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Group Bouba–Kiki Effects: The Interplay of Social Categorization, Competition, and Sound Symbolism

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Over the last several decades, social psychologists who study groups have investigated the extent to which top-down factors (e.g., group membership) interact with bottom-up factors (e.g., low-level aspects of visual perception) to influence social inference. Although it has been widely understood that language is used to communicate social category distinctions through group labels, the contribution of low-level aspects of language has not been considered. This is a potentially consequential oversight because research on sound symbolism has established that the phonemes of words provide inherent meaning. One of the most well-known and robust examples of sound symbolism is the Bouba–Kiki effect, where round-associated sounds (e.g., "Bouba," "Maluma") are associated with round shapes, and sharp-associated sounds (e.g., "Kiki," "Takete") are associated with angular shapes. We examined how sound symbolism and intergroup factors might together give rise to inferences about social groups. Study 1 found that when people are making sense of novel groups to which they are not assigned, then sound symbolism guides their impressions of the groups. Study 2 revealed that in a competitive intergroup context, the sound symbolism effect is diminished or even reversed, and behavior is driven by intergroup bias. Study 3 found that the sound symbolism effect may be partially resilient even in an intergroup context when there is less implied competition between novel groups. Together, this work suggests that although sound structure can carry inherent meaning even when reasoning about novel groups, assignment into groups can alter the inferences that people make about others from phonemic information.

Public Significance Statement

This research sheds light on the surprising ways that social group dynamics influence our perceptions, even down to the sounds of words. It reveals that the intuitive link between the sound of a word and its meaning—known as sound symbolism, exemplified by the Bouba–Kiki effect—can be significantly altered by mere group assignment and competitive settings. This finding emphasizes the power of social contexts in shaping our cognitive processes and suggests that our understanding of language and symbols is not fixed, but flexible and subject to the influences of our social environments.

Keywords: sound symbolism, minimal group paradigm, resource allocation, trait inferences

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One of the most vexing aspects of intergroup psychology is that the categorical cues that animate discrimination often seem so arbitrary (e.g., the amount of melanin in your skin, the placement of a geographic border, the religious traditions passed down to you by your ancestors). A large body of research suggests that conflict over resources, negative stereotypes, and desires to organize society based on group-based hierarchies give significance to otherwise arbitrary group differences (Campbell, 1965; Sidanius & Pratto, 1999).

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The data and analysis scripts are publicly available on the Open Science Framework at https://osf.io/wje2r/?view_only=281262a6cc7b455abcb4b5cc6c4bb665. The authors presented a version of this article in a talk titled "Integroup Constraints on Sound Symbolism" at the annual meeting of the Society for Personality and Social Psychology in February 2025.

While the authors were working on an earlier version of this article, Kyle G. Ratner's son Leo was born, and his round face and cheerful disposition earned him the nickname Bouba. The authors thank Leo for his inspiration.

Youngki Hong played a lead role in conceptualization, data curation, formal analysis, investigation, methodology, project administration, validation, visualization, writing–original draft, and writing–review and editing. Allison R. Auten played a supporting role in project administration. Kyle G. Ratner played an equal role in conceptualization, methodology, writing–original draft, and writing–review and editing.

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However, research using the minimal group paradigm has shown that intergroup bias can occur even when group distinctions are seemingly trivial and created in a lab setting (Tajfel et al., 1971). For example, in the dot estimation paradigm, participants estimated the number of dots shown on a screen and were randomly categorized as "overestimators" or "underestimators" of the number of dots. Similarly, in the artistic preference paradigm, participants were asked to indicate their preference for abstract paintings by Klee or Kandinsky and were then categorized as fans of Klee or Kandinsky. Despite the arbitrary and novel nature of these group assignments, participants consistently allocated more resources or rewards to their ingroup members (Tajfel et al., 1971). That is, intergroup biases do not require long-standing animosities between groups and may arise as a result of social categorization (Abrams, 1985; Rabbie & Horwitz, 1969; Tajfel & Turner, 1986; Tajfel et al., 1971). Such categorization into minimally defined groups can influence a wide range of responses, including perception, attitudes, emotions, and behaviors in favor of one's ingroup over outgroup (Brewer & Silver, 1978; Howard & Rothbart, 1980; Locksley et al., 1980; Otten & Moskowitz, 2000), and such findings have been replicated in different contexts, even where there is no indication that they should have a real-world impact on one's well-being and social standing (e.g., Brewer & Silver, 1978; Dunham, 2018; Pietraszewski et al., 2014).

Researchers who use the minimal group paradigm often assume that category labels convey no social meaning beyond demarcating ingroup and outgroup distinctions. The presumed insignificance of minimal group category labels makes the demonstration of intergroup bias particularly powerful because it suggests that even during informationally stripped-down circumstances, people cannot help themselves but favor their ingroup. However, recent research suggests that these labels might contain more inferential residue than just signaling ingroup and outgroup distinctions (Hong & Ratner, 2021). Hong and Ratner (2021), using the classic dot estimation and artistic preference minimal group paradigms alongside reverse correlation methods, found that people associate distinct traits with overestimators versus underestimators and Klee fans versus Kandinsky fans. For instance, overestimators were perceived as more confident yet aggressive, whereas underestimators were seen as more trustworthy yet unhappy. Similarly, Klee fans were viewed as more caring and sociable compared to Kandinsky fans.

Moving beyond the logically inferred knowledge that a label could provide, labels also have phonemic properties that could convey semantic meaning. For instance, the Klee and Kandinsky groups consist of the fans of Klee and Kandinsky (not the artists themselves), but the group labels prominently feature the artists' names. Therefore, it is possible that the smooth sound of Klee and the staccato of Kandinsky activate different associations that are then misattributed to the groups. If this were to occur, then it would challenge the belief that group labels are conceptually arbitrary until ladened with semantic knowledge from experience with the groups or logical inferences about the underlying meaning of the labels. Instead, the meaning of the labels could come preformed with conceptual meaning due to the sound structure of the words from which they are drawn. This raises the possibility that the meaning provided by sound symbolism during the minimal group paradigm could influence how people reason about novel ingroup and outgroup members. Sound symbolism refers to the nonarbitrary relationship between the sounds of words and their meanings (e.g., Köhler, 1929; Sidhu & Pexman, 2015). For example, certain sounds, such as rounded vowels, are often associated with round shapes or agreeable personality traits, whereas sharp consonants are linked to angular shapes or extraverted personality traits. Throughout this article, we use "sound symbolism" to refer to these systematic associations between phonemes and conceptual associations.

The extensive sound symbolism literature provides credence to the possibility that the phonemes of the labels should not be overlooked as meaning-making attributes when reasoning about groups. Words assigned to concepts across languages show commonalities in how sounds are mapped to meaning. For example, Blasi et al. (2016) found that words for "nose" across diverse languages are often associated with nasal sounds, and Ćwiek et al. (2022) reported that round-sounding phonemes are frequently used to describe rounded shapes or objects. These findings challenge the traditional view that the relationship between the sounds of words and their meaning is arbitrary, suggesting instead that certain sounds can evoke specific meanings or sensations. One of the most well-known examples of sound symbolism is the Bouba–Kiki effect, in which individuals overwhelmingly match round shapes with words like "Bouba" that have rounded vowel sounds and angular shapes with words like "Kiki" that have sharp-associated vowels (Köhler, 1929; Ramachandran & Hubbard, 2001).

Further research has shown that the association between sounds and meaning extends to social perception, where the sound structure of names influences how individuals perceive others' physical and personality characteristics. For instance, names with rounded vowel sounds are often associated with round shapes and perceived as more friendly or approachable, whereas names with sharp-associated vowel sounds are linked to angular shapes and traits of determination or rigidity (Sidhu & Pexman, 2015). Names containing sonorant phonemes (e.g., "Mona") are perceived as more emotional, agreeable, and conscientious, whereas names with voiceless stop phonemes (e.g., "Katie," "Curtis") are perceived as more extraverted (Sidhu & Pexman, 2015). Additionally, people associate face and body shapes with names that have a congruent sound structure (e.g., "Kirk" with sharp/angular shapes, "Bob" with round shapes; Barton & Halberstadt, 2018; Lea et al., 2007; Sidhu et al., 2016). Sound symbolism also seems to drive expectations in social interactions. Maglio and Feder (2017) found that the vowels in a target's name influenced perceived psychological closeness in a manner that induced perceivers to believe they would tip servers differently depending on the vowels in their name and would exhibit different emotional reactivity in the presence of therapists that only differed in the vowels in their names. The implications of sound symbolism are also evident in popular culture, where fiction writers intuitively follow principles of sound symbolism when choosing names to match the personalities of their characters (Sidhu & Pexman, 2019).

Even though intergroup psychologists have made strides in the last couple of decades in examining how top-down factors, such as group membership and intergroup motivations, interact with bottom-up low-level perceptual processes, it is notable that this work has largely focused on visual perception. For example, studies have investigated how mere group membership can influence the structural encoding of faces, as evidenced by N170 ERP responses to faces of novel ingroup members compared to novel outgroup members (Hong et al., 2022; Ratner & Amodio, 2013). However,

the same consideration of low-level aspects of language, such as phonemes, has been nonexistent. The prevailing view has been that any inferences derived from group labels flowed from either the stereotypic knowledge a perceiver attached to the group or the perceiver's positionality in relation to the groups of interest, such as whether the perceiver belonged to one of the groups and if the groups were in competition with each other (Tajfel & Turner, 1986). As stated earlier, it was not until Hong and Ratner (2021) that social psychologists established that people read into group label meaning in ways beyond straightforward ingroup and outgroup distinctions.

The present research examined inferences about group labels in a way that could test influences of sound symbolism, social categorization, and competition, as well as the interplay among them. We started with the assumption that sound symbolism would most likely have an effect when groups were novel because preexisting stereotypes and other rich associations can exert a strong influence on group perceptions. Thus, we focused on examining our variables of interest related to reasoning about novel groups, following the extensive minimal group tradition (Tajfel et al., 1971).

