48 (0.05)	(3.39, 3.57)	137.26	(1, 85)	<.001	.62	0.77
White									
Athlete	3.97 (0.07)	(3.82, 4.12)	4.00 (0.08)	(3.94, 4.06)	0.24	(1, 93)	.627	.00	0.65
Businessman	3.94 (0.08)	(3.78, 4.09)	3.80 (0.03)	(3.73, 3.87)	4.72	(1, 93)	.032	.05	0.66
Doctor	4.12 (0.09)	(3.95, 4.29)	3.66 (0.05)	(3.57, 3.87)	45.77	(1, 93)	<.001	.33	0.86
Rapper	3.87 (0.09)	(3.77, 3.97)	3.78 (0.02)	(3.73, 3.82)	4.43	(1, 93)	.038	.05	0.14

Note: Means reflect ratings of each subcategory on its own category-specific trait index compared to the average of the other subcategories. Refer to Appendix C for list of trait ratings used to calculate the respective Subcategory Trait Index means.

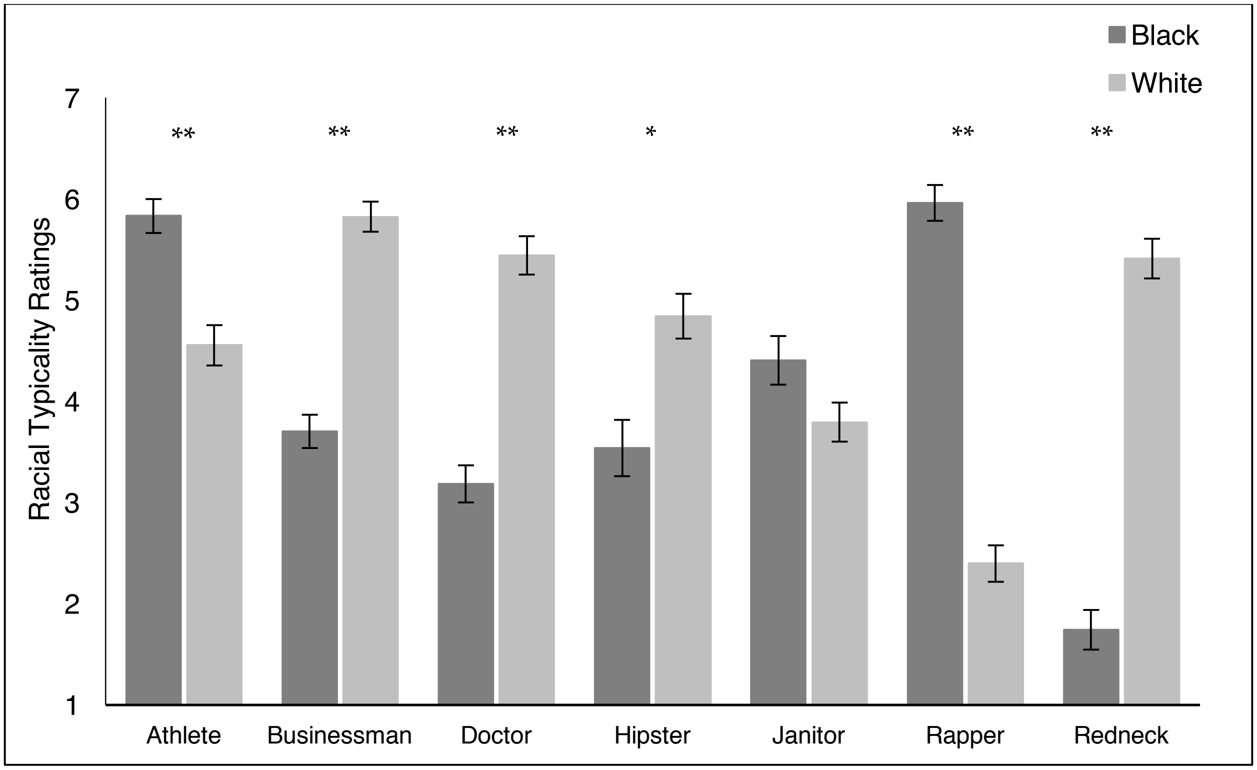

Figure 1. Perceptions of racial typicality by target race and subcategory (Experiment 1). Error bars represent standard error of the mean.

* $p < .01$. **$p < .001$.

