

Impact of Face Masks and Viewers' Anxiety on Ratings of First Impressions from Faces

Perception

2022, Vol. 51(1) 37–50

© The Author(s) 2021



Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/03010066211065230

journals.sagepub.com/home/pec



Kun Guo 

School of Psychology, University of Lincoln, UK

Alexander Hare

School of Psychology, University of Lincoln, UK

Chang Hong Liu

Department of Psychology, Bournemouth University, UK

Abstract

Face mask is now a common feature in our social environment. Although face covering reduces our ability to recognize other's face identity and facial expressions, little is known about its impact on the formation of first impressions from faces. In two online experiments, we presented unfamiliar faces displaying neutral expressions with and without face masks, and participants rated the perceived approachableness, trustworthiness, attractiveness, and dominance from each face on a 9-point scale. Their anxiety levels were measured by the State-Trait Anxiety Inventory and Social Interaction Anxiety Scale. In comparison with mask-off condition, wearing face masks (mask-on) significantly increased the perceived approachableness and trustworthiness ratings, but showed little impact on increasing attractiveness or decreasing dominance ratings. Furthermore, both trait and state anxiety scores were negatively correlated with approachableness and trustworthiness ratings in both mask-off and mask-on conditions. Social anxiety scores, on the other hand, were negatively correlated with approachableness but not with trustworthiness ratings. It seems that the presence of a face mask can alter our first impressions of strangers. Although the ratings for approachableness, trustworthiness, attractiveness, and dominance were positively correlated, they appeared to be distinct constructs that were differentially influenced by face coverings and participants' anxiety types and levels.

Keywords

face covering, first impression, approachableness, trustworthiness, attractiveness, dominance, anxiety

Date Received: 9 August 2021; accepted: 21 November 2021

Corresponding author:

Kun Guo, School of Psychology, University of Lincoln, Lincoln, LN6 7TS, UK.

Email: kguo@lincoln.ac.uk

Introduction

The emergence of global pandemic of coronavirus disease 2019 (COVID-19) has resulted in the legal requirement to wear face coverings in public spaces, which inevitably conceal facial information from nose and mouth regions. Considering that face perception tends to be a holistic process in which we need to integrate local facial cues from separable facial features to reliably perceive an individual's identity and emotional state (e.g., Bruce & Young, 2012; Guo, 2012), face coverings unavoidably interfere with face perception performance, such as reducing face identity and facial expression recognition accuracy (Carbon, 2020; Grundmann et al., 2021; Noyes et al., 2021). The impact of face coverings on other aspects of face perception, such as the formation of first impression from a stranger's face, is less clear.

As an inherent part of our social cognition and interaction, we routinely make social judgements or subjective inference about people we met first time by using visual appearance of their faces either conscious or unconsciously. A brief exposure or single glance is often sufficient for us to form a relatively truthful and stable first impression about a stranger's personality and social traits, such as dominance, hierarchy, warmth, trustworthiness, attractiveness, and threat, which subsequently guide our social behavior and interaction with the stranger over time (e.g., Bar et al., 2006; Bruce & Young, 2012; Todorov et al., 2013; Gunaydin et al., 2017). Among various social inferences one can make from the face, trustworthiness, approachableness or aggressiveness, attractiveness, and dominance are commonly studied facial traits (e.g., Little et al., 2011; Todorov et al., 2013; Hahn & Perrett, 2014), which are probably due to trustworthiness and dominance being integral part of first impression formation as suggested in both two-dimensional (i.e., valence/trustworthiness and dominance; Oosterhof & Todorov, 2008) and three-dimensional face evaluation models (i.e., valence/trustworthiness, dominance, and youthful-attractiveness; Sutherland et al., 2013), attractiveness being a key component in three-dimensional face evaluation model (Sutherland et al., 2013), and approachableness/aggressiveness being closely associated with face valence evaluation (Oosterhof & Todorov, 2008).

