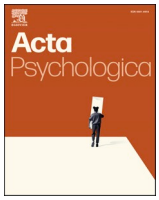
Acta Psychologica 256 (2025) 104978

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy



Would you hire Liam over Kirk? Name sound symbolism and hiring☆

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ARTICLE INFO

Keywords:
Sound symbolism
Personality
Hiring
Names

ABSTRACT

Sound symbolism is the phenomenon by which certain language sounds evoke particular associations. Previous work has demonstrated that names evoke personality associations based on the sounds they contain, with names containing sonorant consonants evoking different associations than those containing voiceless stops. Here we examined whether these associations would impact a mock hiring task. We created job ads that described an ideal candidate as being high in one of the six factors of the HEXACO framework of personality. Participants were given a pair of candidates, one whose name contained sonorants (e.g., "Molly") and one whose name contained voiceless stops (e.g., "Katie"). Whether job ads contained three personality adjectives (Experiment 1), a single adjective (Experiment 2), or a single adjective and a picture (Experiment 3) participants were more likely to choose the candidate with the sonorant name for certain personality factors. In Experiment 4 participants saw videotaped mock interviews of candidates presented with a sonorant or voiceless stop name. Names were less influential in the presence of audiovisual information than perceived name fit. These results demonstrate the impact of name sound symbolism in a more material scenario. They also help establish boundary conditions and moderators for name sound symbolism.

1. Introduction

Personnel selection decisions are often based on limited information, but hiring staff typically have access to job applicants' names early and often in the selection process (e.g., written at the top of a job application or resume, spoken in an interview). Indeed, the role of applicant names has been widely investigated as a potential source of ethnicity-based bias in resume screening (for a review, see Derous & Ryan, 2019). Bertrand and Mullainathan (2004; for a recent extension see Obenauer, 2023) found that resumes with names judged to sound White were more likely to receive a callback than resumes with names judged to sound African-American. Beyond race, Young et al. (1993) found that the age implied by a name affected judgments of intelligence and popularity. These findings ostensibly operate via the sociodemographic variables implied by a name. In the present studies, we examined whether the associations evoked by the sounds in a name (i.e., *sound symbolism*; see below) could be another source of bias in hiring decisions. In particular, previous work has shown that certain sounds are associated with certain personality traits (Sidhu et al., 2019; Sidhu & Pexman, 2015). We examined whether such associations could make certain names sound like better fits for certain kinds of jobs on a mock hiring task.

1.1. Sound symbolism

Sound symbolism is a phenomenon in which certain language sounds (i.e., phonemes) show associations with certain perceptual and/or semantic features. For instance, individuals tend to pair nonwords containing sonorants (e.g., "maluma") with round shapes and those containing voiceless stops (e.g., "takete") with spiky shapes (Köhler, 1929; McCormick et al., 2015; Ramachandran & Hubbard, 2001; Sidhu et al., 2022). This particular association has been demonstrated across cultures, languages (Bremner et al., 2013; Ćwiek et al., 2022; Styles & Gawne, 2017) and ages (Pejovic & Molnar, 2017). One way of explaining this effect is as a crossmodal analogy, in which features of the phonemes (e.g., their acoustics) analogically correspond to visual features of shapes (for a review see Sidhu & Pexman, 2018). For example, Fort and Schwartz (2022) found that the acoustics of round-associated phonemes tended to be more continuous than those of spiky-

☆ Analysis code and data can be found here: https://osf.io/dgx3b/. A pre-registration for Experiment 2 can be found here: https://osf.io/kd9pr.

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https://doi.org/10.1016/j.actpsy.2025.104978
Received 24 July 2024; Received in revised form 14 February 2025; Accepted 1 April 2025
Available online 16 April 2025

associated phonemes. While shape sound symbolism is the most commonly studied form of sound symbolism, there are demonstrated associations for many other dimensions including size (Sapir, 1929; Thompson & Estes, 2011), brightness (Newman, 1933), and motion (Cuskley, 2013), to name a few.

Work on sound symbolism has traditionally been conducted using tasks which ask participants to pair invented nonwords (e.g., "maluma" or "takete") with simple targets (e.g., a pair of contrasting shapes). Using invented nonwords has allowed researchers to create nonwords with phonemes of interest, without needing to account for meaning (e.g., avoiding words with meanings that are associated with roundness or spikiness). However, this naturally leads to the question of whether phoneme associations impact the processing of real words. It is reasonable to assume that the more information associated with a linguistic stimulus, the less of an effect the associations of its phonology will have. Westbury (2005) theorized that words with meanings could be processed in a way that would avoid or inhibit the effects of their sound symbolic associations. Sidhu and Pexman (2015) approached the question of sound symbolic associations in strings with semantics by examining sound symbolism using real first names—existing words with episodic information, though without associated semantics. They found that names containing sonorants and/or /b/ vs. voiceless stops (e.g., "Mona" vs. "Kate") were judged as better matches for round vs. spiky silhouettes (see also Sidhu et al., 2016).

In addition to their experiments with silhouettes, Sidhu and Pexman (2015) used participant ratings to assemble a list of personality traits that were considered "round" (e.g., "friendly, sensitive, introverted") and those that were considered "sharp" (e.g., "aggressive, determined, rigid"). The authors found that participants judged names containing sonorants (voiceless stops) to be more likely to possess the "round" ("spiky") adjectives. This was notable for going beyond the perceptual dimensions that are typically studied in sound symbolism, to demonstrate the existence of associations between phonemes and more abstract dimensions.

Sidhu et al. (2019) took this a step further, and examined personality sound symbolism within an existing broad and comprehensive framework of personality, namely the HEXACO: a six factor model of personality (Lee & Ashton, 2008; see Table 1 for a list of definitions quoted from Lee & Ashton, 2009). The HEXACO model includes the personality factors Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness and Openness. The HEXACO and Big Five represent two of the leading comprehensive models of personality, with both models assuming that personality traits are encoded in language (i.e., the lexical approach to personality), both models replicating across a variety of languages and cultures, and both models including multiple traits in common (Hough et al., 2015). The HEXACO factors of Extraversion, Conscientiousness and Openness correspond closely with their Big Five counterparts. Emotionality is a rotational variant of Big Five Neuroticism, including more content related to sensitivity; while Agreeableness is a rotational variant of the Big Five factor of the same name including more content related to hostility. The additional factor—Honesty-Humility—relates to sincerity and (lack of) interest in luxuries. In comparison to the Big Five, the HEXACO model may be particularly valuable for explaining certain critical behaviours at work. For example, recent meta-analyses have found that the HEXACO model explains substantially more variance in workplace deviance than the Big Five model (32 % vs 19 %, respectively; Pletzer et al., 2019), and the inclusion of the trait Honesty-Humility markedly increases the prediction of leadership performance beyond the Big Five model alone (R^2 = .10 vs R^2 = .04; Javalagi et al., 2024). Moreover, the Honesty-Humility dimension (unique to the HEXACO) has been shown to be important to include in capturing an individual's perceptions of and gravitation toward others (Lee et al., 2009). The six-factor HEXACO model has also been more robustly found across languages than the Big Five (Lee & Ashton, 2008). Overall, the HEXACO model offers some advantages over the Big Five model in capturing differences in personality that may be important in the personnel selection process.

Table 1
A description of each factor of the HEXACO, quoted verbatim from Lee and Ashton (2009).

Personality factor	Description
Honesty-Humility	"Persons with very high scores on the honesty-Humility scale avoid manipulating others for personal gain, feel little temptation to break rules, are uninterested in lavish wealth and luxuries, and feel no special entitlement to elevated social status. Conversely, persons with very low scores on this scale will flatter others to get what they want, are inclined to break rules for personal profit, are motivated by material gain, and feel a strong sense of self-importance."
Emotionality	"Persons with very high scores on the Emotionality scale experience fear of physical dangers, experience anxiety in response to life's stresses, feel a need for emotional support from others, and feel empathy and sentimental attachments with others. Conversely, persons with very low scores on this scale are not deterred by the prospect of physical harm, feel little worry even in stressful situations, have little need to share their concerns with others, and feel emotionally detached from others."
eXtraversion	"Persons with very high scores on the Extraversion scale feel positively about themselves, feel confident when leading or addressing groups of people, enjoy social gatherings and interactions, and experience positive feelings of enthusiasm and energy. Conversely, persons with very low scores on this scale consider themselves unpopular, feel awkward when they are the center of social attention, are indifferent to social activities, and feel less lively and optimistic than others do."
Agreeableness	"Persons with very high scores on the Agreeableness scale forgive the wrongs that they suffered, are lenient in judging others, are willing to compromise and cooperate with others, and can easily control their temper. Conversely, persons with very low scores on this scale hold grudges against those who have harmed them, are rather critical of others' shortcomings, are stubborn in defending their point of view, and feel anger readily in response to mistreatment."
Conscientiousness	"Persons with very high scores on the Conscientiousness scale organize their time and their physical surroundings, work in a disciplined way toward their goals, strive for accuracy and perfection in their tasks, and deliberate carefully when making decisions. Conversely, persons with very low scores on this scale tend to be unconcerned with orderly surroundings or schedules, avoid difficult tasks or challenging goals, are satisfied with work that contains some errors, and make decisions on impulse or with little reflection."
Openness	"Persons with very high scores on the Openness to experience scale become absorbed in the beauty of art and nature, are inquisitive about various domains of knowledge, use their imagination freely in everyday life, and take an interest in unusual ideas or people. Conversely, persons with very low scores on this scale are rather unimpressed by most works of art, feel little intellectual curiosity, avoid creative pursuits, and feel little attraction toward ideas that may seem radical or unconventional."

