

Trait Judgements of Multimodal Emotional Cues

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Abstract

It is well known that people's perceptions of traits, such as trustworthiness or dominance, are influenced by their facial expressions (Van Der Zant et al., 2021). While studies regarding trait judgements and emotional cues have primarily been based on facial expressions, with literature beginning to analyse postural cues, few studies have explored this judgement concerning vocal emotional cues. As people do not only receive facial expressions when forming judgements about other people's traits, this study aims to examine the trait judgements of participants when presented with faces and voices that portray various emotions. Participants (N = 89) judged the trustworthiness and dominance of four identities (Female N = 2, Male N = 2) displaying four emotions (angry, happy, sad, neutral) via facial and vocal emotional cues. The video clips displayed congruent emotional expressions (both cues express the same emotion) or incongruent expressions (cues express different emotions). As predicted, happy facial expressions were judged to be the most trustworthy and angry facial and vocal expressions were viewed as most dominant. Contrary to predictions, participants perceived neutral voice cues as more trustworthy than all other emotion cues. Participants rated incongruent happy face and neutral voice cues as more trustworthy than congruent happy cues. Congruent angry stimuli were perceived as more dominant than all other incongruent stimuli. The results demonstrate that vocal emotional expressions can influence trait judgements of others.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

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Contributor Roles

ROLE	ROLE DESCRIPTION	STUDENT	SUPERVISOR 1	SUPERVISOR 2
CONCEPTUALIZATION	Ideas; formulation or evolution of overarching research goals and aims.	X	X	
METHODOLOGY	Development or design of methodology; creation of models.	X	X	
PROJECT ADMINISTRATION	Management and coordination responsibility for the research activity planning and execution.	X		
SUPERVISION	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.		X	
RESOURCES	Provision of study materials, laboratory samples, instrumentation, computing resources, or other analysis tools.	X	X	
SOFTWARE	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code.	X		
INVESTIGATION	Conducting research - specifically performing experiments, or data/evidence collection.	X		
VALIDATION	Verification of the overall replication/reproducibility of results/experiments.			
DATA CURATION	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use.	X		
FORMAL ANALYSIS	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data.	X	X	
VISUALIZATION	Visualization/data presentation of the results.	X		
WRITING – ORIGINAL DRAFT	Specifically writing the initial draft.	X		
WRITING – REVIEW & EDITING	Critical review, commentary or revision of original draft	X	X	

Introduction

While we are often cautioned not to judge others by first impressions, the literature shows this is precisely what we do. People make rapid and automatic judgements about another's traits based on facial appearance (Zebrowitz & Montepare, 2008). These judgements have important social consequences as they extend to how we treat others, who we favour, and who we vote for (Oosterhof & Todorov, 2009; Said et al., 2009; Zebrowitz, 2017). While these judgements are better than chance in accurately predicting a person's characteristics, they are often erroneous due to an overgeneralisation of emotional expressions to trait judgements (Zebrowitz, 2017). For example, neutral faces are rated on multiple trait dimensions via their perceived emotional expression, with faces perceived to have positive valence or warmth resembling happiness and faces viewed as threatening or dominant resembling anger (Said et al., 2009). This is consistent with the view that perceptions of trustworthiness and dominance fundamentally underlie trait impressions (Zebrowitz, 2017). People are likely to consider someone more dominant if they appear to express even the slightest anger, likewise for expressions of subtle happiness and trustworthiness (Van Der Zant et al., 2021). Some literature suggests first impressions of facial expressions are linked to adaptive information necessary for social interactions. That is trustworthiness judgements attempt to decipher behavioural intentions that signal approachability or avoidance (Todorov, 2008). The perceived trustworthiness of a face has been found to have a strong influence on social cues that influence decision-making, such as investing money in a hypothetical trust game (van 't Wout & Sanfey, 2008). Faces expressing anger are thought to signal avoidance and defence behavioural responses (Zebrowitz & Montepare, 2008).

While extensive literature has explored this overgeneralisation hypothesis regarding facial expressions, recent research has begun to explore whether other emotional cues contribute to this effect. Investigating whether the same inaccuracies of overgeneralising exist when looking at multimodal expression cues may help us understand these judgements holistically and how they are

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perceived in the real world. Emotion can be detected from cues other than faces, such as body movement, body posture, and vocal intonations (Mondloch et al., 2013). Some studies suggest that interpreting these cues, such as hand gestures and tone of voice, can influence emotion perception and facial expressions (de Gelder & Vroomen, 2000; Hietanen & Leppänen, 2008; Mondloch et al., 2013). Trustworthiness has been identified in vocal stimuli and postural gait, and dominance is rapidly recognisable in postural emotional cues, detected in 40 ms (Van Der Zant et al., 2021). Head postures also influence people's perceptions; heads tilted down holding a direct gaze are seen as less trustworthy, more dominant, and with more negative valence (Zhang et al., 2020).

In some cases, non-facial cues, such as aggressive body cues, are more recognisable than facial cues in constructed and real-life stimuli (Abramson et al., 2017). This further suggests that perceptions of facial expressions may consider postural expressions in contextualising emotions. A study by Mondloch et al., (2013) investigated whether conflicting emotions, presented through incongruent cues, interfere with emotion perception and how this compares to congruent cues. Exploring asymmetries in congruency allows for an understanding of how facial expressions and body postures interact to influence each other. Mondloch et al. (2013) had participants make three alternative judgements where the choice was forced for sadness, anger, and fear, three similar emotions in that they are considered negatively valenced. Their results showed that for each facial expression, emotion recognition accuracy decreased when presented with incongruent postures (sad face and angry posture) and that the degree of influence each emotion had on each expression cue was variable and independent. The overarching results showed that the accuracy and speed at which people recognise emotional facial expressions are influenced by body postures. Similar results were found in a study by Van Der Zant et al., (2021), which explored whether overextension of emotional expressions to trait judgements in facial cues extends to postural cues. Participants completed a storybook task in which they chose from two characters which person they would want to help them face a challenge. The challenges would require a trustworthy or dominant person to help who had either congruent or incongruent emotional cues. For example, one character might have an emotional face (happy or