To accomplish this goal, we conducted three studies. In Study 1, we examined the effects of group labels typically associated with different shapes (e.g., Bouba/Maluma vs. Kiki/Takete) on personality and trait inferences about a typical member of various groups. Because the groups were novel and participants were not assigned to any group, the only information available to participants was the differing sounds of the group labels. We expected a sound symbolism effect consistent with previous research, such that groups with round-associated vowel sounds (Bouba, Maluma) would be perceived as agreeable, but the groups with sharp-associated vowel sounds (Kiki, Takete) would be perceived as extraverted (Sidhu & Pexman, 2015). This study was designed to create a baseline of how sound symbolism might guide group inferences when there is an absence of other intergroup factors but also assess whether sound symbolism is even taken into account when perceivers traverse levels of analysis from reasoning about single objects and people to reasoning about groups. In Study 2, we randomly assigned participants to one of two groups with different-sounding names. We also made competition over resources salient in participants' minds by having them complete a resource allocation task before completing the personality and trait judgments of the group members. This created situations where the motivation to view members of one's own group more favorably (Brewer, 1999) may not always align with the inferences implied by sound symbolism. We tested two competing hypotheses: First, ingroup favoritism would dominate inferences about group members because participants identified with one of the groups and perceived the groups as competing with each other. Alternatively, the phonemic meaning of the labels and the intergroup factors would together shape inferences. This is because the groups were novel, and therefore, the intergroup context was less significant compared to established groups with more complex knowledge structures (e.g., racial and ethnic groups). Finally, in Study 3, we made the competition between groups less salient to test whether minimizing the competitive context while retaining group assignment to preserve the self-relevance of the groups to the perceiver (i.e., they belong to one group but not the other) would allow sound symbolism to contribute a larger role when making inferences about group members.

Transparency and Openness

All three studies' data and analysis scripts are publicly available on our Open Science Framework page at https://osf.io/wje2r/?view_only=281262a6cc7b455abcb4b5cc6c4bb665. We did not preregister our sample size, hypotheses, or methods prior to conducting any of the studies in this research. In this article, we detail our sample size determination procedures, experimental manipulations, and measures used in each study. We did not exclude any sample from our analyses. All analyses were conducted using R (Version 4.3.1). The studies were approved by the Institutional Review Board and were conducted in accordance with all applicable ethical guidelines.

Study 1

In Study 1, we examined the Bouba–Kiki effect within a group setting to demonstrate whether sound symbolism conveyed by group labels can influence group perception. Participants were not assigned to any groups. They were simply asked to make trait and personality inferences about a typical member of a group with a round-sounding name (Bouba or Maluma) and a group with a sharp-sounding name (Kiki or Takete).

We expected several effects to emerge.First, participants would be much more likely to choose a round shape to represent the Bouba/Maluma groups and an angular shape to represent the Kiki/Takete groups, demonstrating a canonical demonstration of the Bouba–Kiki effect (Köhler, 1929). Second, the round- and sharp-sounding group labels would generally be associated with certain traits that previous work found to be linked to round- and sharp-sounding individual names (e.g., Sidhu et al., 2019): Members of the Bouba/Maluma groups would be perceived as more agreeable, whereas members of the Kiki/Takete groups would be seen as more extraverted. We included a range of traits to explore whether sound symbolism effects might extend beyond agreeableness and extraversion. Although our hypotheses remained neutral regarding most traits, we predicted that traits positively correlated with agreeableness (e.g., caring) would be rated higher for round-sounding labels, whereas traits positively correlated with extraversion (e.g., sociable) would be rated higher for sharp-sounding labels, based on prior findings (Sidhu et al., 2019).

Method

Participants

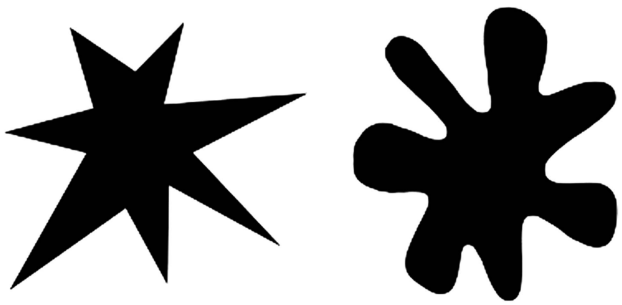
For Study 1, we recruited 201 participants (M_{age} = 30.70, SD = 14.89; 125 women and 76 men) to participate in an online study in exchange for either course credit or monetary compensation. Half the participants were from a university research pool, while the other half were from CloudResearch (https://www.cloudresearch.com). The sample size was determined based on a previous study using responses to novel groups (n = 76 from Loersch & Arbuckle, 2013). We simply rounded this number to 100, and because we used two sets of names for groups (Bouba vs. Kiki; Maluma vs. Takete), we recruited 100 participants in each label set (100 Bouba/Kiki, 101 Maluma/Takete), resulting in a total sample size of 201 (one additional participant was included due to a system error). The racial and ethnic breakdown of our sample was 116 White, 32 Asian, 19 Latinx/Hispanic, 16 Black, one Native American, 14 multiracial, and three other (i.e., nonspecified) participants.

Procedure

Participants performed several tasks administered via Qualtrics (https://www.qualtrics.com). First, participants rated a typical member of a group called either Bouba or Maluma and a typical member of a group called either Kiki or Takete (Bouba was always paired with Kiki and Maluma was always paired with Takete) on 13 trait dimensions (trustworthy, attractive, dominant, caring, sociable, confident, emotionally stable, responsible, intelligent, aggressive, mean, weird, and unhappy)[1] that are typically used to assess facial impressions (Oosterhof & Todorov, 2008) but have also been used to assess trait impressions of group members without visual stimuli in previous studies (Hong & Ratner, 2021). Ratings were made on scales from 1 (*not at all*) to 7 (*extremely*) for one group member at a time (e.g., Bouba or Kiki), randomized across participants. The order in which Bouba/Maluma and Kiki/Takete were presented was randomized across participants. The order of each trait presentation was also random. Participants also rated the Big Five personality traits (openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism) of a typical member of each group by completing the short version of the Big Five questionnaire (Lang et al., 2011). We included this Big Five questionnaire because previous research on the effects of sound symbolism on social perception examined the closely related Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience personality traits (Sidhu et al., 2019). The order of trait and personality questionnaire presentation was randomized across participants. We also asked participants to assign a round or angular shape to represent each group (Figure 1). Participants were presented with the instruction, "If you were to assign a symbol to the Kiki group and the Bouba group, which symbol would you assign to represent each group?" Their responses were mutually exclusive (i.e., the angular shape must be associated with one group and the round shape must be associated with the other group). We included this measure because it is the most canonical task in the literature for showing evidence of sound symbolism (Köhler, 1929; Ramachandran & Hubbard, 2001). The inclusion of this measure allowed us to explore how sound symbolism interacts with group categorization to influence not only social perception but also sound–meaning mapping itself. Specific instructions for different parts of the study can be found in the Supplemental Materials.

Figure 1

Angular vs. Round Shape Choices to Represent Groups Labeled Bouba/Maluma and Kiki/Takete



Results

Trait and Personality Ratings

To examine the effects of sound symbolism on group perception, we conducted a repeated-measures multivariate analysis of variance (MANOVA). The independent variable was the group label (round: Bouba or Maluma vs. sharp: Kiki or Takete), whereas the dependent variables were 18 trait and personality ratings of a typical member of each group. We controlled for the label condition (i.e., Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. We found a significant multivariate effect for group label (Pillai's trace = .17), $F(1, 200) = 2.01$, $p = .01$, indicating that a member of a round-sounding group was perceived as distinct from a member of a sharp-sounding group. We then conducted univariate F tests examining the effects of group labels on each of the 18 traits. The results showed that a typical member of a round-sounding group was rated more trustworthy, caring, agreeable, and open-minded than a typical member of a sharp-sounding group, whereas a member of a sharp-sounding group was rated more dominant, confident, aggressive, mean, sociable, and extraverted. As expected, agreeableness was rated higher for round-sounding groups than sharp-sounding groups, whereas extraversion was rated higher for sharp-sounding groups than round-sounding groups (Sidhu et al., 2019). Furthermore, traits positively correlated with extraversion—dominant and mean—were also rated higher for the sharp-sounding groups than the round-sounding groups. Similarly, three traits positively correlated with agreeableness—trustworthy, caring, and open-minded—were also rated higher for the round-sounding groups than the sharp-sounding groups. We found no difference between labels in attractive, emotionally stable, responsible, intelligent, weird, unhappy, conscientious, and neurotic.

The univariate F test results, including the means, standard deviations, F values, p values, and effect sizes, are presented in Table 1. The correlations among 18 traits can be found in Supplemental Figure S1.

Image Matching

Using a chi-square test of goodness of fit, we found that the match between group labels and shapes is more congruent (e.g., the label Bouba matched with the round shape and the label Kiki matched with the angular shape) than incongruent, $\chi^2(1) = 107.51$, $p < .001$. Descriptively, 86.57% (174 out of 201) of the participants matched the shapes and the labels congruently, and 13.43% of the participants did not.

Power Analysis

Because we relied on the sample size from previous work rather than conducting an a priori power analysis, we performed a post hoc power analysis using the *pwr* package in R. Using an averaged Cohen's d of .23 for trait and personality ratings with significant differences, we found that with $n = 201$ and $\alpha = .05$, the observed power was .90.

[1] Participants were presented with the instruction, "In this task, you will evaluate what you think a typical Bouba person is like on a number of different traits." No other instructions or visual aids were presented.