Sidhu et al. (2019) examined the associations of sonorant and voiceless stop names with each factor of the HEXACO, using a variety of measures (i.e., forced choice [Experiment 1; *E1*] rating scales with real names [E2]; rating scales with invented names [E4]). The general pattern of results was that sonorant names were associated with high Honesty-Humility (E4), Emotionality (E1, E4), Agreeableness (E1, E2, E4), Conscientiousness (E1, E4) and Openness (E2); voiceless stop names were associated with high Extraversion (E2, E4).[1] They also found that

[1] Out of interest, we examined how well the traits generated by participants in Sidhu and Pexman (2015) aligned with these findings, by examining which HEXACO factor they best loaded onto in Lee and Ashton (2008). Five of the six "round" adjectives were consistent with these findings (i.e., loaded onto one of the factors associated with sonorant names); four of the six "sharp" adjectives were consistent with these findings (i.e., loaded onto one of the factors associated with voiceless stop names).

sonorant names were judged as being higher in likeability, however this did not mediate the associations between names and personality factors.

In short, previous work has demonstrated that sound symbolism can be used to understand the associations one makes to names. In addition, there is considerable evidence that these associations go beyond singular adjectives to broader personality factors. Despite the value of this work, the stimuli were presented without context in these studies. As such, the extent to which the associations will translate to more material scenarios is not clear. The goal of the present study was to test the generalizability of name sound symbolism by examining whether these associations will affect responses when framed in terms of a hiring decision. This presents participants with a more comprehensive target with which to match names than a personality trait presented in isolation.

In addition to the HEXACO, we also included the stereotype content model (in Experiment 4; Fiske, 2018; Fiske et al., 2002). In particular, the stereotype content model is made up of the dimensions *warmth* (defined by traits such as friendliness and trustworthiness) and *competence* (defined by traits such as capability and assertiveness). These two dimensions appear to apply universally to social situations in which a person forms an impression of an individual or group (Fiske et al., 2007), including job interviews (e.g., Amaral et al., 2019; Wilhelmy et al., 2019). By incorporating the two primary evaluative features of social judgment, the stereotype content model provides an additional perspective on the effects of sound symbolism in this context. It is also notable that some existing work suggests a *brand* name can convey warmth (Pogacar et al., 2021).

1.2. Sound symbolism and names in everyday life

In parallel to work on the psychology of sound symbolism over the past two decades, there has been work exploring how such associations affect judgments in various contexts. A notable example is research investigating the effects of sound symbolism in brand names (for a review, see Motoki et al., 2022). In his pioneering work on the topic, Klink (2000) presented participants with pairs of invented brand names for various products, and had them decide which they believed would be higher in a certain property (e.g., Which brand of knives seems sharper? "puckle" or "duckle"). Across a variety of products and properties, participants' responses demonstrated that the sounds in the brand names affected their judgments. For instance, "puckle" was rated as sharper than "duckle". Subsequent work has shown this for a variety of properties ranging from the fizziness of a drink (Pathak et al., 2022) to the efficacy of a medicine (Park et al., 2021). Moreover, research has shown that when a brand name signals desirable properties (e.g., small size for a convertible) participants rate the product more positively (Shrum et al., 2012). Finally, sound symbolism can also affect the names chosen for a product. For example, Pathak et al. (2020) found that participants preferred names containing voiced vs. voiceless consonants for a hand lotion.

Related to the present study, there is also research showing that the sounds in a brand name can affect a brand's perceived personality (within a five factor model of brand personality; Aaker, 1997). For example, Klink and Athaide (2012) compared brand names containing front and back vowels. They found that those containing front vowels were perceived as more sophisticated and sincere, while those containing back vowels were perceived as more rugged. Pathak and Calvert (2020) extended this to consonants, finding that brands containing voiced consonants were judged as more rugged, while those containing voiceless consonants were judged as more sophisticated.

Person names represent an especially fertile ground for testing the broader consequences of sound symbolism. They are arguably the most important labels that a person interacts with in daily life. To be sure, there is a great deal of work on how sociodemographic cues in a name affect behaviour (e.g., Bertrand & Mullainathan, 2004; Derous & Ryan, 2019; Obenauer, 2023; Young et al., 1993). However, sound symbolism suggests the intriguing possibility that employers could also infer a job applicant's personality traits, and thus their fitness for a job, based on their name. As such, applicants' names may contribute to more than one form of bias in selection. The perceived personality of a candidate is a very important factor in the hiring process. There is a great deal of work showing that the personality fit between an individual and an organization has a large impact on performance (Barrick & Parks-Leduc, 2019; Kristof-Brown et al., 2005, 2023). As such, some research has found that personality may be the most commonly assessed construct in personnel selection (Ryan et al., 2015). Beyond personality tests, employers infer personality information from job applicants' resumes (Cole et al., 2009), social media (Wilcox et al., 2022), and job interviews (Heimann et al., 2021; Huffcutt et al., 2001; Lievens et al., 2005) to inform hiring decisions. The sound of a name could present another source of bias, if employers interpret the sound of job applicants' names as a cue to their personality.

1.3. Present study

The present study builds upon existing work in several ways. Instead of being asked to associate names with personality traits, participants were asked to choose between a pair of candidates for a given job description. We thus examined whether previously observed associations between names and personality emerge on a more material task. Further, in Experiments 3 and 4, we included pictures and videos, respectively, along with names. This addressed the fundamental question of whether the sound of a word can affect behaviour in the presence of other relevant information.

2. Experiment 1

In Experiment 1, we presented participants with a mock hiring task consisting of job ads describing ideal candidates who were high in one of the six factors of the HEXACO. Participants chose between a pair of candidates based on their names. One candidate's name contained sonorant consonants while the other contained voiceless stop consonants.

2.1. Method

2.1.1. Ethics statement

All experiments were approved by the University of Calgary Research Ethics Board.

2.1.2. Participants

Our aim was to include 60 participants, a sample size that Sidhu et al. (2019) found sufficient for detecting such effects using a similar design. These participants were recruited using the platform Prolific (https://www.prolific.co/). We collected data until 60 participants (37 females; $M_{Age} = 29.28$; $SD_{Age} = 11.16$) passed our attention check (a trial in which the audio asked participants to press the spacebar instead of making a numerical rating).

All participants were fluent in English and reported normal or corrected to normal vision. Participants were compensated $2.10 (Canadian) for an estimated study duration of ten minutes.

2.1.3. Materials

Name stimuli consisted of the 36 name pairs used in Experiment 1 of Sidhu et al. (2019). In each pair one name contained at least one sonorant (/l/, /m/, or /n/) and no voiceless stops (/p/, /t/, or /k/; henceforth *sonorant name*); the other name contained at least one voiceless stop and no sonorants (henceforth *voiceless stop name*). While sound symbolism effects have been found for other types of consonants, sonorants and voiceless stops have been shown to be associated with the opposite ends of a variety of dimensions (Sidhu et al., 2022), making them an ideal comparison. Both names in a pair were of the same gender; there were 18 male and 18 female pairs (e.g., Noel and Kurt;

Megan and Katie; for a full list of stimuli see Appendix A). The names were matched in terms of frequency (based on Alberta baby name statistics from 2014; http://www.servicealberta.ca/Alberta_Top_Babies_Names.cfm), length within one syllable, and location of the relevant phoneme (i.e., a name with a sonorant onset was matched with name with a voiceless stop onset). Independent samples *t*-tests indicated that sonorant and voiceless stop names as a whole did not differ in number of syllables ($p = .82$) nor frequency ($p = .86$). We conducted a post hoc analysis of the racial distributions of each name in the United States using a dataset of voter information from 2018 to 2021 (Rosenman et al., 2023). The vast majority of names were most likely to belong to a White individual (86.11 %). Of the remaining names, 8.33 % were most likely to belong to a Black individual, and 5.56 % to a Hispanic individual. This suggests that racial stereotypes associated with the names are not likely to play a large role in the present studies.

Personality traits were the same 36 traits used in Sidhu et al. (2019). For each factor of the HEXACO, we included the three traits that loaded most heavily onto its high and low ends in a previous factor analysis (Lee & Ashton, 2008). In other words, for each factor, there were three traits that described its high end, and three traits that described its low end (e.g., "outgoing" and "withdrawn" for Extraversion, respectively). For a full list of traits see Appendix B.