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angry) and a neutral body, and vice versa. The results further confirmed what the literature shows: happy faces are preferred over neutral expressions for trustworthy challenges, and angry postural cues are preferred over neutral ones for dominant challenges. This study provides evidence for differences in how people are influenced by emotional expressions when making trait judgements depending on which cues they receive. Van Der Zant et al. (2021) call for further investigation into other emotional cues, like voice, as some emotions, such as happiness, are not easily recognised in postural cues. They also bring attention to a limitation in their design where happy cues were only paired with trustworthy challenges, and angry cues were only paired with dominant challenges. Thus, they highlight the need for studies to investigate pairing happy and angry cues with trustworthiness and dominance traits to explore how different emotion expressions influence trait judgements.

Literature on how vocal intonations influence trait judgements is generally surrounded by how rapidly these judgements are made and their consistency across perceivers. Consistent with face and body expressions, what is known is that people form spontaneous impressions about a person from their voice (Lavan, 2023; Mileva & Lavan, 2023). A recent study by Mileva & Lavan (2023) explored the time course of trait impressions from voices and found that impressions are formed rapidly. However, unlike faces, perceivers required longer exposure times to the voices for impressions to stabilise. Similar results were found by Lavan (2023), yet their analysis shows that impressions formed during short exposure to voices often correlate with those formed after more prolonged exposure (Lavan, 2023). Similarly to postural cues, dominance is the fastest recognised in vocal impressions after only 25 ms of exposure (Lavan, 2023). Other research in this field has explored how social trait ratings of faces and voices vary according to within- and between-person judgements. Lavan et al. (2021) found that, unlike faces, impressions of social traits in voices have consistently more variability within people than between people. This means people's trait judgements of trustworthiness, dominance, and attractiveness for the same person after hearing their voice differ significantly in different encounters (Lavan et al., 2021). While this author found no literature on how multiple emotional expressions interact or influence judgments for multiple traits, Tsankova et al. (2012) have explored the influence

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of facial and vocal emotional expressions in forming trustworthiness judgments. The study involved 25 adults watching multimodal clips from all possible neutral and trustworthy face and voice combinations. Their study found that participants rated the most trustworthy stimuli combination as trustworthy faces and neutral voices as the most trustworthy. The authors suggest that face cues are superior to voice cues for trustworthiness judgements (Tsankova et al., 2012).

This study examined participants' trait judgements of trustworthiness and dominance when presented with congruent and incongruent face and voice emotion cues. Past research shows judgements of traits can be overgeneralised according to perceived emotions conveyed on neutral faces (Said et al., 2009). Also, evidence indicates that trustworthiness is associated with happy cues, and dominance is associated with anger cues (Oosterhof & Todorov, 2009; Said et al., 2009). Sadness was included out of interest as another negatively valenced emotion but with low arousal. Thus, participants were presented with video stimuli showing congruent (happy/happy) and incongruent (happy/angry) face and voice cues and were required to rate the trustworthiness and dominance of each stimuli. The incongruent stimuli enabled the authors to determine whether participants preferred facial or vocal cues when judging the stimuli's trustworthiness and dominance. The congruent stimuli allowed us to determine whether multimodal cues elicit expected patterns of results for ratings of trustworthiness and dominance.

We expected participants to rate happy cues (face and voice) as more trustworthy and angry cues (face and voice) more dominant than all other emotion cues. We also anticipated that participants would rate congruent happy cues (happy/happy) as most trustworthy, with happy/neutral cues rated slightly less trustworthy. Finally, we expected to see that happy facial expressions and neutral voice cues were rated as more trustworthy than neutral face and happy voice cues. We expected to see a similar pattern of anger and dominance where participants would rate congruent angry cues as most dominant, with angry/ neutral cues rated slightly less dominant. Finally, we expected to see that angry

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facial expressions and neutral voice cues would be rated as more dominant than neutral face cues and angry voice cues.

Method

Participants

Eighty-nine undergraduate psychology students (64 females, $M_{\text{age}} = 19.64$, age range: 17-43 years) participated in this study. An additional 14 students were excluded for failing to complete the task ($n = 6$) or follow instructions ($n = 8$). Participants were recruited via the SONA research participants system at the University of Adelaide and were compensated with partial course credit. An a priori power analysis was conducted using G*Power (Faul et al., 2007) for a 4(facial expression) x 4(vocal expression) x 2(trait) repeated measures ANOVA. To detect a small effect ($f = 0.10$) at 95% power and an alpha of 0.05, the sample size required was 88, a number we exceeded. This study was approved by the Human Research Ethics Committee at the University of Adelaide, approval number [blinded for review].

Materials

Stimuli. The facial expression stimuli used in the study were four Northern European Caucasian identities (2 female, 2 male) comprising dynamic facial expressions drawn from Schalk et al. (2011). Vocal expression stimuli were recordings from Sauter et al. (2010) of non-linguistic affect vocalisations from native English speakers without professional training. Schalk et al. (2011) reported an overall recognition rate of 81%, with Sauter et al. (2010) reporting 76.40% for amusement, 79.75% for anger, and 68.77% for sadness. Participants were presented with isolated stimuli, including 18 facial expressions, followed by 18 vocal recordings, shown separately for each identity. The facial expression clips and the vocal expression recordings were combined using Microsoft Clipchamp to create a series of multimodal face-voice emotion cues for each identity. There were 64 unique stimuli created by using

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all possible combinations of face-voice pairings. Of these emotion cues, 16 were congruent, where the emotion for both face and voice cues were the same, and 48 were incongruent emotion cues. The multimodal clips ranged from 1 to 2 seconds.

The research plan stated there would be 128 trials based on emotion cues drawn from 4 female and 4 male posers. After closer examination of the Sauter et al. (2010) stimulus set, only 2 complete female identities could be established, limiting the number of trials this study could conduct.