Table 1
Study 1: Trait and Personality Rating Results

Trait	Round (*SD*)	Sharp (*SD*)	*F*	Cohen's *d*
Trustworthy	4.91 (1.29)	4.45 (1.43)	15.55***	0.28
Attractive	4.46 (1.11)	4.58 (1.14)	2.38	0.11
Dominant	3.69 (1.36)	4.21 (1.51)	13.06***	0.25
Caring	4.99 (1.23)	4.58 (1.32)	13.21***	0.26
Confident	4.53 (1.37)	4.93 (1.35)	11.91***	0.24
Emotionally stable	4.53 (1.26)	4.48 (1.31)	0.15	0.03
Responsible	4.81 (1.27)	4.65 (1.29)	1.98	0.1
Aggressive	3.05 (1.38)	3.6 (1.61)	15.64***	0.28
Intelligent	4.8 (1.23)	4.79 (1.19)	0.03	0.01
Mean	2.76 (1.36)	3.14 (1.51)	9.28**	0.21
Weird	3.4 (1.52)	3.35 (1.47)	0.17	0.03
Unhappy	3.05 (1.38)	3.02 (1.41)	0.08	0.02
Sociable	4.57 (1.32)	4.84 (1.38)	4.94*	0.16
Extraverted	11.5 (2.33)	12.12 (2.33)	5.89*	0.17
Agreeable	14.4 (3.43)	13.26 (3.53)	10.54**	0.23
Conscientious	13.48 (3.08)	13.49 (3.12)	0	0
Neurotic	10.56 (2.92)	10.87 (3.05)	1.7	0.09
Open-minded	12.92 (2.26)	12.07 (2.4)	9.68**	0.22

Note. Traits in italics show significant differences.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Discussion

In Study 1, we showed for the first time that sound symbolism can influence group perception, as indicated by Bouba–Kiki effects on trait and personality inferences participants made about group members. As predicted, we found that groups with round-sounding names differed significantly from groups with sharp-sounding names on agreeableness and extraversion, consistent with sound symbolism work in nongroup settings (e.g., Sidhu et al., 2019). We found mixed evidence for our hypothesis that traits associated with agreeableness and extraversion would show differential effects as a function of the group labels. Specifically, traits positively correlated with extraversion, such as dominant and mean, were rated higher for sharp-sounding groups than round-sounding groups. Similarly, traits positively correlated with agreeableness, such as trustworthy, caring, and open-minded, were rated higher for round-sounding groups than sharp-sounding groups (see Supplemental Figure S1). One trait negatively correlated with agreeableness—aggressive—was also rated higher for the sharp-sounding groups than the round-sounding groups. However, two traits that were positively correlated with agreeableness and not correlated with extraversion—confident and sociable—were rated higher for the sharp-sounding groups than the round-sounding groups. One possible explanation of these traits showing differences that misaligned with our data-driven hypotheses is that certain traits, despite their association with agreeableness, may evoke divergent sound–symbolic associations in a social group context. For example, traits like confident and sociable might be perceived as signaling sharpness or precision, leading to stronger associations with sharp-sounding groups in this study. Another possibility is that individual differences in participants' interpretations of these traits could result in varied associations with group labels. For instance, some participants may associate sharp sounds with traits indicative of sociality, which could override their broader correlation with agreeableness. However, these interpretations are speculative at this stage and highlight the need for further research to understand these unexpected findings. Nonetheless, these results indicate a role of sound symbolism in shaping perception of groups. The rest of the traits—attractive, emotionally stable, responsible, intelligent, weird, unhappy, conscientious, and neurotic—did not show significant differences between round-sounding and sharp-sounding groups.

We also found that participants strongly assumed that groups with round-sounding names are symbolized by a round shape and groups with sharp-sounding names are symbolized with an angular shape. This both replicates the classic shape and word matching finding known as the Bouba–Kiki effect (Köhler, 1929) and extends it to a group context.

Study 2

In Study 2, we examined the robustness of the Bouba–Kiki effect on group perception. Unlike in Study 1, participants in Study 2 were randomly assigned to one of two groups with different-sounding labels (Bouba vs. Kiki or Maluma vs. Takete), creating an ingroup/outgroup distinction. A target sharing the same group membership as a participant was an ingroup member, whereas a target from the other group was an outgroup member. We then introduced competition over resources by having participants complete a resource allocation task (Tajfel et al., 1971), which required them to distribute resources between an anonymous member of each group. Following this, participants made trait and personality judgments about a typical member of each group.

Here, we considered two competing hypotheses. On the one hand, we hypothesized a strong main effect of ingroup favoritism, whereby the competitive mindset fostered by the resource allocation task would lead to more favorable evaluations of ingroup members compared to outgroup members across all traits and personality dimensions. That is, ingroup members would be rated as more trustworthy, attractive, caring, confident, emotionally stable, responsible, intelligent, and sociable, whereas outgroup members would be rated as more aggressive, mean, weird, and unhappy (Hong & Ratner, 2021). We remained less sure about the differences in the Big Five personality traits but expected that any personality traits significantly correlated with the aforementioned traits would show a similar pattern. On the other hand, we considered the possibility that sound symbolism might remain robust even in the context of intergroup competition. Specifically, given recent findings that arbitrary group labels might carry more inferential significance beyond merely signaling ingroup and outgroup distinctions (Hong & Ratner, 2021), we predicted that the phonemic properties of group labels (e.g., round vs. sharp sounds) could continue to influence trait and personality judgments, regardless of whether the group was categorized as ingroup or outgroup. Specifically, based on the patterns of results from Study 1, we expected that all or a subset of traits such as trustworthy, dominant, caring, confident, aggressive, mean, sociable, extraverted, agreeable, and open-minded would differ between different-sounding labels if sound symbolism effects on personality and trait judgments of group members are indeed robust. Testing these possibilities allowed us to explore the relative strength of sound symbolism effects in shaping group perception within competitive intergroup contexts.

We also conducted additional analyses combining data from Studies 1 and 2 to investigate the broader interplay between competition between groups and sound symbolism. These analyses are critical for understanding how a competitive group context influences the classic Bouba–Kiki findings (i.e., sound–symbol

associations) and how altered sound symbolism may, in turn, relate to the perception of groups.

Method

Participants

For Study 2, we recruited 400 participants (M_{age} = 30.25, SD = 14.12; 221 women, 178 men, and one other) to participate in an online study in exchange for either course credit or monetary compensation. Half the participants were from a university research pool, while the other half were from CloudResearch (https://www.cloudresearch.com). We doubled our sample size from Study 1 because Study 2 added group assignment to the research design. Thus, we recruited approximately 100 participants in each condition (100 Bouba ingroup, 100 Kiki ingroup, 103 Maluma ingroup, and 97 Takete ingroup). The racial and ethnic breakdown of our sample was 240 White, 57 Asian, 49 Latinx/Hispanic, 15 Black, one Native American, one Pacific Islander, 32 multiracial, and five other (i.e., nonspecified) participants.

Procedure

Participants performed several tasks administered via Qualtrics (https://www.qualtrics.com). First, we informed our participants that they would make decisions about how to allocate points between two anonymous individuals and that one person would be a member of a group called Bouba or Maluma and the other person would be a member of a group called Kiki or Takete. We explicitly told them that both individuals were randomly assigned to their respective groups just as the participants themselves (e.g., You have been assigned to a group called Bouba) without any justification or cover story. This design prevented participants from forming lay theories about Bouba or Kiki (or Maluma or Takete) individuals, ensuring that any effects of group labels were solely due to sound symbolism differences. Half the participants were assigned to the group with a round-sounding name (Bouba or Maluma), and the other half were assigned to the group with a sharp-sounding name (Kiki or Takete).

Participants then proceeded to the resource allocation task, where they completed a series of six Tajfel matrices, a standard measure of ingroup favoritism (Hong & Ratner, 2021; Loersch & Arbuckle, 2013; Tajfel et al., 1971). Each matrix presented participants with 13 columns, each containing a pair of numbers arranged in two rows. Participants selected one column per trial, with the two numbers in the selected column representing the points allocated to two anonymous individuals. The only information that was available to the participants in this task was their own as well as the targets' group memberships (e.g., Bouba vs. Kiki). If the target individual shared the same group membership as the participant, then they were allocating points to an ingroup member; if the target had a different group membership, then they were allocating points to an outgroup member. Importantly, participants were not given any explanation about what the points represented or how they would be used. This lack of contextual meaning for the points allowed us to test how competition over arbitrary and even meaningless resources could influence, or be influenced by, sound symbolism. The design of the matrices allows for various allocation strategies, such as striving for fairness (equal points for both individuals), maximizing joint profit (highest combined points), maximizing ingroup profit (favoring ingroup members), or emphasizing group differences (disparity between points allocated to ingroup vs. outgroup members; Tajfel et al., 1971). For our purposes, we focused on the difference between points allocated to the members of the two groups (e.g., Bouba vs. Kiki) across all six matrices. Within each trial, the maximum number of points a participant could allocate to an individual was 28, and the minimum was 1, with the difference between the two individuals' points ranging from 0 to 24. These maximum and minimum values varied across the matrices, allowing for a range of possible allocation patterns, the average of which could still capture participants' tendencies toward ingroup favoritism.

After completing the resource allocation task, participants made trait and personality judgments of a typical member of each group and assigned a round or angular shape to symbolize each group (see the Procedure section of Study 1 for a detailed description).

Results

Resource Allocation Task

To examine the effects of sound symbolism and intergroup competition on how people allocated resources to members of each group, we first averaged the amount participants allocated to each group member (Hong & Ratner, 2021; Loersch & Arbuckle, 2013) and conducted a mixed-design analysis of variance (ANOVA).[2] The independent variables were group label (round: Bouba or Maluma vs. sharp: Kiki or Takete), group membership (ingroup vs. outgroup), and their interaction, whereas the dependent variable was the average number of points allocated to each group member. We controlled for the label condition (i.e., Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. We found a main effect of group membership, $F(1, 795) = 386.00$, $p < .001$, indicating that participants allocated significantly more points to the ingroup member (M = 16.93, SD = 2.99) than to the outgroup member (M = 13.21, SD = 2.49; Cohen's d = .96, 95% CI [3.35, 4.11]). The main effect of group label was not significant, $F(1, 795) = .92$, $p = .34$, nor was the interaction term, $F(1, 795) = .32$, $p = .57$.