Using these traits, we constructed 36 job ads. Each job ad described an ideal candidate as being high in one factor of the HEXACO. There were six ads per factor. Job ads only described candidates who were high in a factor because we deemed it unrealistic for job ads to describe an ideal candidate as being low in, for example, Agreeableness or Conscientiousness. Each job ad contained three traits from a personality factor. Traits corresponding to the negative end of a factor were always preceded by "not". Thus, all traits described a candidate who was high in a given factor. We provided three traits vs. one (as in Sidhu et al., 2019) in order to more closely resemble a job ad (which typically list numerous desirable traits for an applicant), and to provide a richer description of a given personality factor. For example, a job ad describing a candidate high in Extraversion was:

An organization is looking to hire a new employee. The ideal applicant for this job should be:

- Outgoing
- Lively
- Not Antisocial.

In creating the job ads, three traits from a given factor were combined pseudo-randomly, with the requirement that each ad include at least one positive and one negative trait, and that each trait appeared three times across all job ads. This was to create enough job ads for 36 trials (i.e., the number of name pairs we used). We continued randomly arranging traits into job ads until these requirements were satisfied. For a full list of job ads see Appendix C.

2.1.4. Procedure

The experiment was programmed in PsychoPy (Peirce et al., 2019) and run on the online platform Pavlovia (https://pavlovia.org/). Participants received the following instructions:

> In this study you will be shown job ads that describe their ideal candidates.
> You will also be shown a pair of names.
> Your task will be to decide which of the two candidates you would expect to be a better fit for the job, just based on their names.
> There are no right or wrong answers, so just go with your first instinct.

On each trial participants were presented with a pair of names and a job ad. The pairing of ads and names was randomized across participants, as was the order in which job ads were presented. Each participant received all 36 job ads. To ensure that participants read the job ads fully, responses were not accepted until 1000 milliseconds after the trial began.

2.2. Results

All analyses were conducted using the statistical software R (R Core Team, 2021), and the packages "lme4" (Bates et al., 2015), "afex" (Singmann et al., 2016), and "emmeans" (Lenth et al., 2022). Code for all analyses is available at https://osf.io/dgx3b/.

The present analysis consisted of a mixed effects logistic regression. Our dependent variable was whether a participant chose the sonorant name on a given trial (coded as 1 = chose the sonorant name; 0 = chose the voiceless stop name). We began with a model only including gender as a control variable, and random intercepts for participants, names and ads. Our motivation was to interpret the intercept, and whether there was an overall tendency to choose the sonorant name. This resulted in an intercept that was significantly different from zero ($b = 0.18$, $p < .001$), revealing that participants were 1.20 times more likely to select the sonorant name (55.09 % of trials) than the voiceless stop name in the pair.

Next, we included our predictor of interest: personality factor (dummy coded, with Conscientiousness as the reference level because it was the closest to chance). We also included all possible random intercepts and slopes. To deal with convergence issues and singular fits we attempted these remedies, in the following order: increasing the number of iterations, switching to the "bobyqa" optimizer, removing the correlation between the random subject intercept and slope, individually removing the random slopes (beginning with the one with the lowest associated variance), and individually removing the random intercepts (beginning with the one with the lowest associated variance; see Brauer & Curtin, 2018; Meteyard & Davies, 2020).[2] This model was run to interpret subsequent estimated marginal means for each factor, in which the likelihood of choosing a sonorant name for each factor was compared to chance. This revealed that participants were more likely to select the sonorant name for jobs that were high in Honesty-Humility ($EMM = 0.36$, $p = .001$), Emotionality ($EMM = 0.49$, $p < .001$), Agreeableness ($EMM = 0.22$, $p = .046$) and Openness ($EMM = 0.28$, $p = .01$). See Fig. 1 for this study, and Table 2 for a summary of results across all studies. See Online supplementary material for analyses including interactions with name gender in this and all subsequent experiments at https://osf.io/kd9pr.

2.3. Discussion

The results of Experiment 1 indicate that the sound symbolic associations of a name will impact judgments on a mock hiring task. Participants were more likely to choose a candidate with a sonorant name for jobs requiring high Honesty-Humility, Emotionality, Agreeableness and Openness. This is consistent with previous work showing that sonorant names are associated with these personality factors (Sidhu et al., 2019). Interestingly, participants were more likely overall to choose a sonorant name. This is a finding that we will revisit in the General Discussion.

Unlike previous work, here we presented participants with a set of three personality traits to more cohesively represent the construct domain of each trait, and more accurately reflect the job hiring context. This builds upon previous sound symbolism research in which participants are typically given simple targets (e.g., a shape, a single adjective). However, this also required combining traits describing someone high in a factor with those describing someone "not low" in a factor. In

[2] The final model was: `lmer_alt(Chose Sonorant ~ 1 + Personality Factor + Name Gender + (1|Participant) + (1|Names), family = "binomial")`.

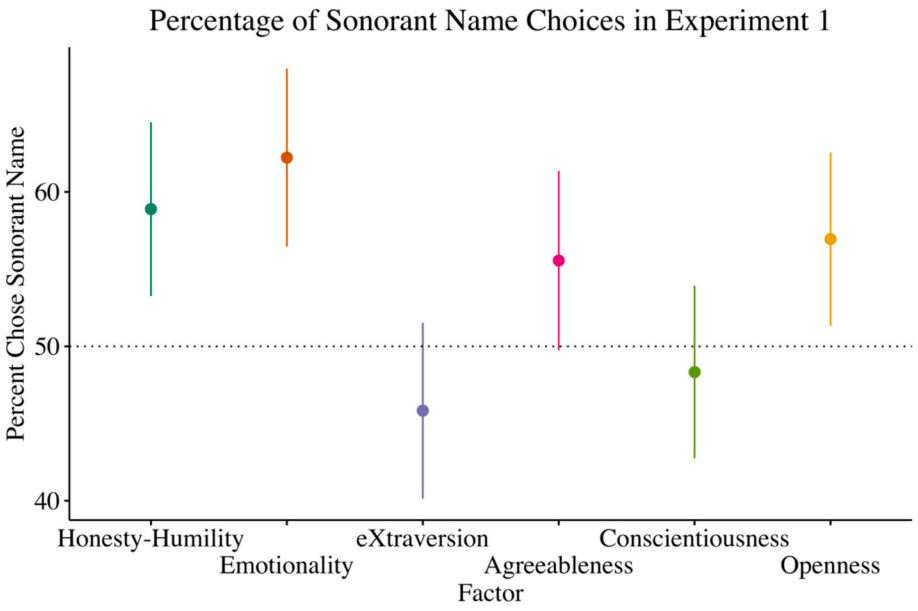

Fig. 1. Percentage of trials on which participants chose the sonorant name in Experiment 1.
Note. This plot shows averages and 95 % confidence intervals computed on subject means.

Table 2
Estimated marginal means and p values for the likelihood of choosing the sonorant name, across all experiments, compared to chance.

Personality factor	Experiment 1 (three adjectives)	Experiment 2 (one adjective)	Experiment 3 (one adjective and photo)	Combined analysis
Honesty-Humility	0.36, 0.001**	0.14, 0.22	0.28, 0.02*	0.26, <0.001***
Emotionality	0.49, <0.001***	0.20, 0.07	−0.17, 0.17	0.18, 0.004**
Extraversion	−0.18, 0.11	0.10, 0.38	−0.12, 0.31	−0.08, 0.22
Agreeableness	0.22, 0.046*	0.45, <0.001***	−0.05, 0.69	0.21, 0.001**
Conscientiousness	−0.08, 0.48	0.04, 0.70	−0.01, 0.91	−0.01, 0.83
Openness	0.28, 0.01*	0.30, 0.007**	0.22, 0.06	0.26, <0.001***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Experiment 2, we conducted a version of this experiment which only used a single trait to disentangle these effects and separately consider associations with affirmed and negated traits.

3. Experiment 2

Experiment 2 consisted of the same mock hiring task as Experiment 1, except that job ads now consisted of a single adjective.

3.1. Method

3.1.1. Participants

Our aim was once again to include 60 participants using Prolific. Using convenience sampling, our sample consisted of 62 participants (25 females; $M_{Age} = 26.21$; $SD_{Age} = 7.91$) who passed our attention check (a total of 63 participants were tested). Only these 62 participants are included in the subsequent analyses.

All participants were fluent in English, and reported normal or corrected to normal vision. Participants were compensated $2.10 (Canadian) for an estimated study duration of ten minutes. A pre-registration for this study can be found here: https://osf.io/kd9pr.

3.1.2. Materials and procedure

The materials and procedure are the same as in Experiment 1 except that in this experiment job ads included a single trait. Job ads were worded differently for traits from the high vs. low end of a factor. An example job ad including a high-end trait is:

> An organization is looking to hire a new employee. The ideal applicant for this job should be: Trustworthy.