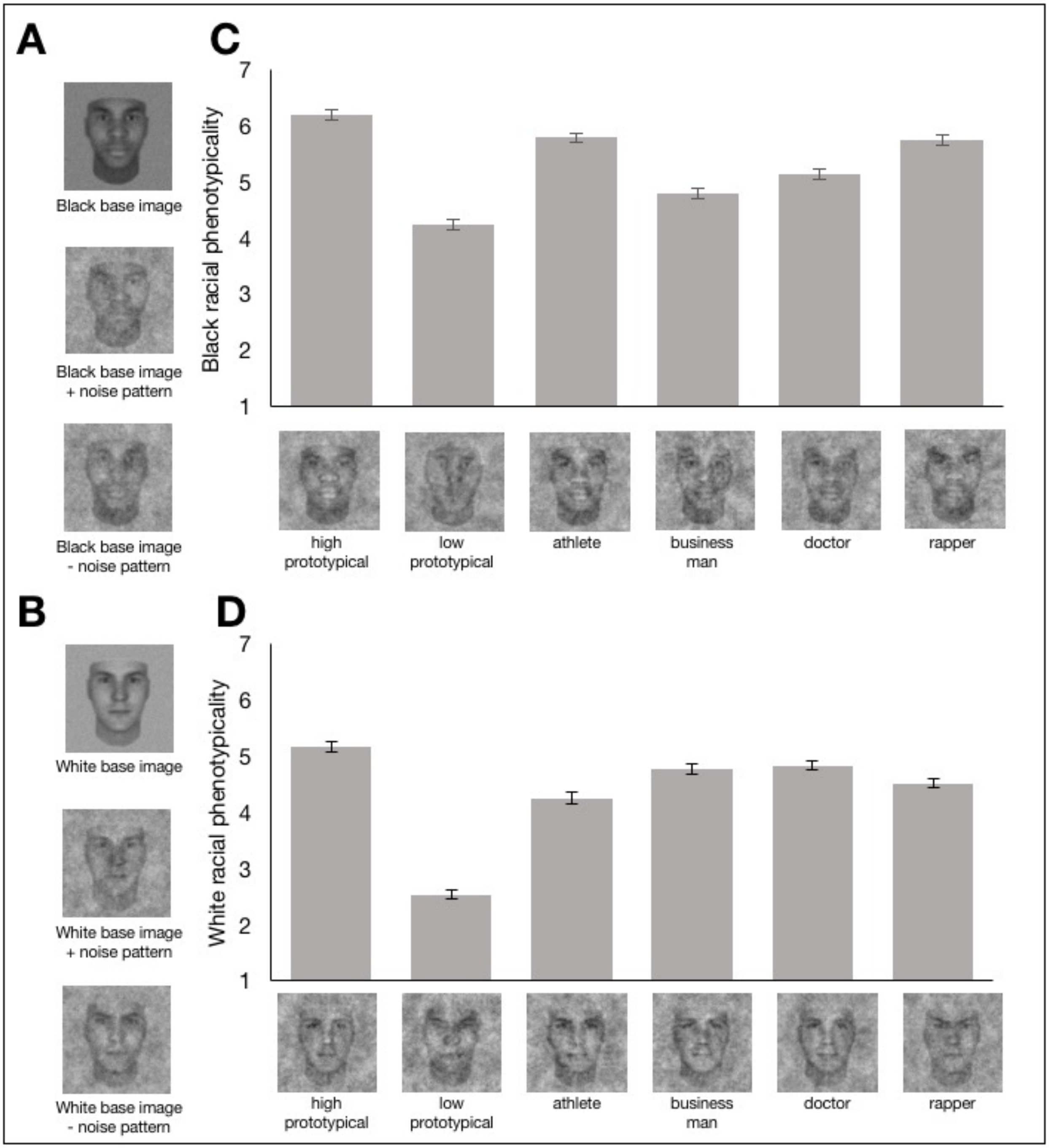

Figure 2. Stimulus generation (A and B) and phenotypicality rating results for Black (C) and White (D) conditions, Experiment 2. Error bars indicate standard error of the mean.