Trait and Personality Ratings

To examine the effects of sound symbolism and intergroup competition on group perception, we conducted a mixed-design MANOVA. The independent variables were the group label (round: Bouba or Maluma vs. sharp: Kiki or Takete), group membership (ingroup vs. outgroup), and their interaction, whereas the dependent variables were 18 trait and personality ratings of a typical member of each group. We controlled for the label condition (Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. A significant multivariate effect was found for group membership (Pillai's trace = .08), $F(1, 776) = 3.86$, $p < .001$. The multivariate effect of group label was not significant (Pillai's trace = .02), $F(1, 776) = 1.10$, $p = .35$, nor was the interaction term (Pillai's trace = .02), $F(1, 776) = .75$, $p = .076$. Therefore, we conducted univariate F tests (repeated-measures ANOVAs) examining the effects of

[2] Although both predictors were modeled as within-subject factors, their interaction reflects variation across participants (i.e., group assignment), making the design mixed in structure. This applies to all subsequent analyses involving group membership and group label as factors.

group membership only. The results showed that the ingroup member was rated more trustworthy, attractive, caring, dominant, confident, emotionally stable, responsible, intelligent, sociable, agreeable, conscientious, and open-minded than the outgroup member, whereas the outgroup member was rated more aggressive, mean, weird, and neurotic than the ingroup member. All traits except for dominant aligned with our predictions, which is consistent with the idea that perceptions of dominance may sometimes be preferred in ingroup members under certain circumstances (Hehman et al., 2015; Hong & Freeman, 2024). As for extraversion, its positive relationship with traits rated higher for both the ingroup (e.g., dominant) and the outgroup (e.g., mean) likely explains the null finding, as it does not distinctly favor either group. The univariate F test results, including the means, standard deviations, F values, p values, and effect sizes for traits, are presented in Table 2. The correlations among 18 traits can be found in Supplemental Figure S2.

Image Matching

Using a chi-square test of goodness of fit, we found that the match between the labels and the shapes is more congruent (e.g., Bouba and round shape, Kiki and angular shape) than incongruent, $\chi^2(1) = 54.16$, $p < .001$. Descriptively, 68.42% (273 out of 399) of the participants matched the shapes and the labels congruently. We also used a chi-square test of independence to examine if there was any difference in the congruency rates between those assigned to groups with round-sounding labels and those assigned to groups with sharp-sounding labels. Descriptively, 131 out of 202 (64.85%) participants assigned to round-sounding groups matched the shapes and the labels congruently, and 142 out of 197 (72.08%) participants assigned to the sharp-sounding groups matched the shapes and the labels congruently. We found no evidence for a statistically significant difference, $\chi^2(1) = 2.09$, $p = .15$, meaning that participants assigned to a round-sounding group matched the shapes and the labels just as congruently as those assigned to a sharp-sounding group.

Table 2
Study 2: Trait and Personality Rating Results—Group Membership

Trait	Ingroup (*SD*)	Outgroup (*SD*)	*F*	Cohen's *d*
Trustworthy	5.15 (1.22)	4.46 (1.32)	58.77***	0.4
Attractive	4.82 (1.12)	4.3 (1.12)	43.33***	0.32
Dominant	3.99 (1.42)	3.78 (1.49)	4.07*	0.11
Caring	5.16 (1.24)	4.5 (1.34)	52.72***	0.37
Confident	5.03 (1.17)	4.61 (1.38)	22.48***	0.24
Emotionally stable	4.84 (1.29)	4.45 (1.28)	19.61***	0.22
Responsible	5.23 (1.2)	4.51 (1.29)	68.7***	0.41
Aggressive	2.98 (1.49)	3.33 (1.58)	10.57**	0.16
Intelligent	5.19 (1.13)	4.64 (1.26)	42.05***	0.33
Mean	2.6 (1.36)	3.19 (1.5)	35.99***	0.29
Weird	3.16 (1.55)	3.5 (1.54)	10.4**	0.16
Unhappy	2.72 (1.33)	3.1 (1.47)	15.37***	0.19
Sociable	4.97 (1.24)	4.59 (1.32)	18.02***	0.22
Extraverted	11.76 (2.44)	11.78 (2.23)	0.01	0
Agreeable	14.65 (3.34)	13.03 (3.37)	47.44***	0.35
Conscientious	14.66 (3.31)	12.9 (3.24)	62.5***	0.4
Neurotic	10.34 (3.05)	11.06 (2.79)	13.23***	0.19
Open-minded	12.84 (2.06)	12.36 (2.12)	10.44**	0.17

Note. Traits in italics show significant differences.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Effects of Social Categorization on Sound Symbolism

Next, we used logistic regression to assess the impact of assignment to competitive groups on the congruency of image matching. The independent variable was group context (no assignment: Study 1 vs. competitive group assignment: Study 2), while the dependent variable was whether a participant matched the labels and shapes congruently (0 = incongruent, 1 = congruent). We controlled for the label condition (Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. We found that participants who were not assigned to a group (Study 1) matched the shapes and labels significantly more congruently ($b = 1.10$, $SE = .23$, $z = 4.69$, $p < .001$, $OR = 3.00$, 95% CI [1.92, 4.82]) than participants who were assigned to a group and completed the resource allocation task (Study 2). These results suggested that although participants from Study 2 were more likely to match group labels and shapes that are congruent than incongruent (68.42%, $SE = 2.33\%$), they were significantly less congruent than participants from Study 1 (86.57%, $SE = 2.41\%$).

Effects of Diminished Sound Symbolism on Group Perception

To further explore the impact of sound symbolism on group perception, we examined whether diminished sound symbolism (i.e., lower rates of congruent sound–symbol matching) related to group perception. This analysis is important for understanding the interplay of sound symbolism, social categorization, and competition and how they influence each other to form social perception of groups. If congruency of sound–symbol mapping is related to personality and trait judgments of group members, this would suggest that social categorization not only directly impacts group members' perceptions but also indirectly affects them by altering the nature of the sound–meaning associations deeply ingrained in human cognition. This, in turn, would lead to changes in how people perceive and evaluate members of groups with different-sounding names.

Specifically, we used a mixed-design MANOVA to assess the effects of congruent versus incongruent sound–symbol matching on personality and trait judgments of a typical member of each group. The independent variables were the group label (round: Bouba or Maluma vs. sharp: Kiki or Takete), group membership (ingroup vs. outgroup), whether participants matched the labels and shapes congruently (0 = incongruent, 1 = congruent), and their interactions, while the dependent variables were trait and personality ratings of a typical member of each group. We controlled for the label condition (Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. Again, the multivariate effect for group membership remained significant (Pillai's trace = .08), $F(1, 770) = 3.89$, $p < .001$. Additionally, the multivariate effect for the interaction between group label and congruent matching was significant (Pillai's trace = .05), $F(1, 770) = 2.11$, $p = .005$. No other multivariate effects were significant. We then examined univariate effects of the Group Label × Congruent Matching interaction.

To streamline the analysis, we used repated-measures ANOVAs to examine univariate effects of group labels on trait and personality

ratings for those who congruently matched the labels and shapes and those who did not separately. We found that those who congruently matched the shapes and the labels rated the member of a group with a sharp-sounding label as more dominant, confident, aggressive, mean, sociable, and extraverted than the member of a group with a round-sounding label. On the other hand, those who incongruently matched the shapes and the labels rated the member of a round-sounding group as more attractive, dominant, confident, emotionally stable, intelligent, sociable, and conscientious than the member of a sharp-sounding group, indicating a reversal of the Bouba–Kiki effect for three traits—dominant, confident, and sociable (Figure 2). They also rated the member of a sharp-sounding group as more unhappy and neurotic. The univariate *F* test results, including the means, standard deviations, *F* values, *p* values, and effect sizes for 18 traits, are presented in Table 3.

Power Analysis

Again, because we did not conduct an a priori power analysis to determine the sample size, we performed a post hoc power analysis. Using an averaged Cohen's *d* of .21 for trait and personality ratings across three traits that showed reversed sound symbolism effects (i.e., six Cohen's *d*s), we found that with $n = 400$ and $\alpha = .05$, the observed power was .99.

Discussion

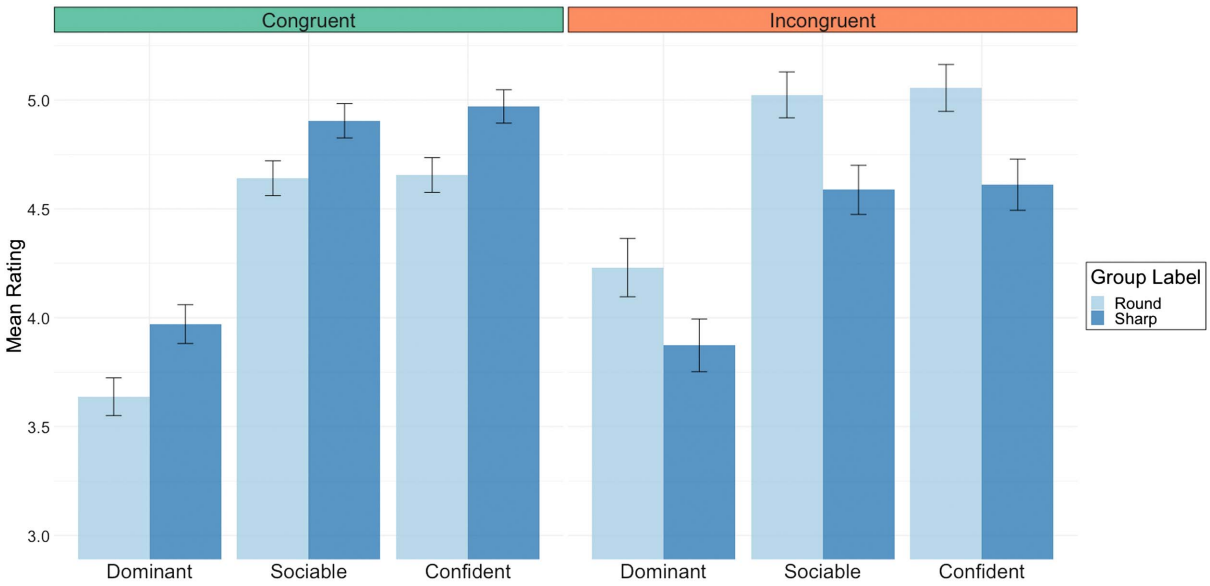
In Study 2, we found a strong ingroup favoritism bias in resource allocations and trait and personality inferences, with participants allocating more points to the ingroup member than to the outgroup member and making more favorable trait and personality inferences about the ingroup member compared to the outgroup member. The inferential role of sound symbolism was more nuanced. There were no main effects of group labels on resource allocations and trait and personality inferences, suggesting that ingroup favoritism was the dominant driver of behaviors and judgments in this context. Moreover, we also found that group competition modulated sound symbolism, evidenced by a significantly lower percentage of participants congruently matching group labels with round versus angular shapes.