Previous studies have indicated that first impression formation may rely on a combination of local (e.g., shape and size of eyes, nose and mouth, gaze direction) and global facial information (e.g., face contour, symmetry and averageness, skin colour and texture). For instance, well-studied attractiveness judgement is mainly driven by facial characteristics of global face symmetry and averageness, sexually dimorphic shape and feature cues (e.g., masculine or feminine cues), skin color and texture, and local facial cues associated with baby schema (e.g., large, bulbous forehead, large eyes) and personality attribution (Little et al., 2011; Hahn & Perrett, 2014). Trustworthiness judgement could be predicted by a range of local facial features (Todorov et al., 2008), such as brow ridge (down/up), cheekbones (shallow/pronounced), and chin (wide/thin), and is further correlated with attractiveness judgement suggesting that the same attractiveness features are used for trustworthiness judgement (e.g., Xu et al., 2012). Representing warmth, approachableness judgement is also correlated with trustworthiness judgement, but is further sensitive to gaze direction and facial expression cues (Oosterhof & Todorov, 2008). Dominance judgement, on the other hand, is more sensitive to facial cues related to physical strength and masculinity features (Oosterhof & Todorov, 2008; Richardson et al., 2021). As these first impression traits seem to show different reliance on local and global facial cues, it is plausible that the same face covering would show different impact on these social inferences.

It is well known that face evaluation could be modulated by the viewers' anxiety, including its different subtypes, such as generalized anxiety and social anxiety. Generalized anxiety is a persistent worry about every-day events (Tyrer & Baldwin, 2006) which can be reflected as a relatively stable tendency of being anxious across many situations (trait anxiety) or an anxious emotional state felt in a particular situation or event (state anxiety; Spielberger et al., 1983). Social anxiety is a persistent fear of social situations due to concerns of potential scrutiny by others (American Psychiatric Association, 2013). These different anxiety subtypes are associated with different levels of

attentional bias (e.g., selectively avoid or attend to negative information) and interpretation bias (e.g., negativity bias with high tendency to interpret uncertain stimuli or events as negative to ensure a more urgent response; Rozin & Royzman, 2001), and subsequently influence social inference of some aspects of facial cues, especially facial expression categorization (e.g., Richards et al., 2002; Green & Guo, 2018). Their impact on the assessment of first impression traits, such as trustworthiness, dominance, approachableness, and attractiveness, is less researched.

Moreover, a few existing studies have produced mixed findings. While some studies have reported that trait and state anxiety showed no effect on the judgement of trustworthiness (Matarozzi et al., 2015) and approachableness (Willis et al., 2013), others have observed that individuals with higher levels of trait anxiety tend to perceive neutral faces as less trustworthy (Willis et al., 2013). Similarly, in comparison with nonanxious participants, individuals with higher social anxiety have been reported to show either little difference in judging trustworthiness in neutral (Cooper et al., 2014) and happy faces (Gutiérrez-García et al., 2018), or reduced trustworthiness rating for neutral (Meconi et al., 2014), angry, and disgusted faces (Gutiérrez-García & Calvo, 2016). They also tend to rate faces as less approachable regardless of expressions (Campbell et al., 2009; Kivity & Huppert, 2016). According to the vigilance-avoidance hypothesis (Mogg et al., 1997), anxious individuals may experience early hypervigilance to potential social threat cues. This may lead to interpret neutral faces as ambiguous, threatening, and less approachable (Kuckertz et al., 2017). As face coverings will increase facial information uncertainty and ambiguity, they may show stronger negative impact on the formation of first impressions in people with higher level of anxiety.

Furthermore, anxiety often leads to the change of face-viewing gaze allocation at local facial features. For instance, individuals with higher level of social and/or Beck anxiety (evaluating 21 physiological and cognitive symptoms of anxiety through self-rated severity for each symptom during the past month; Beck et al., 1988) tend to gaze less at the eyes (Moukheiber et al., 2010; Schneier et al., 2011; Günther et al., 2021) but more at the nose region (Green & Guo, 2018). Given that face coverings only expose the eyes but conceal the nose and mouth regions, it is plausible that anxious individuals may have difficulty to sample sufficient facial cues for reliable face evaluation, and subsequently report different ratings of first impression traits between faces with and without coverings.