An example including a low-end trait is:

> An organization is looking to hire a new employee. The ideal applicant for this job should NOT be: Conceited.

Participants saw each trait once, in a random order. The pairing of ads and names was randomized across participants.

3.2. Results

Analyses were the same as in Experiment 1, except that it was now possible to include factor pole (effects coded; high [0.5] and low [−0.5]) as a control variable. We again observed an intercept that was significantly different from zero ($b = 0.20$, $p < .001$), revealing that participants were 1.22 times more likely to select the sonorant name (54.97 % of trials) than the voiceless stop name in the pair. In the main analysis,[3] we again computed estimated marginal means and found that participants were more likely to select the sonorant name for jobs that were high Agreeableness ($EMM = 0.45$, $p < .001$) and Openness ($EMM = 0.30$, $p = .007$). See Fig. 2. Note that our pre-registration listed comparing estimated marginal means to the overall mean rate of choosing a sonorant name, rather than to chance. We compared to chance instead because we judged this to better address our fundamental question (i.e., whether participants are more likely to choose a sonorant vs. voiceless

[3] The final model was: `lmer_alt(Chose Sonorant ~ 1 + Personality Factor + Name Gender + Factor Pole + (1|Participant) + (1|Names), family = "binomial")`.

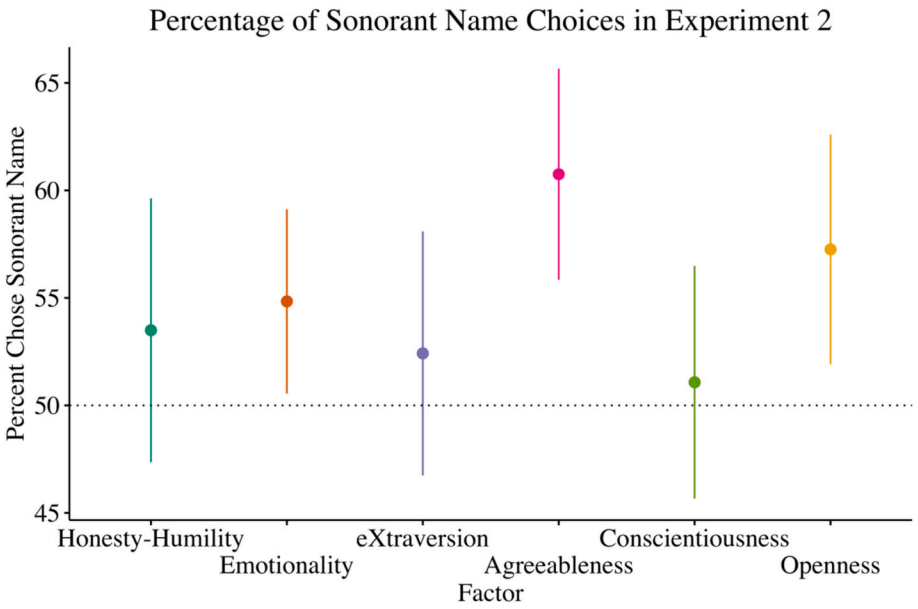

Fig. 2. Percentage of trials on which participants chose the sonorant name in Experiment 2.
Note. This plot shows averages and 95 % confidence intervals computed on subject means.

stop name for a given personality factor). When comparing to the overall rate of choosing a sonorant name (i.e., whether participants are more likely to choose a sonorant vs. voiceless stop name *than usual*, for a given personality factor), we only found that participants were more likely to choose a sonorant name for jobs that were high in Agreeableness (p = .01).

Because traits were presented one at a time, we were able to examine the effects separately for high- and (negated) low-end traits for each factor. Recall that low-end traits were preceded by the word "not" (e.g., The ideal applicant for this job should NOT be: Conceited) indicating that these were also referring to high levels of the trait. As such we conducted a follow-up analysis which included an interaction between personality factor and factor pole. We investigated estimated marginal means for each factor, separately for high- and low-end traits. Participants were more likely to choose the sonorant name for Agreeableness jobs whether they were described with high (EMM = 0.37, p = .01) or low-end (EMM = 0.52, p < .001) traits. They were more likely to choose the sonorant name for Openness jobs when described with high-end traits (EMM = 0.36, p = .02), but not low-end traits (p = .11). Interestingly, when examining only high-end traits, participants were more likely to choose the sonorant name for high Honesty-Humility (EMM = 0.31, p = .04) and Emotionality (EMM = 0.31, p = .04) jobs. This was not true when examining low-end traits (p's = .82, 0.56, respectively). See Fig. 3.

3.3. Discussion

We once again found an effect of name sound symbolism on a mock hiring task. Participants were more likely to choose candidates with a sonorant name for jobs requiring high Agreeableness and Openness. Contrary to Experiment 1, we did not observe name sound symbolism effects for Honesty-Humility and Emotionality. Having demonstrated an effect of name sound symbolism on a mock hiring task, we next explored whether this effect persists in the presence of additional job candidate information. While initial screening processes often lack visual information about a candidate (e.g., a resume), many forms of hiring incorporate visual information (e.g., interviews). To that end, in Experiment 3, we ran a version of this experiment that also presented a picture of each candidate.

4. Experiment 3

Experiment 3 consisted of the same procedure as Experiment 2, except that names were presented along with pictures of each candidate.

4.1. Method

4.1.1. Participants

Our aim was once again to include 60 participants using Prolific. Our sample consisted of 60 participants (21 females; M_{Age} = 32.72; SD_{Age} = 11.82) who passed our attention check.

All participants were fluent in English, and reported normal or corrected to normal vision. Participants were compensated $2.25 (Canadian) for an estimated study duration of ten minutes.

4.1.2. Materials and procedure

Name and trait stimuli were the same as in Experiment 2. This experiment included face stimuli, taken from the FACES database (Ebner et al., 2010). In particular, we included faces of 72 White individuals with a neutral facial expression, 18 each of a younger male, younger female, middle-aged male and middle-aged female faces. We used faces from a wide age range to represent the age distribution of the working population. For each participant, faces were randomly sorted into same-gender, same-age pairs (i.e., pictures were paired differently for each participant). Face pairs were randomly combined with name pairs of the same gender. As in Experiment 2, these were then randomly combined with job ads for each participant and were presented in a random order.

The procedure was the same as in Experiment 2 except that in this experiment names were shown with face stimuli. Face stimuli appeared 1500 milliseconds after the names and job ads. Responses were not accepted until 2000 milliseconds after each trial began (i.e., 500 milliseconds after faces appeared).

4.2. Results

Analyses were the same as in Experiment 2. This time we did not find an intercept that was significantly different from chance (b = 0.02, p = .68), indicating that participants were equally likely to choose the sonorant and voiceless stop names. Conscientiousness was chosen as the reference level as it was closest to the overall mean. Follow up analyses

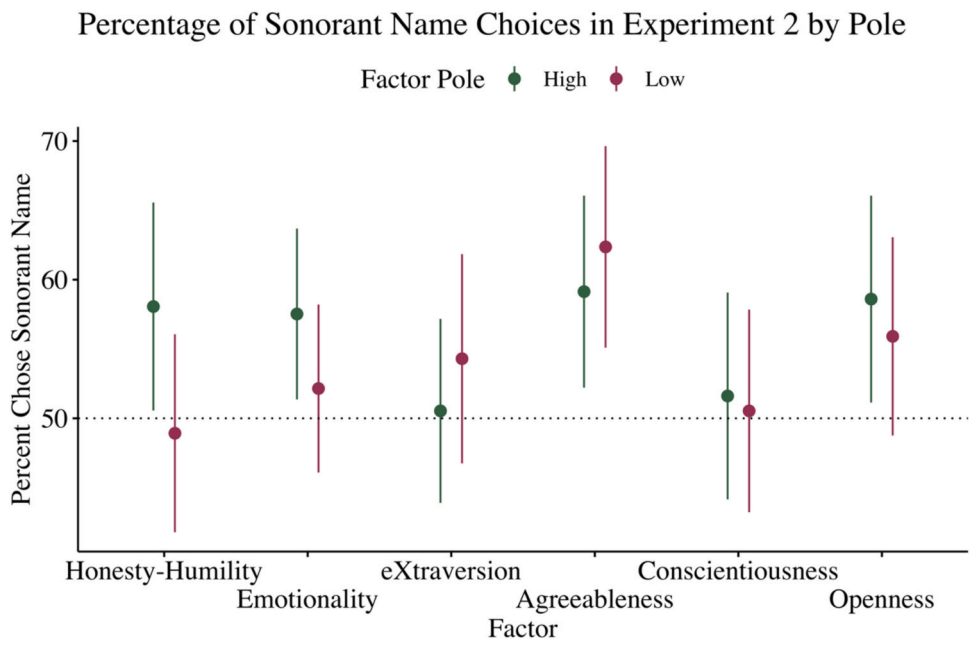

Fig. 3. Percentage of trials on which participants chose the sonorant name in Experiment 2, separately for high- and (negated) low-end traits.
Note. This plot shows averages and 95 % confidence intervals computed on subject means. Trails presenting a low-end were worded such that participants were to choose a candidate who did NOT possess that trait. Thus, higher values for both poles reflect the tendency to choose sonorant names for jobs requiring candidates to be high on a personality factor.

of estimated marginal means indicated that participants were more likely to select the sonorant name for high Honesty-Humility jobs (*EMM* = 0.28, $p = .02$).[4] There was also a non-significant trend in which participants were more likely to select the sonorant name for high Openness jobs (*EMM* = 0.22, $p = .064$). See Fig. 4.