It is notable that those who congruently matched the labels and the shapes showed significant, albeit diminished, Bouba–Kiki effects on trait and personality judgments, such as rating the member of a sharp-sounding group as more dominant, confident, and sociable, partially replicating the sound symbolism effects on personality and trait inferences found in Study 1. On the other hand, those who incongruently matched the labels and the shapes showed significant, yet reversed, Bouba–Kiki effects on group perception, rating the member of a round-sounding group as more dominant, confident, and sociable.

These findings suggest that nonwords such as Bouba and Kiki might have gained some level of meaning through social categorization and competition. This added semantic content appears to reduce or even reverse the effects of sound symbolism, supporting the idea that sound symbolism effects are weaker in linguistic stimuli with associated meaning (Sidhu et al., 2021; Westbury, 2005). For example, assignment to a group in a competitive setting may have changed the trait associations participants made about group labels, which, in turn, changed the sound–symbol association, leading to lower congruent matching between the labels and the shapes. The reverse sound symbolism effects found in the present study provide partial support for this interpretation; in the aggregate,

Figure 2

Reversed Bouba–Kiki Effects for Dominance, Sociable, and Confidence Among Participants Who Showed Incongruent Mapping Between Group Labels and Shapes



Note. All differences between group labels are significant at $\alpha = .05$. See the online article for the color version of this figure.

Table 3
Study 2: Trait and Personality Rating Results—Group Label by Congruent Image–Label Matching

	Congruent matching				Incongruent matching			
Trait	Round (*SD*)	Sharp (*SD*)	*F*	Cohen's *d*	Round (*SD*)	Sharp (*SD*)	*F*	Cohen's *d*
Trustworthy	4.89 (1.34)	4.7 (1.28)	2.91†	0.39	4.98 (1.28)	4.69 (1.34)	3.22†	0.43
Attractive	4.49 (1.12)	4.66 (1.19)	3.04†	0.31	4.7 (1.1)	4.38 (1.13)	5.07*	0.42
Dominant	3.64 (1.43)	3.97 (1.47)	7.22**	0.03	4.23 (1.5)	3.87 (1.36)	3.91*	0.27
Caring	4.92 (1.34)	4.73 (1.32)	2.81†	0.39	4.94 (1.35)	4.75 (1.3)	1.32	0.31
Confident	4.66 (1.32)	4.97 (1.27)	8.15**	0.25	5.06 (1.21)	4.61 (1.32)	8.02**	0.25
Emotionally stable	4.65 (1.32)	4.67 (1.32)	0.03	0.25	4.79 (1.18)	4.44 (1.34)	5.14*	0.24
Responsible	4.94 (1.27)	4.79 (1.33)	1.69	0.45	4.99 (1.3)	4.75 (1.26)	2.2	0.43
Aggressive	2.9 (1.48)	3.17 (1.56)	4.53*	0.2	3.39 (1.56)	3.43 (1.57)	0.04	0.11
Intelligent	4.93 (1.25)	4.91 (1.24)	0.03	0.34	5.1 (1.16)	4.74 (1.15)	6.36*	0.35
Mean	2.68 (1.38)	2.92 (1.45)	4.25*	0.34	3.1 (1.5)	3.1 (1.6)	0	0.26
Weird	3.33 (1.55)	3.18 (1.53)	1.51	0.18	3.32 (1.54)	3.66 (1.61)	3.2†	0.12
Unhappy	2.84 (1.35)	2.89 (1.44)	0.14	0.18	2.83 (1.35)	3.2 (1.54)	4.06*	0.26
Sociable	4.64 (1.32)	4.9 (1.31)	5.54*	0.2	5.02 (1.18)	4.59 (1.27)	8.12**	0.25
Extraverted	11.51 (2.25)	11.93 (2.3)	4.75*	0.05	12.05 (2.43)	11.66 (2.41)	1.66	0.1
Agreeable	14.1 (3.28)	13.66 (3.54)	2.3	0.38	13.77 (3.61)	13.81 (3.43)	0.01	0.27
Conscientious	13.76 (3.32)	13.77 (3.4)	0	0.35	14.29 (3.48)	13.37 (3.43)	4.71*	0.55
Neurotic	10.6 (2.94)	10.71 (2.96)	0.21	0.2	10.32 (2.82)	11.25 (2.99)	7.04**	0.15
Open-minded	12.65 (2.34)	12.53 (2.13)	0.35	0.17	12.7 (1.72)	12.55 (1.86)	0.45	0.14

Note. Traits in italics show significant differences in opposite directions.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$.

assignments to competitive groups changed the trait associations people make about different-sounding group labels to the point they become reversed (e.g., round-sounding groups = dominant). However, given the lack of interaction between group membership and group labels, this explanation remains speculative at this stage, and we cannot infer that social categorization directly caused these changes in sound symbolism. Alternatively, individuals' needs to distinguish their ingroup, and outgroup (Tajfel & Turner, 1986) might have led participants to incongruently match the shapes and the labels, as well as to ascribe different personality traits to groups with different-sounding names to optimize these distinctions (Brewer, 1991). Similarly, due to group assignment, participants might have projected their own traits and/or preferences onto ingroup members but not onto outgroup members (Elder et al., 2023), resulting in reversed Bouba–Kiki effects. Regardless of the specific mechanism, the findings from Study 2 clearly suggest that the Bouba–Kiki effect operates differently when critical intergroup factors, specifically categorization into groups and competition, can guide inferences.

Study 3

In Study 3, we reduced the implied competition between groups because perceiving conflict over resources between groups has been shown to be a potent driver of intergroup perception (Esses et al., 1998). We wanted to assess whether the classic Bouba–Kiki effects would be more resilient in an intergroup context when self-relevance was preserved (i.e., participants belong to one group but not the other) but there was less implied competition between ingroup and outgroup. We did this by having participants complete trait and personality ratings *before* the resource allocation task (i.e., the Tajfel matrices). The task order was relevant because past research has argued that resource allocations make competition between groups particularly salient (Bass & Dunteman, 1963; Blake & Mouton, 1961; Rabbie & Wilkens, 1971). If the competition between ingroup and outgroup during the resource allocation task exacerbated intergroup bias and diminished or even reversed Bouba–Kiki effects, then placing the personality and trait ratings as the initial assessments should make these measures sensitive to sound symbolism effects on personality and trait inferences about group members (e.g., round- and sharp-sounding groups differing on trustworthy, dominant, caring, confident, aggressive, mean, sociable, extraverted, agreeable, and open-minded; see Study 1 results). However, if mere group assignment (not the competition between groups) is enough to change the nature of sound symbolism, then we would see similarly diminished or reversed patterns of sound symbolism that we saw in Study 2.

Similar to Study 2, we conducted additional analyses combining data from Studies 1, 2, and 3 to investigate the interplay between sound symbolism, competition between groups, and social categorization to better inform how competition between groups and social categorization influence the classic Bouba–Kiki effects as well as how altered sound symbolism may, in turn, relate to the perception of groups.

Method

Participants

For Study 3, we recruited 207 participants (M_{age} = 28.84, *SD* = 12.87; 117 women, 90 men) to participate in an online study in exchange for either course credit or monetary compensation. Half the participants were from a university research pool, while the other half were from CloudResearch (https://www.cloudresearch.com). The sample size was determined based on the average effect size for group membership effects from Study 2 (Cohen's $d = .29$). An a priori power analysis with the expected effect size of Cohen's $d = .29$, an α level of .05, and desired power of .80 revealed that we needed 96 participants. We rounded up and recruited approximately 100 participants in each condition (103 Bouba/Maluma

ingroup, 104 Kiki/Takete ingroup). The racial and ethnic breakdown of our sample was 105 White, 44 Asian, 31 Latinx/Hispanic, nine Black, 16 multiracial, and two other (i.e., not specified) participants.

Procedure

Study 3 was nearly identical to Study 2 except for the order of tasks participants completed. In Study 3, participants completed trait and personality ratings before completing the Tajfel matrices.

Results

Trait and Personality Ratings

To examine the effects of sound symbolism and group membership on group perception, we conducted a mixed-design MANOVA. The independent variables were the group label (round: Bouba or Maluma vs. sharp: Kiki or Takete), group membership (ingroup vs. outgroup), and their interaction, whereas the dependent variables were trait and personality ratings of a typical member of each group. We controlled for the label condition (Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. Significant multivariate effects were found for group membership (Pillai's trace = .15), $F(1, 390) = 3.92$, $p < .001$, and for group label (Pillai's trace = .11), $F(1, 390) = 2.63$, $p < .001$. The multivariate effect of the interaction term was not significant (Pillai's trace = .04), $F(1, 408) = .93$, $p = .54$. Therefore, we conducted univariate F tests (repeated-measures ANOVAs) examining the effects of group membership and group label separately. The results showed that the ingroup member was rated more trustworthy, attractive, caring, emotionally stable, responsible, intelligent, agreeable, conscientious, and open-minded than the outgroup member. In contrast, the outgroup member was rated more aggressive, mean, and unhappy than the ingroup member. The univariate F test results, including the means, standard deviations, F values, p values, and effect sizes for traits, are presented in Table 4. The correlations among 18 traits can be found in Supplemental Figure S2.