Guided by these previous research, we would hypothesize that the ratings of different first impression traits of approachableness, trustworthiness, attractiveness, and dominance may be affected differently by face masks (e.g., more evident impact on the perceived face approachableness and trustworthiness), and the viewers' anxiety types and levels (e.g., negative correlation between generalized or social anxiety and approachableness or trustworthiness judgements, and possible larger correlation for evaluating masked than unmasked faces). We have examined these hypotheses in two online experiments. In Experiment 1, we compared participants' perceived approachableness, trustworthiness, attractiveness, and dominance ratings for unfamiliar faces with and without wearing a face mask. Their ratings were further correlated with their trait and state anxiety scores. In Experiment 2, as analysis from Experiment 1 revealed little influence of face masks on attractiveness and dominance judgements, we only compared participants' approachableness and trustworthiness ratings for faces with and without face masks, and correlated their ratings with social anxiety scores.

Experiment 1: Effect of Face Covering and Generalized Anxiety on First Impression Judgement

Materials and Methods

One hundred thirty participants (26 men), aged between 18 and 80 years old (27.73 ± 15.77 , Mean \pm SD), took part in this online study voluntarily. The suitability of this sample size was

confirmed by power analysis using G*power software. With a conservative effect size of 0.25 often reported in previous studies on the ratings of first impression traits (e.g., Gutiérrez-García et al., 2018), a sample of 76 participants in this study would have been large enough for this face mask effect to be detected with a power of 0.95 at alpha level 0.05 and 1 nonsphericity correction in a 2 (face mask condition) \times 2 (face gender) \times 2 (participant gender) repeated measures design. Also, with a conservative effect size of 0.3, a sample of 84 participants would have been large enough for the correlation between generalized anxiety and first impression traits to be detected with a power of 0.8 at alpha level 0.05 in a two-tailed Pearson correlation design. These participants were mainly recruited from university student and staff population. All participants reported normal or corrected-to-normal visual acuity. The Ethical Committee in School of Psychology, University of Lincoln approved this study (PSY20211034). Written informed consent was obtained from each participant, and all procedures complied with the British Psychological Society Code of Ethics and Conduct.

Thirty full-color high-resolution (281 \times 381 pixels) Caucasian faces in full frontal view with neutral facial expressions were selected from AR Face Database (Martinez & Benavente, 1998). All faces have the same background and clothing. A typical surgical face mask was then placed on these faces via Adobe® Photoshop 2017 CC. In total, 60 images, 30 faces (15 male + 15 female) \times 2 face mask conditions (mask-off vs. mask-on), were created for the testing (see Figure 1 for example). These face images subtended a visual angle of $\sim 10.5 \times 8^\circ$ on a common 5.5 inches mobile phone screen at a typical viewing distance of ~ 38 cm (Boccardo, 2021).

Most participants completed this online experiment via Qualtrics on their mobile phones. During the self-paced data collection, participants were first required to complete the State-Trait Anxiety Inventory Form Y-I (STAI-s, 20 items measuring subjective feelings of apprehension, tension, and worry at the time) and Y-II (STAI-t, 20 items measuring anxiety proneness; Spielberger et al., 1983). All 60 face images were then displayed once in a random order in two blocks (30 images per block with different face identities). Each block consisted an equal mixture of masked and unmasked faces, and two versions of the same face identity (mask-off vs. mask-on) were presented in separate blocks to prevent participants from simply remembering and duplicating the responses given to one version to the other version. Each face image was co-presented with four draggable scales in a fixed order on which participants could rate the perceived approachableness, trustworthiness, attractiveness, and dominance rating on a 9-point scale (1 represents “none of the listed trait” and 9 represents “full of the listed trait”).