Procedure. Participants enrolled in our study via SONA were subsequently directed to a Qualtrics survey. Consent was obtained, and demographic information was collected, such as age, gender, and time living in Australia. A practice question displaying a character from the animated movie 'Inside Out' exhibiting the emotion of anger was completed where the participants rated characters perceived level of trustworthiness and dominance. Participants then completed the test trials. Participants rated the multimodal clips on traits of trustworthiness and dominance using a 5 pt Likert Scale ranging from 'not at all (1)' to 'completely (5)' (Appendix). The 64 multimodal clips were presented in a randomised order. After rating the multimodal clips, participants then rated the isolated emotion cues. The isolated facial expression emotion cues were presented first, in a randomised order, followed by the isolated vocal emotion cues, presented in a random order. Isolated stimuli were collected for control purposes to assess the recognisability of emotional cues in this sample. A debriefing section concluded the survey with the option of participants providing their email if they wish to be provided with results when published.

Analysis Plan. Jamovi was used to conduct statistical analysis of trustworthiness and dominance in the data. To test the hypotheses two 4 (facial expression: happy, neutral, angry, sad) x 4 (vocal expression: happy, neural, angry, sad) repeated measures ANOVAs were run¹. Assumptions were assessed with a Greenhouse-Geisser test, and appropriate analysis was run according to normality

¹ Initial ANOVAs that also included gender as a factor found no main effects or interactions related to gender. Thus, gender was omitted from the presented analyses.

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results. Bonferroni-corrected post-hoc tests were conducted to follow up significant effects. First, the analysis compared trait ratings for isolated, congruent, and incongruent emotion cues. The DV was the average rating of trustworthiness or dominance assigned to each stimulus. Next, the analysis compared trait ratings for congruent and incongruent stimuli to examine whether participants rated congruent stimuli higher on the expected trait than incongruent stimuli. The DV was the proportion of emotion cue type labelled as the expected trait. Finally, to examine participants' judgements of facial and vocal expressions, the analysis compared emotion cue x trait interactions with the DV being the proportion of each emotion cue (face and voice) participants judged as the expected trait (trustworthy or dominant).

Results

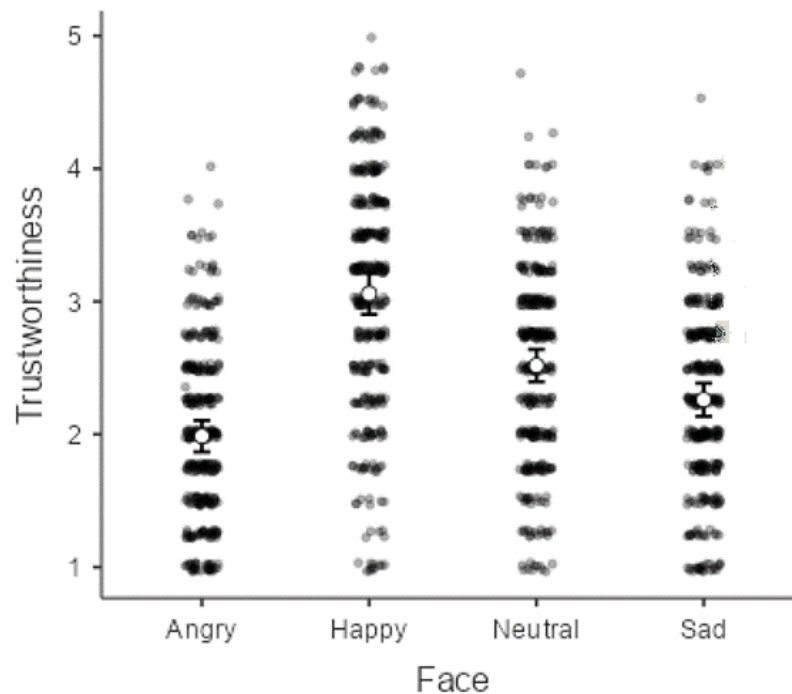
Trustworthy Judgements

A 4 (facial expression: happy, sad, angry, neutral) x 4 (vocal expression: happy, sad, angry, neutral) repeated measures ANOVA, using the average rating of trustworthiness assigned to each stimulus as the DV, showed a significant main effect of face (Figure 1), $F(3,264) = 114.51, p < .001, \eta^2_p = 0.57$. Bonferroni-corrected follow-up t-tests (alpha level = .05/16 = .0031) indicated that happy face stimuli were rated as most trustworthy, followed by neutral, sad, and finally angry faces (all p s < .001), with a large effect size ($\eta^2_p = 0.57$). Neutral faces were rated as more trustworthy than sad faces, neutral/sad $t(88) = 6.54, p < .001$, and angry faces were rated as least trustworthy, angry/neutral $t(88) = -11.89, p < .001$, angry/sad $t(88) = -11.89, p < .001$.

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Figure 1

The mean trustworthiness ratings for face emotion cues.



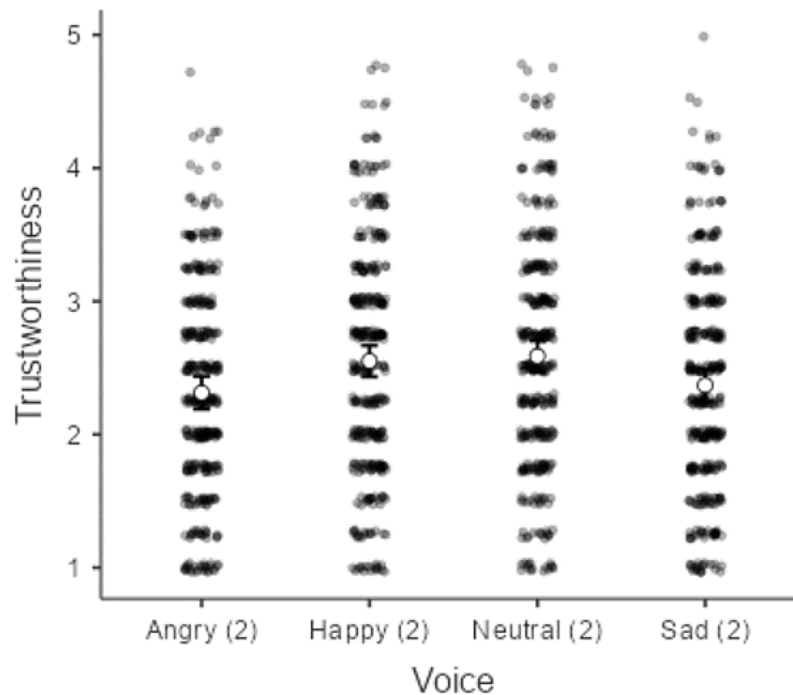
Note. Dots represent individual data points. Error bars represent standard errors.