We also found that the member of the round-sounding group was rated more trustworthy and responsible than the member of the sharp-sounding group, whereas the member of the sharp-sounding group was rated more attractive, aggressive, mean, and extraverted than the member of the round-sounding group. The univariate F test results, including the means, standard deviations, F values, p values, and effect sizes for 18 traits, are presented in Table 5.

Resource Allocation Task

To examine the effects of sound symbolism and mere group categorization on how people allocated resources to members of each group, we averaged the amount participants allocated to each group member and conducted a mixed-design ANOVA. The independent variable was the group label (round: Bouba or Maluma vs. sharp: Kiki or Takete), group membership (ingroup vs. outgroup), and their interaction, whereas the dependent variable was the average number of points allocated to each group member. We controlled for the label condition (Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. We found a main effect of group membership, $F(1, 409) = 60.77$, $p < .001$, indicating that participants allocated significantly more points to the ingroup member ($M = 15.58$, $SD = 2.55$) than to the outgroup member ($M = 13.90$, $SD = 1.90$; Cohen's $d = .55$, 95% CI [1.24, 2.11]). The main effect of group label was not significant, $F(1, 409) = .30$, $p = .58$, nor was the interaction term, $F(1, 409) = .39$, $p = .53$.

Table 4
Study 3: Trait and Personality Rating Results—Group Membership

Trait	Ingroup (*SD*)	Outgroup (*SD*)	*F*	Cohen's *d*
Trustworthy	5.41 (1.2)	4.42 (1.42)	58.45***	0.54
Attractive	4.82 (1.18)	4.48 (1.13)	8.88**	0.21
Dominant	4.08 (1.48)	4.34 (1.46)	3.26†	0.13
Caring	5.3 (1.14)	4.57 (1.41)	33.75***	0.42
Confident	5.07 (1.25)	4.91 (1.36)	1.56	0.09
Emotionally stable	4.81 (1.28)	4.29 (1.34)	17.28***	0.29
Responsible	5.3 (1.23)	4.66 (1.41)	24.86***	0.35
Aggressive	2.99 (1.44)	3.71 (1.58)	24.07***	0.35
Intelligent	5.31 (1.11)	4.76 (1.25)	22.33***	0.34
Mean	2.61 (1.33)	3.3 (1.47)	25.4***	0.38
Weird	3.59 (1.53)	3.66 (1.44)	0.25	0.03
Unhappy	2.73 (1.38)	3.14 (1.37)	9.08**	0.22
Sociable	5.01 (1.3)	4.88 (1.35)	0.93	0.07
Extraverted	13.16 (3.27)	13.63 (3.16)	2.15	0.1
Agreeable	15.07 (3.29)	12.92 (3.63)	39.72***	0.46
Conscientious	14.6 (3.64)	12.93 (3.25)	24.89***	0.34
Neurotic	10.29 (3.84)	10.69 (3.28)	1.45	0.08
Open-minded	14.61 (3.18)	13.4 (3.38)	14.14***	0.27

Note. Traits in italics show significant differences.
† $p < .10$. ** $p < .01$. *** $p < .001$.

Image Matching

Using a chi-square test of goodness of fit, we found that the match between group labels and shapes was more congruent (e.g., Bouba and round shape, Kiki and angular shape) than incongruent, $\chi^2(1) = 57.40$, $p < .001$. Descriptively, 76.32% of the participants matched

Table 5
Study 3: Trait and Personality Rating Results—Group Label

Trait	Round (*SD*)	Sharp (*SD*)	*F*	Cohen's *d*
Trustworthy	5.1 (1.37)	4.73 (1.42)	7.35**	0.18
Attractive	4.5 (1.16)	4.8 (1.16)	6.94**	0.19
Dominant	4.12 (1.45)	4.3 (1.5)	1.61	0.08
Caring	5.02 (1.31)	4.85 (1.34)	1.68	0.09
Confident	4.91 (1.33)	5.06 (1.29)	1.37	0.09
Emotionally stable	4.67 (1.28)	4.43 (1.38)	3.51†	0.13
Responsible	5.17 (1.28)	4.78 (1.41)	8.88**	0.22
Aggressive	3.16 (1.5)	3.54 (1.59)	6.00*	0.17
Intelligent	5.07 (1.17)	5 (1.26)	0.32	0.04
Mean	2.82 (1.42)	3.1 (1.45)	3.92*	0.15
Weird	3.67 (1.51)	3.58 (1.45)	0.41	0.05
Unhappy	2.94 (1.38)	2.94 (1.39)	0.00	0.00
Sociable	4.93 (1.33)	4.96 (1.32)	0.05	0.02
Extraverted	12.99 (3.15)	13.8 (3.25)	6.65*	0.16
Agreeable	14.32 (3.6)	13.66 (3.63)	3.46†	0.12
Conscientious	13.83 (3.53)	13.71 (3.57)	0.13	0.03
Neurotic	10.51 (3.7)	10.46 (3.45)	0.02	0.01
Open-minded	14 (3.39)	14.02 (3.28)	0.01	0.01

Note. Traits in italics show significant differences.
† $p < .10$. * $p < .05$. ** $p < .01$.

the shapes and the labels congruently, and 23.67% of the participants did not. We then used a chi-square test of independence to test if there was any difference in the congruency rates between those assigned to groups with round-sounding labels and those assigned to groups with sharp-sounding labels. Descriptively, 80 out of 103 (77.67%) participants assigned to round-sounding groups matched the shapes and the labels congruently, and 78 out of 104 (75%) participants assigned to the sharp-sounding groups matched the shapes and the labels congruently. We found no evidence for a statistically signficant difference, $\chi^2(1) = .08$, $p = .77$, indicating that participants assigned to a round-sounding group matched the shapes and the labels just as congruently as those assigned to a sharp-sounding group.

Effects of Social Categorization on Sound Symbolism

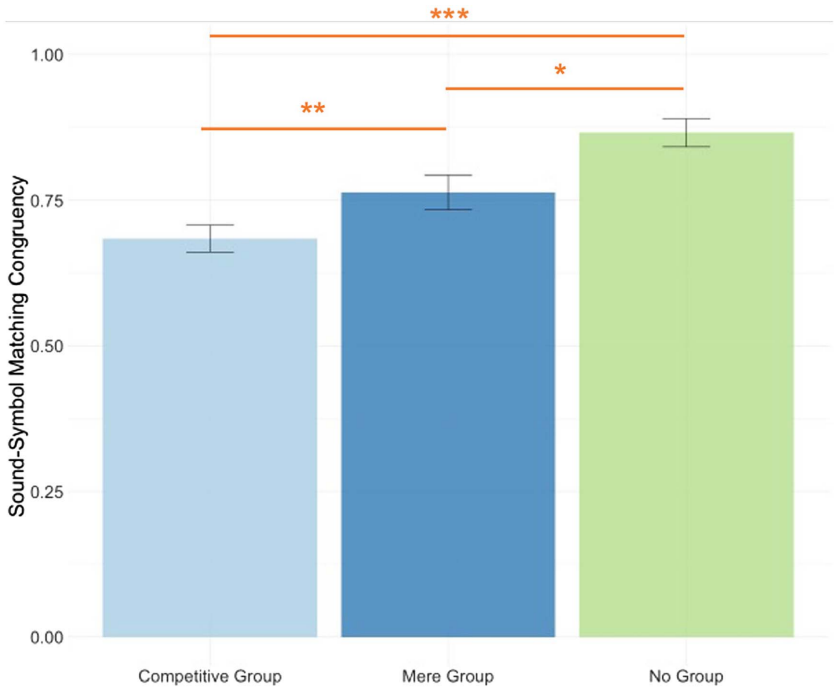
Next, we used logistic regression to assess the impact of assignment to competitive groups on the congruency of image matching. The independent variable was group context (no assignment: Study 1, competitive group assignment: Study 2, mere group assignment: Study 3), whereas the dependent variable was whether a participant matched the labels and shapes congruently (0 = incongruent, 1 = congruent). We controlled for the label condition (Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. We found that participants who were merely assigned to groups (Study 3) were significantly more congruent than participants who were in a competitive group setting (Study 2; $b = -.39$, $SE = .20$, $z = 2.03$, Tukey-adjusted $p = .048$, $OR = .68$, 95% CI [.46, .99]). However, they were significantly less congruent than participants who were not assigned to a group (Study 1; $b = .71$, $SE = .26$, $z = 2.69$, Tukey-adjusted $p = .01$, $OR = 2.04$, 95% CI [1.22, 3.46]). These results suggested that although the Bouba–Kiki effect was somewhat resilient to mere group assignment when intergroup competition was not made salient, mere group assignment itself could still significantly diminish sound symbolism (Figure 3), as indicated by a significantly lower matching congruency rate (76.32%, $SE = 2.96\%$) compared to those who were not assigned to a group (86.56%, $SD = 2.41\%$).

Effects of Diminished Sound Symbolism on Group Perception

Next, we further explored the effects of such reduced sound symbolism effects on group perception by using a mixed-design MANOVA. The independent variables were the group label (round: Bouba or Maluma vs. sharp: Kiki or Takete), group membership (ingroup vs. outgroup), whether participants matched the labels and shapes congruently (0 = incongruent, 1 = congruent), and their interactions, while the dependent variables were 18 trait and personality ratings of a typical member of each group. We controlled for the label condition (i.e., Bouba/Kiki pair vs. Maluma/Takete pair) by entering it as a covariate in the model. Both the

Figure 3

Sound–Symbol Mapping Congruency Rates Across Group Contexts



Note. The highest congruency rate was observed among participants who were not assigned to a group (86.56%; Study 1—no group), followed by those merely assigned to a group (76.32%; Study 3—mere group) and those who were assigned to a competitive group context (68.42%; Study 2—competitive group). See the online article for the color version of this figure.
* $p < .05$. ** $p < .01$. *** $p < .001$.

multivariate effects for group membership (Pillai's trace = .15), $F(1, 386) = 3.93$, $p < .001$, and group label (Pillai's trace = .11), $F(1, 386) = 2.65$, $p < .001$, remained significant. Additionally, the multivariate effect for the interaction between group label and congruent matching was significant (Pillai's trace = .19), $F(1, 386) = 5.14$, $p < .001$. No other multivariate effects were significant.