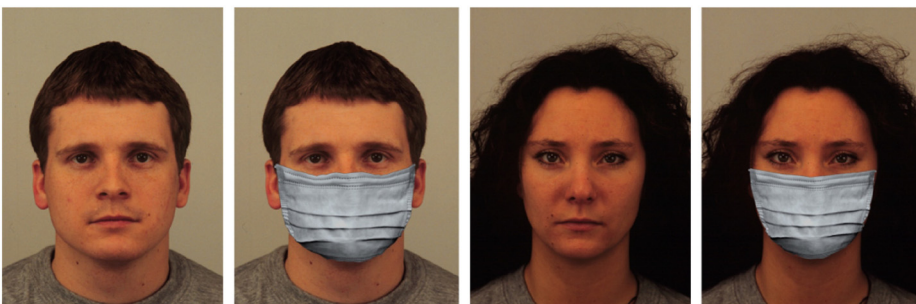


Figure 1. Examples of a male and female face displaying neutral facial expressions without and with wearing a surgical face mask.

Results

Table 1 shows the results of rating for the perceived face approachableness, trustworthiness, attractiveness, and dominance. Previous studies have reported that the viewers (especially female viewers) could show a same-sex bias in assessing other people's facial traits, such as face identity and attractiveness (DeBruine, 2004; Chaudhuri et al., 2013). To also examine potential interaction effect between face gender and participant gender on the judgement of first impression traits in masked and unmasked faces, we conducted 2 (face mask: off vs. on) \times 2 (face gender: male vs. female) \times 2 (participant gender: male vs. female) repeated measures analysis of variance (ANOVA) separately for each of four measured first impression traits.

Approachableness Judgement

The ANOVA analysis revealed significant main effect of face mask ($F(1, 512) = 5.35, p = .02, \eta_p^2 = 0.01$) with higher approachableness ratings in mask-on over mask-off conditions (4.82 ± 1.5 vs. 4.48 ± 1.43), significant main effect of face gender ($F(1, 512) = 63.54, p < .001, \eta_p^2 = 0.11$) with higher approachableness ratings for female over male faces (5.23 ± 1.31 vs. 4.07 ± 1.36), but non-significant main effect of participant gender ($F(1, 512) = 0.19, p = .66, \eta_p^2 = 0.001$). All the interactions between these factors were nonsignificant (all $ps > .35$).

Trustworthiness Judgement

The ANOVA revealed significant main effect of face mask ($F(1, 512) = 4.19, p = .04, \eta_p^2 = 0.01$) and face gender ($F(1, 512) = 55, p < .001, \eta_p^2 = 0.1$), but nonsignificant main effect of participant gender ($F(1, 512) = 0.05, p = .83, \eta_p^2 = 0.001$). Specifically, higher trustworthiness was rated for masked over unmasked faces (4.31 ± 1.4 vs. 4.03 ± 1.32), and for female over male faces (4.68 ± 1.27 vs. 3.66 ± 1.24). All the interactions were nonsignificant (all $ps > .41$).

Attractiveness Judgement

The ANOVA only revealed significant main effect of face gender ($F(1, 512) = 55.79, p < .001, \eta_p^2 = 0.1$) with higher attractiveness ratings for female over male faces (4.68 ± 1.35 vs. 3.56 ± 1.38), but nonsignificant main effect of face mask ($F(1, 512) = 2.08, p = .15, \eta_p^2 = 0.004$) and participant gender ($F(1, 512) = 0.7, p = .4, \eta_p^2 = 0.001$). All the interactions were nonsignificant (all $ps > .31$).

Table 1. Ratings of first impression traits.

		Approachableness	Trustworthiness	Attractiveness	Dominance
		mask off vs. mask on	mask off vs. mask on	mask off vs. mask on	mask off vs. mask on
Male viewers	Male face	3.95 ± 1.35 vs. 4.38 ± 1.56	3.56 ± 1.24 vs. 3.84 ± 1.47	3.46 ± 1.31 vs. 3.57 ± 1.41	3.78 ± 1.43 vs. 3.62 ± 1.21
	Female face	4.98 ± 1.40 vs. 5.40 ± 1.57	4.43 ± 1.46 vs. 4.79 ± 1.58	4.37 ± 1.35 vs. 4.81 ± 1.51	3.36 ± 1.25 vs. 3.12 ± 1.14
Female viewers	Male face	3.80 ± 1.30 vs. 4.13 ± 1.34	3.45 ± 1.16 vs. 3.78 ± 1.24	3.45 ± 1.37 vs. 3.75 ± 1.39	4.18 ± 1.22 vs. 3.97 ± 1.14
	Female face	5.18 ± 1.20 vs. 5.35 ± 1.33	4.67 ± 1.15 vs. 4.84 ± 1.27	4.75 ± 1.31 vs. 4.77 ± 1.37	4.03 ± 1.20 vs. 3.67 ± 1.14

Note: Data in each cell were expressed as mean \pm SD.