There was also a main effect of voice (Figure 2), $F(3,264) = 21.41$, $p < .001$, $\eta^2_p = .20$. A significant main effect was found of voice emotion cues with a large effect size ($\eta^2_p = .20$). Bonferroni-corrected post-hoc results showed that neutral voices were rated more trustworthy than sad, $t(88) = 5.20$, $p < .001$, and angry voices, $t(88) = -6.41$, $p < .001$ (see Figure 2), but similar to happy voices $t(88) = -1.15$, $p = 1.00$. There was no difference between neutral and angry or sad voices, $t(88) = -1.39$, $p = 1.00$.

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Figure 2

The mean trustworthiness ratings for voice emotion cues.



Note. Dots represent individual data points. Error bars represent standard errors.

Multimodal Trustworthy Judgements

The main effects of face and voice were qualified by a significant face x voice interaction (Figure 3), $F(9,792) = 9.66$, $p < .001$, $\eta^2_p = .01$. Below I examine the influence of the face-voice pairings, grouped by the facial expression presented.

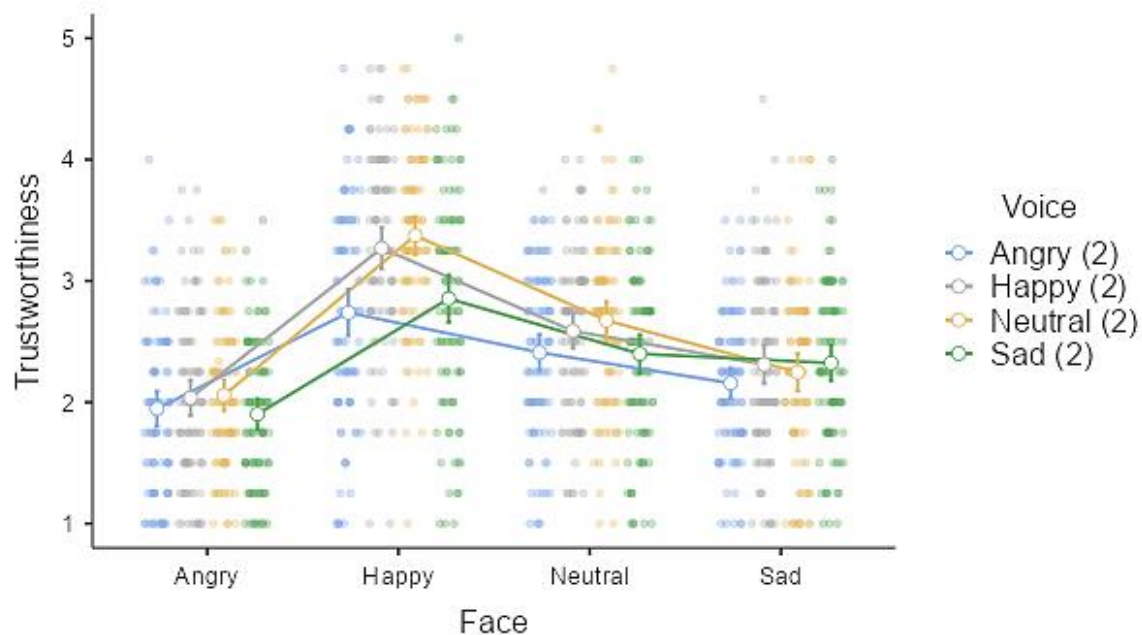
Happy Faces

The Bonferroni-corrected post-hoc tests show that participants perceived higher trustworthiness of the incongruent stimuli of happy faces and neutral voices $t(88) = 5.64$, $p < .001$. Congruent stimuli of happy faces and voices were less trustworthy, $t(88) = 3.63$, $p = .06$, with happy faces with sad voices the next least trustworthy, $t(88) = -1.32$, $p = 1.00$, and happy faces with angry

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Figure 3

The mean trustworthiness ratings for face and voice emotion cues.



Note. Dots represent individual data points. Error bars represent standard errors.

voices the least trustworthy, $t(88) = 6.64, p < .001$. This interaction effect disconfirms the second hypothesis, as happy facial expressions when paired with neutral voices were rated as more trustworthy than happy facial expressions and happy vocal expressions.

Neutral Faces

The congruent stimuli of neutral faces and voices were perceived as more trustworthy than the incongruent stimuli of neutral faces and happy voices. Neutral faces with sad and angry voices were rated as the least trustworthy.

Sad Faces

When paired with sad faces, voice interactions of all emotions showed little influence on trustworthiness ratings, with congruent stimuli of sad faces and voices and incongruent stimuli of sad

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faces and happy voices showing an almost linear relationship. Sad faces with neutral voices were rated slightly less trustworthy, and sad faces and angry voices were rated as the least trustworthy.

Angry Faces

Similar, almost linear results were found for angry faces and voice pairings. Angry faces and neutral voices were perceived as most trustworthy, with angry faces and happy voices slightly less trustworthy. Congruent stimuli of angry faces with angry voices were rated less trustworthy, with angry faces and sad voices rated as least trustworthy overall.