As in Experiment 2, we conducted an exploratory follow-up analysis in which we included the interaction between personality factor and pole. We investigated estimated marginal means for each factor, separately for high- and (negated) low-end traits for each factor. Again, recall that low-end traits were preceded by the word "not" (e.g., The ideal applicant for this job should NOT be: Conceited). Participants were more likely to select the sonorant name for Honesty-Humility jobs when prompted using low- (*EMM* = 0.32, $p = .03$) but not high-end traits (*EMM* = 0.25, $p = .11$). Conversely, they were more likely to select the sonorant name for Openness jobs when prompted using high- (*EMM* = 0.34, $p = .03$) but not low-end traits (*EMM* = 0.06, $p = .69$). See Fig. 5.

4.3. Discussion

We discovered that name sound symbolism persisted even in the presence of additional information in the form of candidate pictures. The most notable difference from previous experiments was the finding that Emotionality and Agreeableness were not associated with Sonorant names. It is possible that judgments for these personality factors are especially affected by the presence of an image. Alternatively, it could be that name sound symbolism is weakest for these factors and most susceptible to the influence of other information. In order to conduct a high-powered test of name sound symbolism effects in hiring, we next combined data from Experiments 1, 2 and 3 into a single analysis.

5. Combined analysis

This analysis combined the data from Experiment 1, 2 and 3. We began with a model including experiment (dummy coded; with Experiment 3 as the reference level) and name gender as predictors. We again observed an intercept that was significantly different from zero ($b = 0.18$, $p < .001$), revealing that participants were 1.20 times more likely to select the sonorant name (53.42 % of trials) than the voiceless stop name in the pair. We next included personality factor (dummy coded, with Conscientiousness as the reference level because it was the closest to chance).[5] We found that participants were more likely to select the sonorant name for jobs that were high Honesty-Humility (*EMM* = 0.26, $p < .001$), Emotionality (*EMM* = 0.18, $p = .005$), Agreeableness (*EMM* = 0.21, $p = .001$), and Openness (*EMM* = 0.26, $p < .001$).

We next included an interaction between experiment and personality factor, and followed this up with a comparison of estimated marginal means for experiment, separately for each personality factor. This revealed that several effects differed by experiment. Compared to Experiment 3, participants were more likely to select the sonorant name for jobs high in Emotionality in Experiments 1 (*EMM* = 0.50, $p < .001$) and 2 (*EMM* = 0.20, $p = .03$), and more likely to select the sonorant name for jobs high in Agreeableness in Experiment 2 (*EMM* = 0.22, $p = .002$). Finally, compared to Experiment 2, participants were marginally more likely to select the sonorant name for jobs high in Emotionality in Experiment 1 ($p = .06$).

In Experiment 4 we explored the limits of name sound symbolism in the presence of additional information, by presenting participants with short videos of candidates answering simulated interview questions.

6. Experiment 4

In Experiment 4, we presented participants with videotaped

[4] The final model was: `lmer_alt(Chose Sonorant ~ 1 + Personality Factor + Name Gender + Factor Pole + (1 + Name Gender + Factor Pole||Participant) + (1|Name Pair) + (1 + Name Gender|Trait), family = "binomial")`.

[5] The final model was: `lmer_alt(Chose Sonorant ~ Personality Factor + Name Gender + Experiment + (1|Participant) + (1 + Experiment||Names), family = "binomial")`.

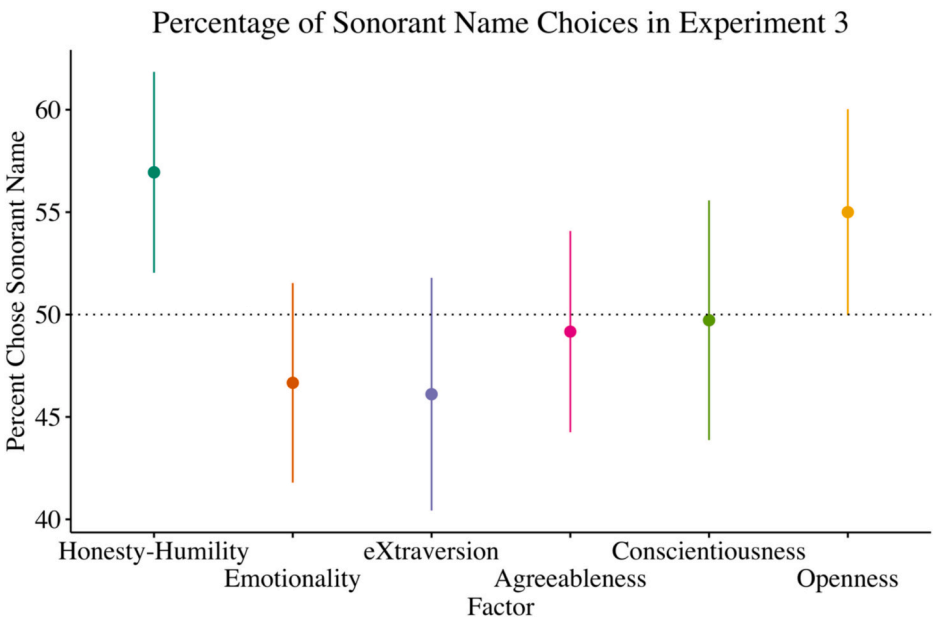

Fig. 4. Percentage of trials on which participants chose the sonorant candidate in Experiment 3.
Note. This plot shows averages and 95 % confidence intervals computed on subject means.

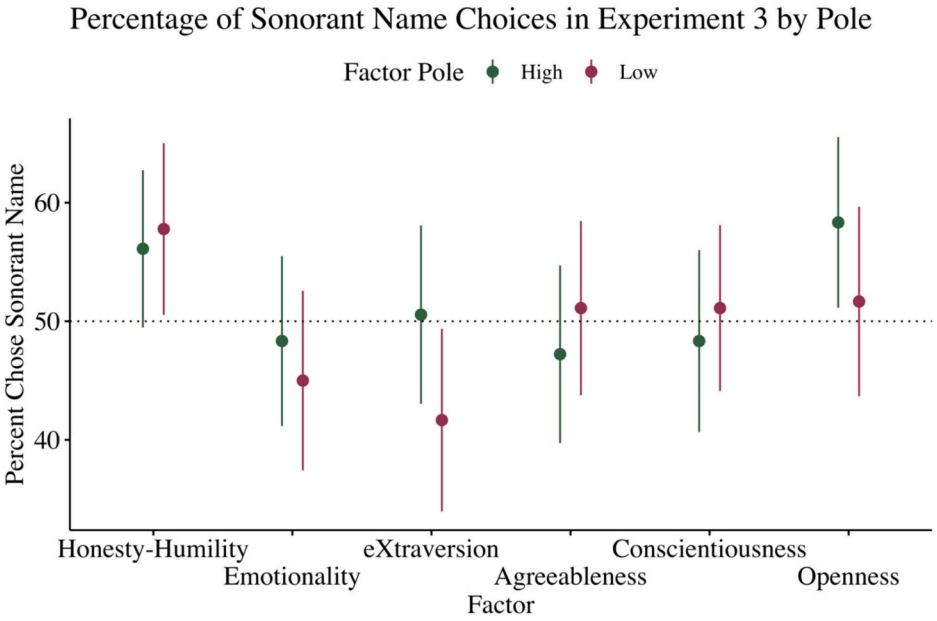

Fig. 5. Percentage of trials on which participants chose the sonorant name in Experiment 3, separately for high- and low-end traits.
Note. This plot shows averages and 95 % confidence intervals computed on subject means. Trails presenting a low-end were worded such that participants were to choose a candidate who did NOT possess that trait. Thus, higher values for both poles reflect the tendency to choose sonorant names for jobs requiring candidates to be high on a personality factor.

interviews of two job candidates. One was presented with a name containing sonorant consonants, the other with a name containing voiceless stop consonants. Participants then completed a variety of rating scales regarding their impressions of the candidates. This experiment introduced ratings on the stereotype content model (Fiske, 2018; Fiske et al., 2002) in addition to the HEXACO.