Next, we used repeated-measures ANOVAs to examine the univariate effects of group label on trait and personality ratings for those who congruently matched the labels and shapes and those who did not separately. We found that those who congruently matched the shapes and the labels rated the round-sounding group member as more trustworthy, caring, responsible, weird, and agreeable than the sharp-sounding group member, but they rated the sharp-sounding group member as more attractive, dominant, confident, aggressive, mean, and extraverted. On the other hand, those who incongruently matched the shapes and the labels rated the round-sounding group member as more dominant, confident, aggressive, and extraverted than the sharp-sounding group member, but rated the sharp-sounding group member as more weird, agreeable, and neurotic, indicating reversed Bouba–Kiki effects for six traits (Figure 4). These results partially mirror the findings from Study 2 for dominant and confident, where incongruent matching between group labels and symbols was associated with a reversed pattern of results for these two traits. Although Study 2 also found a reversed pattern for sociable, this was not replicated in Study 3. However, additional traits such as weird, aggressive, extraverted, and agreeable exhibited reversed patterns related to diminished sound symbolism (i.e., incongruent matching between group labels and symbols). The univariate F test results, including the means, standard deviations, F values, p values, and effect sizes for 18 traits, are presented in Table 6.

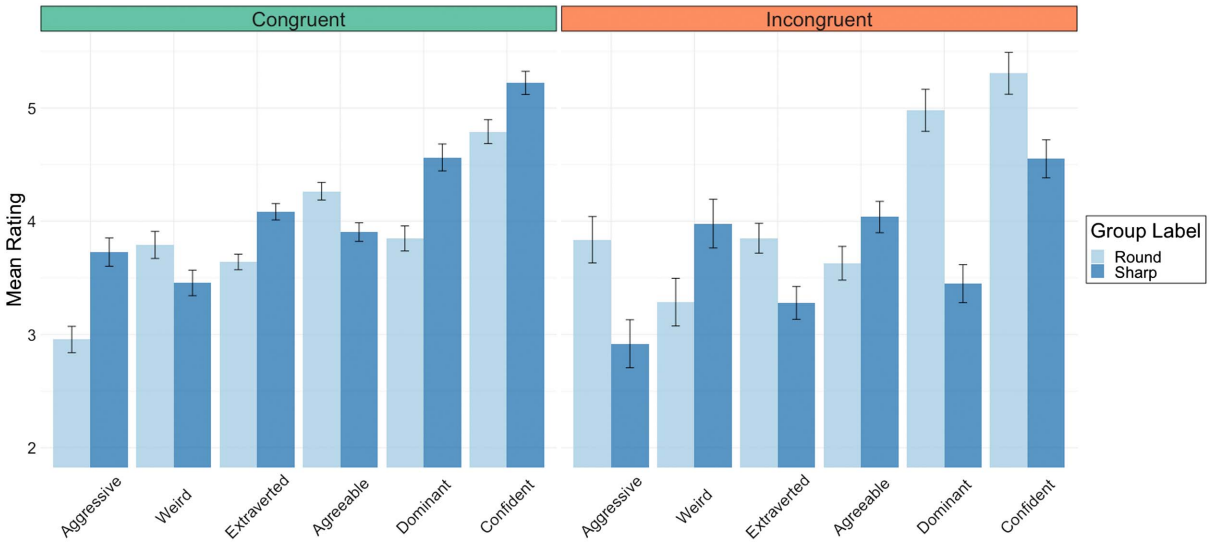
Discussion

In Study 3, we hypothesized that the Bouba–Kiki effects on group perception might be resilient in an intergroup context with less implied competition between groups. We also had the competing hypothesis that mere group assignment alone might be enough to overshadow or disrupt sound symbolism. We found support for both hypotheses. Specifically, we partially replicated the Bouba–Kiki effects on group perception from Study 1, as indicated by significant differences in trustworthy, aggressive, mean, and extraverted between round- and sharp-sounding groups. We found additional differences in attractive and responsible that, although unexpected, provide further evidence that sound symbolism can influence group perception. These findings suggest that sound symbolism effects on group perception may be resilient even in an intergroup context when competition between groups is less salient. We also found that mere group assignment alone changed the nature of sound symbolism as evidenced by a significantly lower rate of congruent matching between the group labels and the shapes. Interestingly, the rate of congruent matching was significantly higher than was the case in a competitive intergroup context (Study 2), suggesting that sound symbolism was diminished by mere group assignment but to a lesser extent than in a competitive intergroup context.

Again, we also found that those who congruently matched the labels and the shapes showed significant Bouba–Kiki effects on group perception, partially replicating findings from Studies 1 and 2, such as rating the sharp-sounding group member as more dominant, confident, and extraverted. On the other hand, those who incongruently matched the labels and the shapes showed significant, reversed Bouba–Kiki effects on group perception, such as rating the round-sounding group member as more dominant, confident, and

Figure 4

Reversed Bouba–Kiki Effects for Aggressive, Weird, Extraverted, Agreeable, Dominant, and Confident Among Participants Who Showed Incongruent Mapping Between Group Labels and Shapes



Note. All differences between group labels are significant at $\alpha = .05$. Extraverted and agreeable were rescaled to range from 1 to 6 instead of their usual range of 3–21 for visualization purposes. See the online article for the color version of this figure.

Table 6
Study 3: Trait and Personality Rating Results—Group Label by Congruent Image–Label Matching

Trait	Congruent matching				Incongruent matching			
	Round (*SD*)	Sharp (*SD*)	*F*	Cohen's *d*	Round (*SD*)	Sharp (*SD*)	*F*	Cohen's *d*
Trustworthy	5.16 (1.33)	4.73 (1.43)	7.74**	0.5	4.9 (1.5)	4.71 (1.41)	0.38	0.71
Attractive	4.45 (1.13)	4.87 (1.16)	10.82**	0.13	4.67 (1.23)	4.57 (1.12)	0.18	0.49
Dominant	3.85 (1.39)	4.56 (1.49)	19.46***	0.16	4.98 (1.3)	3.45 (1.17)	37.07***	0.03
Caring	5.1 (1.21)	4.76 (1.33)	5.73*	0.43	4.76 (1.59)	5.14 (1.35)	1.68	0.33
Confident	4.79 (1.33)	5.22 (1.28)	8.84**	0.05	5.31 (1.29)	4.55 (1.17)	9.06**	0.23
Emotionally stable	4.66 (1.23)	4.42 (1.41)	2.82†	0.23	4.69 (1.45)	4.47 (1.28)	0.69	0.48
Responsible	5.13 (1.22)	4.75 (1.43)	6.6*	0.24	5.33 (1.46)	4.9 (1.36)	2.24	0.68
Aggressive	2.96 (1.46)	3.73 (1.57)	20.35***	0.32	3.84 (1.43)	2.92 (1.48)	9.67**	0.42
Intelligent	5.09 (1.15)	5.01 (1.28)	0.36	0.27	5.02 (1.27)	5 (1.17)	0.01	0.54
Mean	2.77 (1.44)	3.18 (1.47)	6.13*	0.31	2.96 (1.38)	2.84 (1.39)	0.19	0.48
Weird	3.79 (1.51)	3.46 (1.42)	4.29*	0.03	3.29 (1.47)	3.98 (1.51)	5.37*	0.23
Unhappy	3 (1.37)	2.94 (1.41)	0.13	0.18	2.73 (1.43)	2.92 (1.37)	0.42	0.3
Sociable	4.87 (1.32)	5.03 (1.29)	1.16	0.04	5.12 (1.36)	4.73 (1.4)	1.92	0.16
Extraverted	12.51 (3.11)	14.1 (3.26)	19.79***	0.14	14.55 (2.77)	12.84 (3.04)	8.44**	0.01
Agreeable	14.75 (3.51)	13.46 (3.72)	10.15**	0.42	12.94 (3.54)	14.33 (3.29)	4*	0.41
Conscientious	13.91 (3.5)	13.69 (3.6)	0.3	0.3	13.59 (3.62)	13.76 (3.52)	0.05	0.46
Neurotic	10.81 (3.74)	10.17 (3.24)	2.92†	0.03	9.55 (3.43)	11.41 (3.93)	6.45*	0.24
Open-minded	14.05 (3.29)	14 (3.37)	0.02	0.24	13.82 (3.73)	14.08 (3.01)	0.15	0.33

Note. Traits in italics show significant differences in opposite directions.
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

extraverted. Additional reversals of the typical pattern were found for aggressive, weird, and agreeable. Except for the trait "weird," these results were not surprising given the Bouba–Kiki effects on group perception found in Study 1. That is, because round-sounding groups were rated as more agreeable and less aggressive than sharp-sounding groups in Study 1, it is plausible that mere group assignment reversed those effects among participants who incongruently matched the labels and the shapes.

General Discussion

In three studies, we examined the interplay of sound symbolism, social categorization, and competition between groups and how they influence perceptions of social groups. Study 1 demonstrated that the classic Bouba–Kiki effect can occur when the words represent group labels. Specifically, a typical member of a group with a round-sounding label (Bouba or Maluma) was perceived as more caring and agreeable, whereas a typical member of a group with a sharp-sounding label (Kiki or Takete) was seen as more dominant and extraverted, consistent with previous findings of the Bouba–Kiki effect in nongroup social perception (e.g., Sidhu & Pexman, 2015). Additionally, most participants matched round-sounding group labels with round shapes and sharp-sounding group labels with angular shapes, demonstrating a canonical Bouba–Kiki effect (Köhler, 1929; Ramachandran & Hubbard, 2001). In Study 2, we introduced a competitive group setting by assigning participants to one of two groups (Bouba/Maluma or Kiki/Takete) and tasking them with allocating resources between the two groups. This setting completely abolished sound symbolism in trait and personality inferences despite the strong evidence of ingroup favoritism in both resource allocation and trait and personality inferences. Interestingly, a significantly lower percentage of participants matched the group labels with round and angular shapes congruently (e.g., round shape = Bouba vs. angular shape = Kiki), indicating a disruption to sound symbolism. Furthermore, participants who incongruently matched the labels and the shapes exhibited reversed sound symbolism, rating a typical member of a round-sounding group as more confident, dominant, and sociable than a typical member of a sharp-sounding group. Study 3 showed that sound symbolism may be somewhat resilient to group assignment when there is less implied competition between groups. Despite the resilience of sound symbolism in such an intergroup context, we observed similarly diminished or reversed, albeit to a lesser extent, Bouba–Kiki effects on trait and personality ratings of typical members of groups with different-sounding labels. Overall, these findings suggest that group assignment and competition between groups fundamentally shifted how some participants engaged in sound–meaning associations (i.e., sound symbolism) in a multimodal way (both in sound–symbol matching and personality and trait inferences).