Happy face/Neutral voice vs. Neutral face/Happy voice

Hypothesis 3 predicted that participants would perceive higher trustworthiness of happy faces and neutral voices than neutral faces and happy voices. Post-hoc tests comparing these two stimuli found a significant difference, $t(88) 5.64, p < .001$. Thus, hypothesis 3 was confirmed.

Trustworthiness Summary

Overall, the main effect for face showed that happy facial expressions were judged as the most trustworthy. However, although we predicted that a similar pattern would be found for vocal expressions, this was not the case. Rather, neutral vocal expressions were judged as most trustworthy. These differences in main effects suggest that participants judge neutral voices differently from neutral faces when paired with neutral faces and neutral voices. The Bonferroni-corrected post-hoc tests confirmed the third hypothesis.

Dominance Judgements

A 4 (facial expression: happy, sad, angry, neutral) x 4 (vocal expression: happy, sad, angry, neutral) repeated measures ANOVA, using the average rating of dominance assigned to each stimulus as the DV, showed a significant, large main effect of face (Figure 4), $F(3,264) = 64.68, p < .001, \eta^2p = 0.42$. Bonferroni-corrected follow-up t-tests (alpha level = $.05/16 = .0031$) indicated that angry stimuli were rated as most dominant, followed by neutral, happy, and finally sad faces (all $ps < .001$). Neutral

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Figure 4

The mean dominance ratings for face emotion cues.



Note. Dots represent individual data points. Error bars represent standard errors.

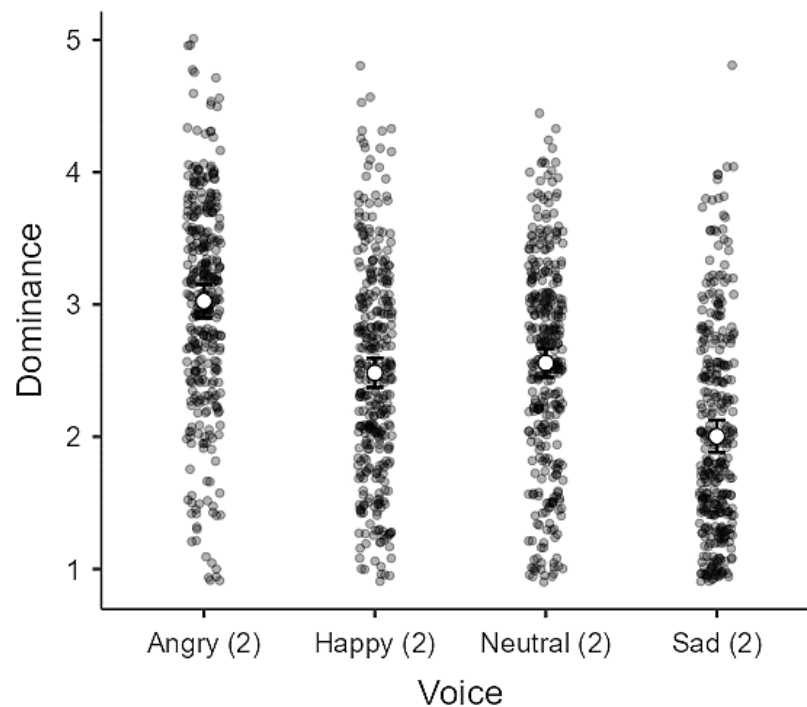
faces were rated as more dominant than happy faces, neutral/happy $t(88) = -2.30$, $p = 0.15$, and sad faces were rated as the least dominant, sad/happy $t(88) = 7.01$, $p < .001$, sad/neutral $t(88) = 10.00$, $p < .001$.

There was also a large main effect of voice (Figure 5), $F(3,264) = 94.62$, $p < .001$, $\eta^2p = .52$. Bonferroni-corrected post-hoc tests showed that angry voices were rated as most dominant, followed by neutral, happy, and finally sad voices (all $ps < .001$). Neutral voices were rated as similar to happy voices, neutral/happy $t(88) = -1.98$, $p = 0.30$, and sad voices were rated as least dominant, neutral/sad $t(88) = 10.48$, $p < .001$, happy/sad $t(88) = 9.30$, $p < .001$.

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Figure 5

The mean dominance ratings for voice emotion cues.



Note. Dots represent individual data points. Error bars represent standard errors.

Multimodal Dominance Judgements

The main effects of face and voice were qualified by a significant face x voice interaction (Figure 6), $F(9,792) = 8.32$, $p < .001$, $\eta^2p = .09$. Below I examine the influence of the face-voice pairings, grouped by the facial expression presented.