6.1. Method

6.1.1. Participants

Our final sample consisted of 355 participants (301 females, 45 males, 6 non-binary, 3 did not provide a gender; $M_{Age} = 20.12$; $SD_{Age} = 4.11$) who were undergraduate students at the [university name hidden for review] and participated in exchange for course credit. We aimed for a total sample size of 400 but ended up being short of that due to time constraints in the semester. All participants were fluent in English and reported normal or corrected to normal vision. Participants received course credit in exchange for participating. These participants passed the following data screening requirements: rated the seriousness with which they took rating both candidates at least 3/5, had both interview videos on screen for their entire duration, and indicated that their data should be used.

6.1.2. Materials and procedure

Video stimuli consisted of two short videos, each featuring a candidate answering interview questions about themselves. These were: "What is your greatest weakness and what is your greatest strength?, What is your management style?, What makes you a valuable employee?, and Tell me about a time when you had to come up with a new idea." The duration of Candidate One's video was 2:47; Candidate Two's video was 2:41. These were taken from longer recordings used in the pilot study of Pike et al. (2022). Both candidates were young White females. The two candidates were given the names "Noelle" and "Trista", or "Luna" and "Tia". That is, one candidate was given a sonorant name and the other a voiceless stop name. These particular names were chosen to be matched on number of syllables, and because they showed the largest associations with personality factors of interest in Sidhu et al. (2019). The pair of names used (i.e., "Noelle" and "Trista", or "Luna" and "Tia") was counterbalanced across participants. The assignment of names to candidates was also counterbalanced across participants.

After each video, participants rated the candidate on a variety of scales. The first was a 60-item HEXACO personality inventory, in which the participant rated how well 60 traits (ten for each factor) described the candidate. Ratings were made on a seven-point Likert scale from 1 (Not at All) to 7 (Extremely Well). Participants also rated how well candidates were described by six adjectives related to warmth, and six related to competence (i.e., the Stereotype Content Model), from 1 (Not at All) to 5 (Extremely Well).[6] Participants were then asked whether they would rate the candidate positively from 1 (Strongly Disagree) to 5 (Strongly Agree; *Overall Positivity*) and if they would hire the candidate ("Yes" or "No"; *Decision to Hire*). After seeing both videos, participants were also asked how well each candidate's name fit them from 1 (Not at All) to 5 (Extremely Well; *Name Fit*). See Online supplementary material for all scale items.

6.2. Results

6.2.1. HEXACO analyses

We first computed reliability scores for each HEXACO factor (i.e., across the ten adjectives related to each factor). To do this, we considered ratings for each video as a single set of ratings, ignoring name and candidate. Thus, each participant contributed two sets of ratings. We found good reliability for Honesty-Humility ($\alpha = .91$), Emotionality ($\alpha = .89$), Extraversion ($\alpha = .88$), and Agreeableness ($\alpha = .79$). We found lower reliability for Conscientiousness ($\alpha = .53$) and Openness ($\alpha = .67$). In addition, we ran a confirmatory factor analysis to examine how closely ratings on our sixty adjectives conformed to the expected six factor HEXACO solution. This resulted in a poor fit (CFI = .57), suggesting that the following analyses should be interpreted with some degree of caution.

The analyses consisted of mixed effects linear regressions. Our dependent variable was a participant's overall rating of a candidate on a certain factor of the HEXACO. These were computed by averaging ratings on all traits pertaining to a given factor, after reverse-coding low-end traits. Our predictors of interest were name type (effects coded; sonorant [0.5], voiceless stop [−0.5]), video (effects coded; [0.5, −0.5]) and their interaction. We built our random effects structure in the same manner as previous experiments. We computed six separate models: one for each factor of the HEXACO. Note that due to singular fits, we were not able to include random effects in the analysis of Extraversion. The interaction between name type and video was significant in the prediction of Honesty-Humility ($b = -0.33$, $p = .03$). We followed this up with a comparison of estimated marginal means for name type, separately for each video and found that name type was not a significant predictor for either video (p's $> .27$). There were no other significant interactions between name type and video for any factor (all p's $> .24$), nor was there a significant effect of name type for any factor (all p's $> .13$). There was a main effect of video in which Candidate Two was rated as being higher in Agreeableness ($b = -0.28$, $p < .001$) and Conscientiousness ($b = -0.38$, $p < .001$). To summarize, there was no evidence that name type had any effect on personality ratings, see Table 3.

6.2.2. Stereotype content analyses

These analyses were the same as those of HEXACO factors, except that the dependent variable was a participant's overall rating of a candidate on likability and warmth.

6.2.2.1. Warmth. There was not a significant interaction between name type and video ($b = -0.21$, $p = .33$), nor were there significant effects of name type ($b = 0.01$, $p = .84$) or video ($b = -0.00$, $p = .99$).

6.2.2.2. Competence. There was not a significant interaction between name type and video ($b = -0.20$, $p = .10$), nor were there significant effects of name type ($b = -0.01$, $p = .76$) or video ($b = 0.02$, $p = .64$).

6.2.3. Other analyses

All subsequent analyses follow the same format of including name type, video and their interaction.

6.2.3.1. Overall positivity. Here the dependent variable was a participant's rating of a candidate's overall positivity. There was not a significant interaction between name type and video ($b = -0.17$, $p = .19$), nor was there a main effect of name type ($b = -0.02$, $p = .74$) or video ($b = -0.11$, $p = .09$).

6.2.3.2. Decision to hire. Here the dependent variable was a binary decision of whether the participant would hire the candidate. There was not a significant interaction between name type and video ($b = 0.04$, $p = .90$), nor was there a main effect of name type ($b = -0.11$, $p = .51$) or video ($b = 0.06$, $p = .74$).

6.2.4. Name fit

Beyond these initial analyses, we conducted exploratory analyses based on the idea that the perceived fit between the candidate and the presented name could lead to more positive ratings (e.g., Barton & Halberstadt, 2018). Thus, we conducted exploratory analyses to investigate whether the perceived fit between a name and a candidate predicted any of the above variables, or moderated the effect of name type. These analyses included standardized name fit, name type and their

Table 3
Coefficients of name type, and name type × video interaction, in the prediction of scores on each personality factor.

Dependent variable	Effect of name type	Name type × video Interaction coefficient
Honesty-Humility	$b = 0.01$, $p = .82$	$b = -0.34$, $p = .03$*
Emotionality	$b = 0.07$, $p = .13$	$b = -0.03$, $p = .71$
Extraversion	$b = -0.10$, $p = .26$	$b = -0.21$, $p = .24$
Agreeableness	$b = 0.00$, $p = .97$	$b = -0.12$, $p = .34$
Conscientiousness	$b = -0.04$, $p = .50$	$b = -0.13$, $p = .39$
Openness	$b = 0.01$, $p = .92$	$b = -0.08$, $p = .53$
Warmth	$b = -0.01$, $p = .84$	$b = -0.21$, $p = .33$
Competence	$b = -0.01$, $p = .76$	$b = -0.19$, $p = .12$
Overall Positivity	$b = -0.02$, $p = .75$	$b = -0.18$, $p = .19$
Decision to Hire	$b = 2.69$, $p = .14$	$b = -0.08$, $p = .84$

* $p < .05$.

[6] Participants rated candidates on a total of 34 different adjectives. Several of these were intended to capture attributions that are relevant to job interviews (likeability, competence, dedication, sycophancy, conceitedness and feelings of superiority; Wingate & Bourdage, 2019). None of these showed significant effects (p's $> .13$) and we omitted them going forward to streamline the reporting of results, except for those related to the Stereotype Content Model.

interaction as fixed effects. The dependent variable was one of: rating on a given personality factor, rating on a stereotype content factor, overall positivity, or decision to hire.

6.2.4.1. HEXACO analyses. A higher rated name fit was a predictor of higher ratings of Honesty-Humility ($b = 0.17, p < .001$), Extraversion ($b = .0.15, p < .001$), Conscientiousness ($b = 0.10, p = .002$) and Openness ($b = 0.14, p < .001$). There was a significant interaction between name fit and name type for Emotionality ($b = 0.11, p = .02$) and Agreeableness ($b = 0.17, p = .004$; p's for all other factors $> .12$). We followed this up with a comparison of estimated marginal means for name type, separately at high and low name fit (operationalized as one standard deviation below and above the mean). Degrees of freedom were determined using the Kenward-Roger approximation. In the follow up analyses of Emotionality, there was no effect of name type at low name fit ($t[498] = 0.58$, $p = .56$). However, when there was a high name fit, candidates with sonorant names were rated as higher in Emotionality ($t[498] = 2.76$, $p = .006$). In the follow up analyses of Agreeableness, name type did not have an effect at low ($t[3.87] = 1.50, p = .21$) nor high ratings of name fit ($t[3.85] = 1.68$, $p = .17$).

6.2.4.2. Stereotype content model. A higher name fit was predictive of ratings of higher candidate warmth ($b = 0.12, p < .001$) and competence ($b = 0.10, p < .001$). Name fit did not interact with name type in either case (p's $> .17$).