In all of our studies, participants were informed that group assignment (for both themselves and the targets) was completely random. This design feature ensured that participants could not logically formulate a lay theory about what Bouba or Kiki (or Maluma or Takete) people were like. Instead, any effect of group labels could only be attributed to sound symbolism differences between these labels. Beyond isolating potential sound symbolism effects, the clear indication to our participants that placement in each group was randomly determined allowed us to examine whether participants would still exhibit ingroup favoritism when group membership could not be attributed to an individual characteristic that accounted for their placement in a particular group (i.e., similarity between group members; Aldan & Dunham, 2023). We found that such explicit random group assignment did not nullify the ingroup favoritism bias effect in either resource allocation decisions or trait and personality ratings. These results are notable because some past work (e.g., Rabbie & Horwitz, 1969) cast doubt on whether random assignment to minimal groups would result in ingroup bias, but other work by Tajfel and Billic (1974) argued that

random assignment produces minimal ingroup bias. Our results suggest that convoluted paradigms (e.g., the classic ones that differentiate groups based on dot estimation tendencies and aesthetic preferences) are not necessary to produce minimal group effects and that random assignment to groups labeled with nonsense words are sufficient to trigger ingroup favoritism.

Perhaps our most surprising finding was that a sizable (but nonmajority) portion of participants in both Studies 2 and 3 showed "reversed" sound symbolism, as evidenced by a significant association between matching Bouba/Maluma to the spiky shape and Kiki/Takete to the angular shape (i.e., incongruent sound–symbol matching) and inferring that Bouba/Maluma were more dominant, confident, and sociable than Kiki/Takete. Although future research will be necessary to probe why an intergroup context would make some people change their phoneme–meaning mapping, these findings imply that nonwords like Bouba and Kiki might have acquired meaning through social categorization and intergroup competition beyond their sound–meaning associations (Sidhu et al., 2021; Westbury, 2005).

The consistent lack of interaction between group labels and group membership in our data suggests that sound symbolism effects operate differently in intergroup contexts compared to interpersonal contexts. Relevant to the interpersonal context, Maglio and Feder (2017) reported evidence that people use phoneme meaning derived from a person's name to create expectations for what experiences with that individual will be like. Extrapolating from their findings, it could have been the case in our intergroup work that sound–meaning mapping could have colored participants' expectations about what an ingroup and outgroup member might be like, so an ingroup named Bouba/Maluma and an ingroup named Kiki/Takete would be expected to have slightly different attributes. For instance, a Bouba ingroup might be expected to be especially trustworthy because of the association between rounded phonemes and agreeableness, but a Kiki ingroup might be expected to be a dependable social resource because sharp-sounding phonemes are associated with dominance and dominance is associated with the ability to enact good intentions when one has them. This would be consistent with Hong and Freeman's (2024) findings that cues of trustworthiness and dominance interact with ingroup/outgroup status in perceptions of social groups. However, we did not find an interaction in our data. Instead, traditionally recognized ingroup/outgroup motives (i.e., ingroup favoritism and competition) took precedence. Perhaps ingroup/outgroup assignment and, to a larger extent, competition between groups remove ambiguity about how to make sense of groups and thus make reliance on sound symbolism information for inferences less adaptive. This would be consistent with a long history of social psychological research suggesting that ancillary information only biases responses when representations of stimuli of interest are ambiguous (e.g., Balcetis & Dunning, 2006; Bruner & Postman, 1949).

The absence of sound symbolism research on group perception has been a glaring theoretical blind spot in the literature. Social psychologists have long recognized that category labels are the dominant cue for identifying groups in intergroup studies (Gilbert & Hixon, 1991; Macrae & Quadflieg, 2010; Zarate & Smith, 1990). The Implicit Association Test, for instance, is the most popular measure for assessing difficult-to-control group attitudes and stereotypes, and category labels are frequently used to activate the group concept (e.g., Greenwald et al., 1998). Despite the reliance on language to activate group representations in this research, intergroup theories have focused solely on the semantic knowledge activated by words (e.g., the meaning derived from associations in memory), but lower level components of linguistic analysis, such as phonetics, phonology, morphology, and syntax, have been outside the scope of consideration. In our research, we viewed the phonological level as a particularly good candidate for examining how people perceive novel groups from their category labels because sound symbolism research has shown that phonemes provide meaning to labels even when they are nonsense words, and thus, people are not reliant on semantic knowledge when guiding their inferences. The neglect of lower level aspects of language in research on group perception stands in contrast to the recent explosion of studies that have considered the interplay between lower level aspects of other mental processes, particularly visual perception, and conceptual knowledge about groups (e.g., Hong et al., 2022; Ratner & Amodio, 2013).

Considering the implications of low-level linguistic processing in intergroup perception opens up new theoretical frontiers and avenues for empirical investigation. For instance, classic theories of impression formation and person perception (e.g., Brewer, 1988; Fiske & Neuberg, 1990) could be updated to consider phonological influences on group processing. These models start with the presumption that perceivers initially categorize a target member as belonging to a group and then weigh the degree to which the target is prototypical of such a group. Our results indicate that at this group categorization stage, participants might extract phonemic meaning from category labels used to represent groups to make inferences about the attributes of a typical group member. This could be an especially important consideration when groups are novel, perceivers are not members of a group relevant to their current inferential task, and no competition is implied between groups. In such situations, it is possible that sound symbolism triggered by the label could influence whether the target is perceived to fit the group's category representation and whether further impression formation by the perceiver is necessary. However, this does not imply that the influence of phonological properties of group labels would be isolated in such a specific context. Given the nuanced findings of how sound symbolism interacts with intergroup factors, such as group assignment and competition, further investigation is needed to better understand their interplay and the mechanisms behind their interactions, which would help further refine existing models of social perception.

Our efforts to bring together sound symbolism research and group perception research also inform the cognitive science of sound symbolism. From an evolutionary perspective, sound symbolism may have proven adaptive because the similarity between the acoustic and articulatory properties of a word and its meaning gave our human ancestors an intuitive way to communicate concepts with each other (Imai & Kita, 2014; Köhler, 1929; Ramachandran & Hubbard, 2001). This then became so ingrained in human cognition that the effects of sound symbolism have been replicated and generalized across cultures and languages (Bremner et al., 2013; Ćwiek et al., 2022; Ngo et al., 2011). What is missing from sound symbolism theorizing, however, is that communication occurs within and between groups because people are a social species. Given that language evolved among the pressures of group living,

understanding the function of sound symbolism is incomplete if we do not consider how people use it to make sense of groups. Thus, studying the interplay among sound symbolism, social categorization, and competition between groups provides a window into the environment from which sound symbolism became part of language. Our findings suggest ecologically meaningful boundary conditions for understanding the cognitive function of sound symbolism. People seem to use phonemic meaning to reason about novel groups, but when other information that has been shown to influence intergroup perception, specifically group assignment and competitive context, is available, then intergroup factors take precedence, change the nature of sound symbolism (e.g., incongruent sound–symbol matching), and drive trait and personality inferences.

Constraints on Generality

Given that this work represents the first attempt in the literature to examine the influence of sound symbolism on group perception, we used the most well-established inducers of the Bouba–Kiki effect (Bouba/Kiki, Ramachandran & Hubbard, 2001; Maluma/Takete, Köhler, 1929) in our studies to allow for a direct comparison to other prominent sound symbolism research. However, there are other forms of sound symbolism that we did not investigate. For instance, there is also research that connects phonemes in words to perceived size (Sapir, 1929). Perhaps, in the presence of ingroup/outgroup cues and a competitive context, linguistic variation in group labels associated with size would have a larger influence on intergroup judgments than the phonemic information we varied in the current research.

It is also the case that we sought the strongest test of sound symbolism on group perception by highlighting that people were randomly assigned to each group. Future work should consider how sound symbolism might contribute to intergroup psychology in different ways. For instance, people's sensitivity to sound–meaning mapping might influence the labels they assign to groups. Specifically, if group members want to present their group as friendly, perhaps they would strategically select a round-sounding label to represent their ingroup. However, if the group wants to highlight their ferocity to intimidate others, then a sharp-sounding label would be more congruent with their preferred self-presentation. From this perspective, it seems plausible that people in real-world groups use intuitions about sound symbolism to select names to shape how their group is perceived.

Last, we focused on only two intergroup variables in this research: assignment into groups and the presence/absence of competition between groups. Although these are critical intergroup factors, other factors can also influence intergroup perception, such as power/status differences and stereotypes. Our findings suggest that intergroup factors influence sound symbolism effects on group perception in both sound–symbol matching and personality and trait inferences, but we cannot conclusively know how sound symbolism might interact with intergroup factors not investigated in our studies. Inferences in real-world intergroup situations are multiply determined, so strong ecological validity requires consideration of a wider range of intergroup influences in conjunction with phonemic variation of group labels.

Conclusion

When people are presented with novel groups, group distinctions are often communicated by category labels. Previous research had not investigated how the sound structure of these labels may influence the perception of groups. Our findings show how phonemic meaning clearly affects group perception when perceivers are unaffiliated observers and the more nuanced ways that sound symbolism is expressed when perceivers belong to one of the groups under consideration. This work contributes to our understanding of how language shapes and is shaped by our perceptions and interactions with the social world.

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