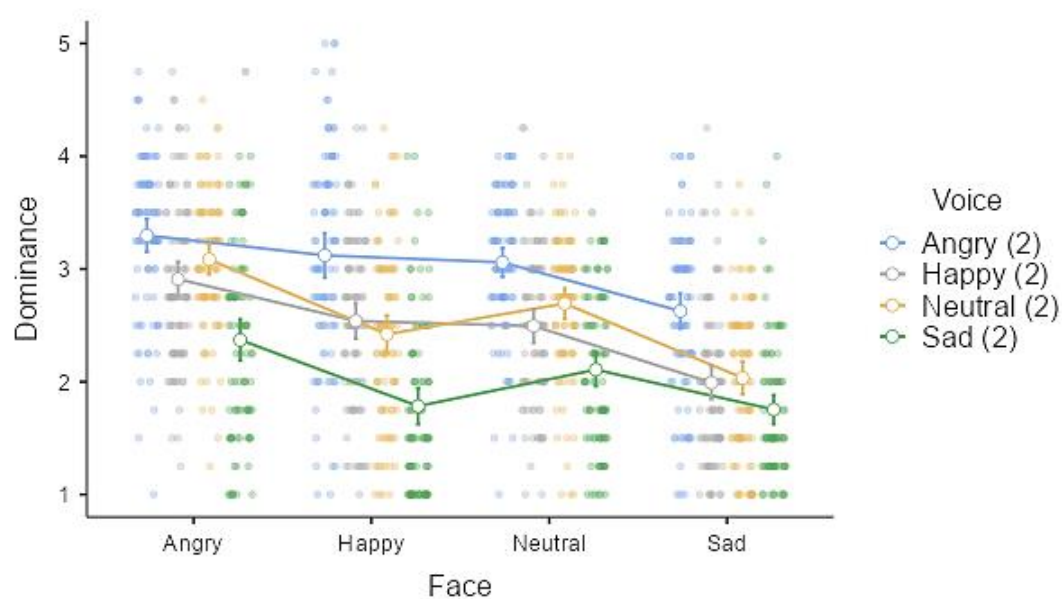
Angry Faces

Bonferroni-correction post-hoc results show congruent stimuli of angry faces and voices were perceived as most dominant (Figure 6). Angry faces with neutral voices were less dominant, angry/neutral $t(88) = 4.58$, $p = .002$, followed by happy voices, angry/happy $t(88) = 2.47$, $p = 1.00$, and finally sad voices were rated the least dominant, angry/sad $t(88) = 8.98$, $p < .001$. This interaction

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Figure 6

The mean dominance ratings for face and voice emotion cues.



Note. Dots represent individual data points. Error bars represent standard errors.

confirms the second hypothesis as congruent angry stimuli were rated as more dominant than all other emotion cues.

Neutral Faces

Neutral faces with angry voices were perceived as the most dominant, with congruent neutral stimuli following. Neutral faces with happy voices were rated less dominant, and neutral faces with sad voices were perceived as the least dominant emotional cue combination.

Happy Faces

Incongruent happy faces with angry voices were perceived as more dominant than congruent happy face and voice stimuli. Happy faces and neutral voices were rated slightly less dominant, with happy faces and sad voices the least dominant.

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Sad Faces

Sad faces with angry voice cues were rated as most dominant, with sad faces and neutral voices perceived as less dominant. Sad faces and happy voices were perceived as slightly less dominant, with congruent sad face and sad voice emotion cues judged as least dominant.

Angry face/Neutral voice vs. Neutral face/Angry voice

Hypothesis 3 predicted that participants would perceive higher dominance of angry faces and neutral voices than neutral faces and angry voices. However, the post-hoc test comparing these two stimuli found no difference, $t(88) = 0.32, p = 1.00$. Thus, hypothesis 3 was not confirmed.

Dominance Summary

Overall, the main effect of face showed that angry facial expressions were judged as the most dominant. This pattern of results is also observed for the main effect of voice, where angry vocal expressions were rated the most dominant overall. However, the third hypothesis was not confirmed.

Discussion

This study shows that, like emotional facial expressions, emotional vocal expressions can also influence first impressions of others. Participants judged happy faces as the most trustworthy emotion and angry faces as the most dominant emotion. This pattern of results is consistent with previous literature (Mileva et al., 2014; Oosterhof & Todorov, 2009; Said et al., 2009; Todorov, 2008; Van Der Zant et al., 2021). This study aimed to better understand whether overgeneralising emotional expressions to trait judgements exist in vocal emotional expressions, as found in emotional postural expressions (Van Der Zant et al., 2021). The results of this research provide supporting evidence that people associate angry vocal expressions with dominance more than happy, neutral, and sad vocal expressions. Results also suggest that neutral vocal expressions are perceived as more trustworthy than happy vocal expressions. This was unexpected, given the literature suggests happiness is most closely associated with the trait of trustworthiness in facial and postural emotional cues.

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Interestingly, neutral voices were also judged to be more trustworthy when paired with a happy face than happy voices paired with a happy face. When viewed as isolated stimuli, neutral faces and voices had higher averages than happy faces and voices. Our findings suggest that neutral voices may not influence trustworthiness judgements of happy faces. Instead, participants may have overextended neutral face and voice emotion cues to judgements of trustworthiness more than happy emotional cues. As judgements of traits from emotionally neutral faces can be driven by the perceived similarity of faces to emotional expressions, participants may have judged the structure of the isolated neutral faces to be similar to happy emotional expressions, which may have driven the high judgement of trustworthiness (Said et al., 2009; Todorov, 2008). However, whether any relationship such as this might extend to neutral voice cues is unknown.

Our results show an interesting overall comparison between face-voice interactions. Figures 3 and 6 show more significant variation in voice cue interactions with face cues for dominance ratings than for trustworthy ratings. For example, in Figure 3, the 4 voice emotions are clustered tightly together for angry, neutral, and sad faces. In fact, the voice cluster for sad faces shows an almost linear pattern, suggesting that when presented with a sad face, each of the 4 voice emotions make no impact on the judgements of trustworthiness. This is especially true for the 4 voice emotions on angry faces. In contrast, Figure 6 shows much more variation in the data points spread for the 4 voice emotions on each facial expression for perceptions of dominance. For example, dominance ratings for sad faces show angry voices as clearly dominant, with neutral and happy voices similarly less dominant and sad voices again less so. This suggests that emotional vocal expressions, when seen with emotional facial expressions, have a greater influence on trait ratings of dominance than on ratings of trustworthiness.

A curious aspect of our analysis is that angry, neutral, and happy voices paired with a happy face were perceived as more dominant than when paired with a sad face. No variability was found when sad voices were paired with happy and sad faces, suggesting that these emotion cue interactions were perceived similarly on their level of dominance. As sadness and anger are both negatively

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valenced (unpleasant) emotions, and happiness is positively valenced (pleasant), it could have been expected that sadness would follow a similar pattern to anger for face-voice interactions. However, our results might be explained by the fact that happiness and anger are highly aroused emotions, whereas sadness is not (Mondloch et al., 2013).