6.2.4.3. Overall positivity. A higher name fit was predictive of higher ratings of overall positivity for a candidate ($b = 0.15, p < .001$). Name fit did not interact with name type ($b = -0.03$, $p = .59$).

6.2.4.4. Decision to hire. A higher name fit was marginally predictive of a greater likelihood of endorsing hiring a candidate ($b = 0.18$, $p = .06$). Name fit did not interact with name type ($b = -0.24$, $p = .21$).

6.3. Discussion

Name sound symbolism had no effect on judgments of personality when participants saw a video of the candidates being evaluated. This seems to suggest a boundary condition for name sound symbolism, such that the effect is diminished in the presence of additional visual and auditory information. However, we found that the perceived fit between a candidate and their name interacted with effects of name type for Emotionality and Agreeableness, and was predictive of various personality factor and stereotype content component ratings.

7. General discussion

We examined whether previously demonstrated sound symbolic associations between names and HEXACO personality factors would affect responses on a mock hiring task. Participants were given a job ad that described an ideal candidate along with a pair of names (containing either sonorants or voiceless stops) to choose between. Job ads included three adjectives (Experiment 1), a single adjective (Experiment 2) or a single adjective along with a photo of candidates (Experiment 3). Participants chose the name containing the sonorant more often for jobs describing a candidate high in Honesty-Humility (E1, E3), Emotionality (E1), Agreeableness (E1, E2) and Openness (E1, E2). Thus, the sound symbolic associations of a name will affect responses on a more comprehensive task than has been used previously. In Experiment 4, participants were shown videos of mock interviews and asked to rate candidates on a variety of measures. Overall, name type did not have any effect on ratings. The only exception to this was that candidates with a sonorant name were judged higher on Emotionality when participants judged their name as a good fit.

Many previous studies of sound symbolism have involved nonwords and very simple targets (e.g., a shape). This study builds upon that in two ways. One is that the targets were real words, further demonstrating that sound symbolism can have an effect even in linguistic stimuli with existing associations. Secondly, participants made decisions about relatively material targets. That is, the fit between an individual and a job. This is a relatively richer and more contextualized target than typical studies of sound symbolism (e.g., a simple shape, a single adjective).

A key takeaway from these results is that as more information about a candidate is added (i.e., pictures, videos), the effect of a name is reduced for some personality factors. Because pictures were randomly paired with names, we would expect less of an effect of name type if participants responded based on pictures to a greater extent. Recall that researchers have theorized that when embedded in a word with existing semantics, the associations of a word's phonemes will have less of an effect (e.g., Westbury, 2005). The present results are consistent with this assumption. When additional content is added (e.g., a person's face, tone of voice), the sound symbolic associations of a linguistic stimulus have less effect. We might consider this alongside the results of Experiment 4 in Sidhu et al. (2019), in which participants were given nonwords instead of names. That experiment represents the opposite end of the spectrum, in which participants have the least amount of additional content on which to base their decisions, besides the form of a linguistic stimulus. Indeed, in that context there were effects for five out of the six HEXACO factors when studied with nonwords.

The attenuation of sound symbolism in the presence of additional visual information is consistent with the results of a study by Topolinski and Boecker (2016). That study examined the effects of nonwords' articulatory direction (i.e., inwards vs. outwards) on the expected palatability of associated foods. The researchers found that the effect of articulatory direction disappeared in the presence of informative images (i.e., food pictures). It is notable that research has shown links between an individual's personality and their facial features (Kachur et al., 2020), and that participants can make accurate judgments about personality based on a static face (e.g., Borkenau et al., 2009; Carré et al., 2009). Thus, faces could also be regarded as informative images. Interestingly, in the present findings Emotionality and Agreeableness appeared to be the two factors most affected by the presence of a candidate's picture. One possibility is that participants regarded faces as most informative for these personality factors. Alternatively, these sound symbolism associations may have been less robust to begin with.

The results of Experiment 4 present a somewhat more complex picture: we observed that audiovisual information did not always simply eliminate effects of the sounds in a name. Instead, we found that audiovisual information could moderate the effect of name type (i.e., in significant interactions between name fit and name type for some personality ratings). In particular, we found that participants rated those with a sonorant (vs. voiceless stop) name as being higher in Emotionality *only* when they felt that names were a good fit for candidates. It may be that the extent to which a label is seen as connected to its referent can moderate effects of sound symbolism. While this is a fruitful topic for future research on name sound symbolism, we are hesitant to overinterpret this result until it is replicated, as it was observed only for one measure.

A fruitful framing for this discussion is Occhino et al.'s (2017) conceptualization of *iconicity*: instances in which there is a perceived resemblance between form and meaning (e.g., onomatopoeia). Occhino et al. describe this as arising from an individual's subjective construal of a given word's form. For example, while the form of a word like "mushy" might afford an iconic link with its meaning, this will depend on a given speaker's construal of that form. In the present work, there is the potential to perceive an iconic link between a given name and a personality trait. However, this will depend on an individual's construal of the name. We suggest that the extent to which the sound of a name affects its construal can be decreased as other information is added.

Importantly, the fact that name sound symbolism can be diminished

in the presence of other information does not mean that names are not impactful in the context of hiring. Indeed, in many hiring situations, candidates are often initially screened based on non-visual information (e.g., resumes, job applications), with only a smaller subset of candidates reaching the interview stage. This is consistent with studies demonstrating that names can affect which candidates receive callbacks from potential employers (see Bertrand & Mullainathan, 2004; Obenauer, 2023). As such, the effect of names may still have an important practical impact, even if this effect is strongest without audio and visual information. Also note that there may be factors that could amplify the effect of a name. For example, while names were read silently in the present study, hearing a name pronounced aloud might enhance the salience of its sound symbolic associations. Nevertheless, we do not wish to overstate these results. They may point to an effect of sound symbolism in hiring decisions, but future research, using a more realistic task, is needed. It is also critical to interpret these results alongside those from Sidhu et al. (2019; Experiment 3), in which it was discovered that the sounds in people's real given names (and even the sounds in their nicknames) did not predict their personality. Thus, while name sound symbolism may create the expectation for a certain personality, that expectation is not accurate. Thus, the use of names as a cue in the hiring process could be seen as a contaminating factor (see Highhouse & Brooks, 2023), which would reduce the validity of decisions. However, a limitation of this research is that we simulated personnel selection contexts in a highly controlled environment and limited the amount information that participants evaluated. Although this was critical to accurately capture the focal phenomena (i.e., internal validity), in a true hiring context, employers would have access to more information about applicants. As such, the effects of sound symbolism are likely to be stronger for product selection or brand selection than in the personnel selection context.

There are also some insights to be gained from comparing the results across different experiments. The effect of Emotionality only appeared with three traits (Experiment 1) and not with individual traits (Experiments 2 and 3). One speculative possibility is that this effect is based on an association between high Emotionality and sonorant phonemes, and not negated low traits and sonorants. That is, sonorants may be associated with a trait like "sensitive", but not associated with "not rugged". This is consistent with the fact that in Experiment 2, name type predicted choices for high Emotionality trials but not negated low Emotionality trials. When these two types of traits were presented separately (as in Experiment 2) the overall effect may have been diluted by only being relevant for half of the trials. When both high and low traits were presented together (as in Experiment 1), participants could focus their attention on the high traits. This is highly speculative, and it will require future research to discern the specific effects for high and low ends of each factor.

In addition to examining variations in the effect across different studies, it is worth taking a broader perspective. Together with the results of Sidhu et al. (2019), there are now seven experiments exploring the relationships between phonemes and personality factors in the HEXACO. Any comparisons must be made with caution, as there are differences in the analyses across studies (i.e., frequentist vs. Bayesian) as well as the response variable (i.e., binary choice vs. Likert scale ratings of a single name; see Online Supplementary Material for a Table which combines all results: https://osf.io/xqhua). Nevertheless, when simply noting the presence or absence of effects in each experiment (adopting whatever analysis technique was used), it appears that Agreeableness is the most robust effect, appearing in five experiments. On the other hand, the effects for Extraversion and Conscientiousness seem the least robust, emerging in only two studies. Each of the other three factors emerged in three experiments.

There is also potential to connect this work with the work mentioned in the Introduction on brand personality. Pathak and Calvert (2020) found that hypothetical brand names with voiceless stops were judged as less rugged and more sophisticated than those with voiced stops. They did not observe a difference in sincerity. This seems to conflict with the present finding that voiceless stop names were lower in Emotionality and Honesty-Humility than sonorant names. However, the difference may arise from our use of sonorants, as opposed to voiced stops, as the comparison group.