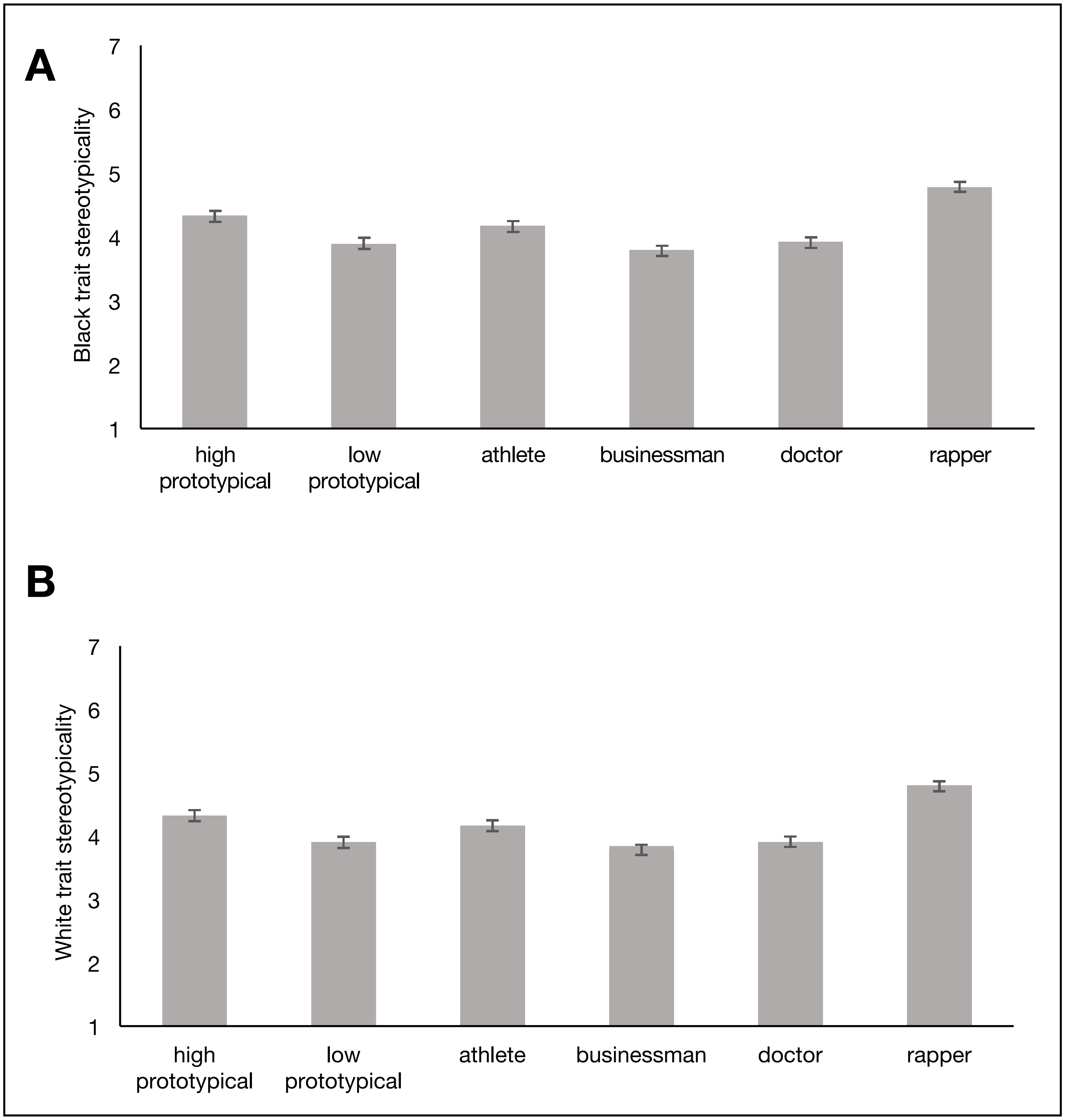

Figure 3. Ratings of subcategory classification images (CIs) on superordinate category trait indices for Black (A) and White (B) CIs, Experiment 2, Part 2. Error bars indicate standard error of the mean.

Appendix A: List of All Coded Traits (Experiment 1)

Aggressive	Likes coffee	Not successful
Arrogant	Loud	Not talented
Athletic	Masculine	Not tall
Baggy jeans	Musical	Not young
Busy	Nice	Powerful
Confident	Northeast	Pretentious
Criminal	Northwest	Privileged
Democrat	Not aggressive	Professional
Dirty	Not arrogant	Racist
Disciplined	Not athletic	Religious
Alcohol	Not busy	Republican
Drives a truck	Not criminal	Rich
Drug	Not dirty	Rural area
Educated	Not educated	Sexist
Eye glasses	Not family-oriented	Skinny pants
Family-oriented	Not fashionable	Smart
Fashionable	Not friendly	South
Flannel	Not funny	Southeast
Friendly	Not hardworking	Strong
Funny	Not liberal	Suburban area
Greedy	Not loud	Successful
Gun	Not musical	Suit
Handsome	Not nice	Talented
Hardworking	Not powerful	Tall
Beard	Not privileged	Urban area
Accent	Not professional	Jewelry
Tattoos	Not racist	Wife beaters[a]
Ironic	Not rich	Young
Jeans	Not smart	
Liberal	Not strong	

[a] A slang term for white tank top undershirts, suggesting lower social class and hostile attitudes toward women.