Furthermore, perceptions of emotional expressions offer the perceiver information that determines their behavioural response, such as approaching or avoiding (Zebrowitz & Montepare, 2008). High dominance ratings of angry voices and happy faces may indicate that participants weighed the happy face cue more heavily. This means that participants may have judged the happy face/angry voice combination as signalling approach behaviours; these evaluations are automatic for facial expressions (Todorov, 2008). As facial expressions are vital for determining and guiding social interactions and adaptive behaviours, even small traces of emotional expressions can signal approach behaviours, and our participants were presented with fully expressive dynamic, happy stimuli (Zebrowitz & Montepare, 2008).

Our findings show that participants rated angry faces and neutral voices similarly to neutral faces and angry voices. These findings were unexpected, as it was predicted that angry facial expressions, when paired with neutral vocal expressions, would be seen as more dominant. Given the strong association between ratings of dominance and angry faces and voices and the significantly lower dominance ratings of neutral faces and voices, the results imply that when these face-voice cues are paired, they directly influence perceptions of dominance. Participants weigh angry emotion cues less when paired with neutral emotional cues. These conclusions are tentative as only four identities and all of similar appearances were involved in his study. However, these findings have interesting implications for how we view the influence of vocal and facial expressions on impressions, especially since anger is so closely associated with avoidance behaviours, as stated above. As this study does not explore behavioural responses concerning these trait judgments, it cannot be determined whether

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meeting a person expressing an angry face but having a neutral-sounding voice, and vice versa, would influence or change how that person might respond in social interactions.

A limitation highlighted in the results of the neutral voice and face ratings of trustworthiness shows that the stimuli used may not represent what their emotional recognisability ratings suggest when presented in this way. No literature can be found by this author where neutral emotional expressions were rated more strongly for trustworthiness than happy emotional expressions. Thus, future research may need to include alternative stimuli, such as happy emotional expressions, that correlate more strongly with trustworthiness.

Another potential limitation of this study is that first impressions of faces and voices are formed quickly, and initial impressions can influence later impressions (Lavan, 2023; Willis & Todorov, 2006). As this study included 64 multimodal video clips from only four identities, trait ratings of the stimuli observed later in the trials may have been influenced by impressions formed earlier in the study. Furthermore, the number of students who began the trials but did not complete them towards the end, making their results void ($n = 8$), may suggest that the number and repetitive nature of the trials impacted people's concentration and ability to complete the task. Perhaps future research should consider this when designing how many multimodal video clips participants view and perhaps include more identities.

Along with highlighting only 4 identities were included who came from Northern European backgrounds, the vocal stimuli included only 4 identities from native British heritage. While the sample of participants included in this study was diverse, and the size required to achieve the required power for analysis was achieved, the stimuli themselves were not diverse. While the availability of identity was limited in the stimulus sets used and the scope of this study was limited, more representative stimuli should be sought or created. Future research aiming to explore this area should ensure a diverse range of stimuli are included if true generalisability is to be achieved.

TRAIT JUDGEMENTS OF MULTIMODAL EMOTIONAL CUES

Future research might expand the findings of this study in many ways. This study focused on trustworthiness and dominance, which strongly underlie impression judgements and social interactions. Expanding trait impressions that correlate with emotions similar to those included in this study would offer more profound insight into the valence/arousal and approach/avoid theory of impression judgements. For example, happiness often correlates with traits such as being responsible, confident, caring, and attractive, and anger is often associated with being aggressive, threatening, mean, and unhappy. Another approach could include more emotions associated with valence and arousal, such as pride, a dominant positively valenced emotion, or fear, another dominant negatively valenced emotion. Other emotions could include surprise or disgust.

Recent work around emotional facial and postural cues shows that judgements of traits differ between adults and children. Postural emotional expressions influence judgements of traits for trustworthiness and dominance in adults, but these postural cues develop throughout childhood (Van Der Zant et al., 2021). Whether a similar pattern exists for vocal expressions would be an interesting area of study, especially given the recent events of the COVID-19 pandemic. Mandatory mask-wearing for extended periods meant that people could not have facial emotional expressions as a source of information when forming impressions about people's traits. Mask-wearing has been strongly correlated with worse emotional recognition for children aged 7-12, especially for happy, sad, and fearful emotions (Chester et al., 2023). Studies have investigated how extensive mask-wearing has altered how people attend to facial cues. For example, people have learned to focus on visual cues from the eyes more heavily if exposed to prolonged mask-wearing (Barrick et al., 2021). However, little has been explored about whether postural and vocal emotional expressions were leaned on more heavily to inform judgments and impressions during and after this time. This is a critical area of research with respect to developmental psychology and how children's judgements of traits are impacted over time.

TRAIT JUDGEMENTS OF MULTIMODAL EMOTIONAL CUES

Moving forward, it is vital that future studies holistically explore the effects various emotional expressions have on trait judgements. People make judgements about others quickly and, as we now know, take into consideration more than just facial expressions when determining their behavioural and social responses. In the real world, people do not see others as isolated stimuli or video recordings of any one expression cue alone. Instead, people consider others' facial, vocal, and postural expressions to form judgements about that person, so research must explore these interactions together. In doing this, research will better inform how perceptions of others' traits are influenced by all emotional cues available to them. This is important as these judgements affect how we view and treat others.

Conclusion

The finding that happy faces had the greatest influence of trustworthiness, yet this was true for neutral voices highlights that how emotional information is presented to us may alter our judgements. As no variation was found between angry and neutral face-voice interactions, it can be suggested that vocal emotional expressions influence the judgements of facial emotional expressions when viewed as multimodal stimuli. Research has extensively explored emotional facial expressions as a factor for influencing judgements of people's traits. However, this provides further evidence for the need to study this phenomenon over multiple emotional cues.