We further found that name fit was related to a variety of ratings in and of itself. In general, when a participant felt that a candidate's name was a good fit, they also rated the candidate as being higher in Honesty-Humility, Extraversion, Conscientiousness and Openness. They also rated such candidates higher in the stereotype content components of competence and warmth, and as marginally more deserving of being hired. This fits with previous work showing that participants prefer individuals whose faces are judged to match their names (Barton & Halberstadt, 2018).[7] More broadly, the literature on crossmodal congruence has found that people tend to rate stimuli more positively when their attributes in different modalities (e.g., colour and taste) are congruent (Peng et al., 2022; for a review see Eklund & Helmefalk, 2022). In general, there is a tendency to like stimuli that are easier to process (i.e., more fluently; see Westerman et al., 2015). Processing fluency could be a mechanism for the effect of name fit, in which it is easier to associate a name with an individual when the two are a good match. It is also possible that these effects arise from a halo effect (e.g., Leuthesser et al., 1995; Thorndike, 1920), a tendency to give a stimulus a generally high rating across multiple scales. Future research could test these possibilities with designs that intentionally manipulate name fit.

In Experiments 1 and 2, as well as the combined analysis, we observed a tendency to choose the candidate with the sonorant name, regardless of the job description. The combined analysis across multiple studies found that participants were 1.20 times more likely to choose the candidate with the sonorant name, regardless of the specific job description. This potential bias toward sonorant names would be an important factor to control for in future research on hiring biases. That is, when studies assess gender and/or racial biases, it would be important to control for the additional factor of sound symbolism.

Personality sound symbolism contributes to the growing list of dimensions that have been shown to have sound symbolic associations. The association between names and personality is especially notable because it demonstrates that symbolic associations are not limited to perceptual dimensions. This inspires the important question of how crossmodal associations can emerge between a concrete perceptual dimension (e.g., sound) and an abstract dimension (i.e., personality). This is a more challenging phenomenon to explain than an association between a pair of concrete perceptual dimensions (e.g., sound and shape). For example, Fort and Schwartz (2022) identified acoustic features of phonemes that were associated with visually smooth or spiky shape contours. One such feature was continuous or discordant sound. There is a clear analogy to be drawn between a continuous sound and a continuous shape outline. However, proposing a similar analogy between, for example, continuous sounds and Honesty-Humility, is less straightforward. Nevertheless, sounds may be associated with some personality traits metaphorically. For example, Kawahara et al. (2015) found that names containing voiceless stops were associated with an unapproachable personality, and suggested that their associated angular shapes could be mapped onto unapproachability.

The answer may lie in shared properties that can exist across dimensions. Liu and Lupyan (2022) recently explored goodness ratings of statements such as "If a nurse were a job, they would be a cat." They found that one factor which explained responses was the similarity of the two concepts (i.e., a nurse and a cat) on abstract dimensions such as bad-good or passive-active. Perhaps there are abstract properties that

[7] This study explored name-face fit based on shape sound symbolism. This did not seem to be the mechanism here, as participants did not systematically rate sonorant vs. voiceless stop names as better fits for either candidate (p's $>$ .43).

can similarly unite phonemes and personality traits. Sidhu et al. (2022) explored ratings of various nonwords on abstract dimensions. They found that, for example, sonorants were rated as being soft (vs. hard) and non-solid (vs. solid). These dimensions could be an avenue for future research to explain the associations between phonemes and personality. For example, while extremely speculative, it is possible that sonorants and Openness could share the property of non-solidity. Emotion is another potential mediator. Indeed, Aryani et al. (2020) found evidence that emotional arousal might underlie shape sound symbolism. This could explain some phoneme-personality associations as well. Sidhu et al. (2019) noted that the phonemes associated with Extraversion tended to be those high in arousal. Relatedly, Motoki et al. (2022) found evidence that valence and potency played a role in linking the sounds in brand names with desirable properties in products.

The main contribution of this work was the discovery that personality sound symbolism, stemming from phonemes in existing names, can affect responses on a mock hiring task. This extends the relevance of name sound symbolism to a new and more material context. It also reinforces the finding that sound symbolism can extend beyond perceptual features. By understanding the associations and biases that drive human judgments, we may be better able to mitigate them.

CRediT authorship contribution statement

David M. Sidhu: Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Timothy G. Wingate:** Writing – review & editing, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Joshua S. Bourdage:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Conceptualization. **Penny M. Pexman:** Writing – review & editing, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: David M Sidhu reports financial support was provided by Natural Sciences and Engineering Research Council of Canada. Penny M Pexman reports financial support was provided by Natural Sciences and Engineering Research Council of Canada. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Name pairs from Experiments 1–3

Sonorant names	Voiceless stop names
Anne	Rita
Joanna	Erica
June	Etta
Lanah	Patty
Laurel	Christie
Lauren	Katie
Lois	Kasey
Luna	Petra
Mara	Kathy
Marla	Katia
Megan	Kate
Mona	Trista
Myah	Tracy
Noelle	Pippa
Norah	Tessa
Nya	Tia
Renee	Greta
Rosanne	Yvette
Abel	Eric
Allen	Hector
Lewis	Chris
Linus	Curtis
Lorne	Kirk
Lou	Ted
Lyle	Titus
Miles	Tucker
Milo	Tate
Morris	Terry
Moses	Pierce
Nathan	Carter
Noam	Kipp
Noel	Kurt
Owen	Jack
Ronin	Victor
Warren	Garrett
Will	Zach

Appendix B. Adjectives in Experiments 1–3

Trait	Factor	Pole
Honest	Honest-Humility	High
Sincere	Honest-Humility	High
Trustworthy	Honest-Humility	High
Conceited	Honest-Humility	Low
Self-centered	Honest-Humility	Low
Snobbish	Honest-Humility	Low
Emotional	Emotionality	High
Sensitive	Emotionality	High
Sentimental	Emotionality	High
Fearless	Emotionality	Low
Rugged	Emotionality	Low
Unemotional	Emotionality	Low
Lively	Extraversion	High
Outgoing	Extraversion	High
Social	Extraversion	High
Antisocial	Extraversion	Low
Dull	Extraversion	Low
Withdrawn	Extraversion	Low
Agreeable	Agreeableness	High
Cooperative	Agreeableness	High
Peaceful	Agreeableness	High
Aggressive	Agreeableness	Low
Blunt	Agreeableness	Low
Quick-tempered	Agreeableness	Low
Hard-Working	Conscientiousness	High
Organized	Conscientiousness	High
Thorough	Conscientiousness	High
Careless	Conscientiousness	Low
Disorganized	Conscientiousness	Low
Irresponsible	Conscientiousness	Low
Complex	Openness	High
Insightful	Openness	High
Philosophical	Openness	High
Conventional	Openness	Low
Narrow-minded	Openness	Low
Simple	Openness	Low

Appendix C. Job ads used in Experiment 1

Job ad	Factor
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Honest - Trustworthy - Not snobbish	Honesty-Humility
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Sincere - Not self-centered - Not conceited	Honesty-Humility
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Trustworthy - Sincere - Not self-centered	Honesty-Humility
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Honest - Not snobbish - Not conceited	Honesty-Humility
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Honest - Not conceited - Not self-centered	Honesty-Humility
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Sincere - Trustworthy - Not snobbish	Honesty-Humility

(*continued on next page*)

(*continued*)

Job ad	Factor
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Sentimental - Sensitive - Not unemotional	Emotionality
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Emotional - Not rugged - Not fearless	Emotionality
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Sensitive - Not unemotional - Not fearless	Emotionality
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Emotional - Sentimental - Not rugged	Emotionality
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Emotional - Not fearless - Not rugged	Emotionality
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Sentimental - Sensitive - Not unemotional	Extraverted
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Social - Not withdrawn - Not dull	Extraverted
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Outgoing - Lively - Not antisocial	Extraverted
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Social - Not withdrawn - Not dull	Extraverted
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Lively - Outgoing - Not antisocial	Extraverted
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Outgoing - Social - Not dull	Extraverted
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Lively - Not withdrawn - Not antisocial	Extraverted
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Peaceful - Not blunt - Not aggressive	Agreeable
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Agreeable - Cooperative - Not quick-tempered	Agreeable
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Peaceful - Agreeable - Not blunt	Agreeable

(*continued on next page*)

(*continued*)

Job ad	Factor
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Cooperative - Not quick-tempered - Not aggressive	Agreeable
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Cooperative - Peaceful - Not aggressive	Agreeable
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Agreeable - Not quick-tempered - Not blunt	Agreeable
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Hard-working - Thorough - Not disorganized	Conscientious
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Organized - Not careless - Not irresponsible	Conscientious
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Hard-working - Not disorganized - Not irresponsible	Conscientious
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Organized - Thorough - Not careless	Conscientious
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Organized - Thorough - Not irresponsible	Conscientious
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Hard-working - Not disorganized - Not careless	Conscientious
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Insightful - Philosophical - Not simple	Openness
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Complex - Not narrow-minded - Not conventional	Openness
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Philosophical - Complex - Not narrow-minded	Openness
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Insightful - Not conventional - Not simple	Openness
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Philosophical - Insightful - Not narrow-minded	Openness
An organization is looking to hire a new employee. The ideal applicant for this job should be: - Complex - Not conventional - Not simple	Openness

Data availability

Link provided in paper.

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