Dominance Judgement

The ANOVA revealed nonsignificant main effect of face mask ($F(1, 512) = 3.44, p = .06, \eta_p^2 = 0.007$), but significant main effect of face gender ($F(1, 512) = 6.86, p = .009, \eta_p^2 = 0.01$) and participant gender ($F(1, 512) = 14.29, p < .001, \eta_p^2 = 0.03$), where male faces were rated as more dominant than female faces (3.89 ± 1.22 vs. 3.55 ± 1.2), and male participants tended to rate face as less dominant than female participants (3.47 ± 1.27 vs. 3.96 ± 1.18). All the interactions were nonsignificant (all $ps > .34$).

Correlation Analysis

The analysis of two-tailed Pearson correlation revealed significant positive correlation between our participants' state and trait anxiety scores ($r(128) = 0.78, p < .001$), and between four rated first impression traits irrespective of face mask and face gender (approachableness vs. trustworthiness vs. attractiveness vs. dominance, $r \geq 0.33$, all $ps < .001$; see also Table S1 in Electronic Supplemental Materials). The relation between state/trait anxiety and first impression traits, on the other hand, was only significant for approachableness and trustworthiness (Figure 2). Both state and trait anxiety scores were negatively correlated with approachableness and trustworthiness ratings in both mask-off ($r \leq -0.18$, all $ps < .05$) and mask-on conditions ($r \leq -0.23$, all $ps < .01$). Furthermore, face covering only affected the relations between participants' trait anxiety and their face trustworthiness judgements, in which trait anxiety was positively correlated with changes in trustworthiness rating between mask-off and mask-on conditions ($r(128) = 0.21, p = .02$). In other words, participants with higher trait anxiety tended to have similar trustworthiness ratings for unmasked faces and their masked counterparts. There was no correlation between state or trait anxiety and the changes in approachableness, attractiveness, or dominance ratings between mask-off and mask-on conditions (all $ps > .05$; see also Table S2 in Electronic Supplemental Materials), and there was no significant difference between two correlations for analyzing the relations between state or trait anxiety and each first impression trait rated in mask-off and mask-on conditions (all $ps > .05$).

Overall, results from this experiment showed that wearing a face mask could enhance the perceived face approachableness and trustworthiness (Figure 3). Female faces were generally rated more approachable, more trustworthy, more attractive, and less dominant than male faces regardless of whether a face mask was on. The correlation analyses revealed relationships between some of these results and anxiety ratings, where participants with higher state or trait anxiety scores found faces were less approachable or trustworthy. However, this relationship was similar whether a face mask was on or not.

Given different anxiety subtypes may show different impact on facial traits judgement (e.g., Willis et al., 2013; Cooper et al., 2014; Kivity & Huppert, 2016), in Experiment 2 we further examined to what extent participants' social anxiety level would affect their judgements of first impression traits for unfamiliar faces with and without face masks. As the analysis in Experiment 1 did not reveal significant impact of face masks on attractiveness and dominance judgements, we only measured participants' face approachableness and trustworthiness ratings in Experiment 2.