References

- Abramson, L., Marom, I., Petranker, R., & Aviezer, H. (2017). Is Fear in Your Head? A Comparison of Instructed and Real-Life Expressions of Emotion in the Face and Body. *Emotion (Washington, D.C.)*, 17(3), 557-565. <https://doi.org/10.1037/emo0000252>
- Barrick, E. M., Thornton, M. A., & Tamir, D. I. (2021). Mask exposure during COVID-19 changes emotional face processing. *PloS one*, 16(10), e0258470-e0258470. <https://doi.org/10.1371/journal.pone.0258470>
- Chester, M., Plate, R. C., Powell, T., Rodriguez, Y., Wagner, N. J., & Waller, R. (2023). The COVID-19 pandemic, mask-wearing, and emotion recognition during late-childhood. *Social development (Oxford, England)*, 32(1), 315-328. <https://doi.org/10.1111/sode.12631>
- de Gelder, B., & Vroomen, J. (2000). Bimodal emotion perception: Integration across separate modalities, cross-modal perceptual grouping or perception of multimodal events? *Cognition and emotion*, 14(3), 321-324. <https://doi.org/10.1080/026999300378842>
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). GPower 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, 39(2), 175-191. <https://doi.org/10.3758/BF03193146>
- Hietanen, J. K., & Leppänen, J. M. (2008). Judgment of other people's facial expressions of emotions is influenced by their concurrent affective hand movements. *Scandinavian journal of psychology*, 49(3), 221-230. <https://doi.org/10.1111/j.1467-9450.2008.00644.x>
- Lavan, N. (2023). The Time Course of Person Perception From Voices: A Behavioral Study. *Psychological science*, 34(7), 771-783. <https://doi.org/10.1177/09567976231161565>
- Lavan, N., Mileva, M., Burton, A. M., Young, A. W., & McGettigan, C. (2021). Trait evaluations of faces and voices: Comparing within- and between-person variability. *Journal of experimental psychology. General*, 150(9), 1854-1869. <https://doi.org/10.1037/xge0001019>
- Mileva, M., & Lavan, N. (2023). Trait impressions from voices are formed rapidly within 400 ms of exposure. *Journal of experimental psychology. General*, 152(6), 1539-1550. <https://doi.org/10.1037/xge0001325>
- Mileva, V. R., Cowan, M. L., Cobey, K. D., Knowles, K. K., & Little, A. C. (2014). In the face of dominance: Self-perceived and other-perceived dominance are positively associated with facial-width-to-height ratio in men. *Personality and individual differences*, 69, 115-118. <https://doi.org/10.1016/j.paid.2014.05.019>

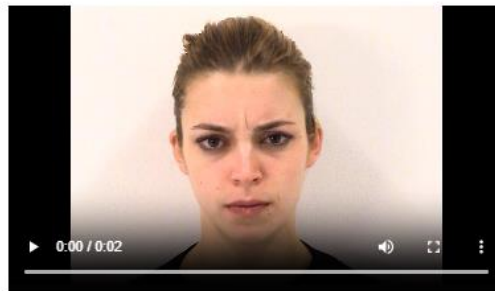
TRAIT JUDGEMENTS OF MULTIMODAL EMOTIONAL CUES

- Mondloch, C. J., Nelson, N. L., & Horner, M. (2013). Asymmetries of Influence: Differential Effects of Body Postures on Perceptions of Emotional Facial Expressions. *PLoS one*, 8(9), e73605-e73605. <https://doi.org/10.1371/journal.pone.0073605>
- Oosterhof, N. N., & Todorov, A. (2009). Shared Perceptual Basis of Emotional Expressions and Trustworthiness Impressions From Faces. *Emotion (Washington, D.C.)*, 9(1), 128-133. <https://doi.org/10.1037/a0014520>
- Said, C. P., Sebe, N., & Todorov, A. (2009). Structural Resemblance to Emotional Expressions Predicts Evaluation of Emotionally Neutral Faces. *Emotion (Washington, D.C.)*, 9(2), 260-264. <https://doi.org/10.1037/a0014681>
- Todorov, A. (2008). Evaluating faces on trustworthiness: An extension of systems for recognition of emotions signaling approach/avoidance behaviors. *Annals of the New York Academy of Sciences*, 1124(1), 208-224. <https://doi.org/10.1196/annals.1440.012>
- Tsankova, E., Aubrey, A. J., Krumhuber, E., Möllering, G., Kappas, A., Marshall, D., & Rosin, P. L. Facial and Vocal Cues in Perceptions of Trustworthiness. In (pp. 308-319). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-37484-5_26
- van 't Wout, M., & Sanfey, A. G. (2008). Friend or foe: The effect of implicit trustworthiness judgments in social decision-making. *Cognition*, 108(3), 796-803. <https://doi.org/10.1016/j.cognition.2008.07.002>
- Van Der Zant, T., Reid, J., Mondloch, C. J., & Nelson, N. L. (2021). The influence of postural emotion cues on implicit trait judgements. *Motivation and emotion*, 45(5), 641-648. <https://doi.org/10.1007/s11031-021-09889-z>
- Willis, J., & Todorov, A. (2006). First Impressions: Making up Your Mind after a 100-Ms Exposure to a Face. *Psychological science*, 17(7), 592-598. <https://doi.org/10.1111/j.1467-9280.2006.01750.x>
- Zebrowitz, L. A. (2017). First Impressions From Faces. *Current directions in psychological science : a journal of the American Psychological Society*, 26(3), 237-242. <https://doi.org/10.1177/0963721416683996>
- Zebrowitz, L. A., & Montepare, J. M. (2008). Social Psychological Face Perception: Why Appearance Matters. *Social and personality psychology compass*, 2(3), 1497-1517. <https://doi.org/10.1111/j.1751-9004.2008.00109.x>
- Zhang, D., Lin, H., & Perrett, D. I. (2020). Apparent Emotional Expression Explains the Effects of Head Posture on Perceived Trustworthiness and Dominance, but a Measure of Facial Width Does Not. *Perception (London)*, 49(4), 422-438. <https://doi.org/10.1177/0301006620909286>

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Appendix

Example test trail.



How would you rate this person?

	Not at all	A little bit	Neither a little nor a lot	A lot	Completely
Trustworthy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dominant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