Experiment 2: Effect of Face Covering and Social Anxiety on First Impression Judgement

Materials and Methods

Two hundred and two participants (53 men), aged between 18 and 80 years old (38.5 ± 16.52), took part in this online study voluntarily. The suitability of this sample size was confirmed by power

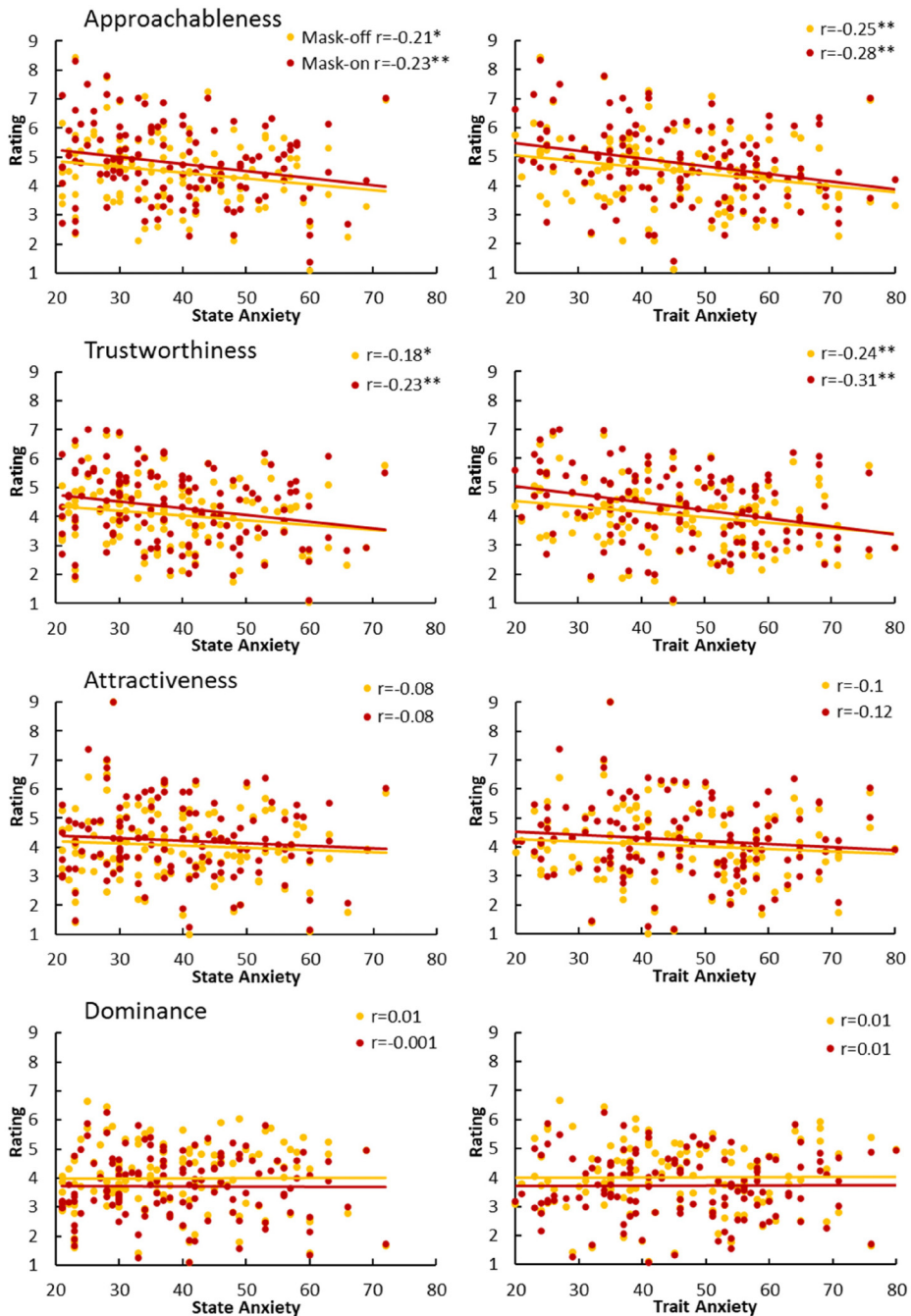


Figure 2. Approachableness (1st row), trustworthiness (2nd row), attractiveness (3rd row), and dominance ratings (4th row) for unmasked and masked faces from individual participants of varying state (left column) and trait anxiety scores (right column). Solid lines in each plot represent trendlines between first impression trait ratings for different face conditions and anxiety scores. r value represents correlation coefficient. * $p < .05$, ** $p < .01$.

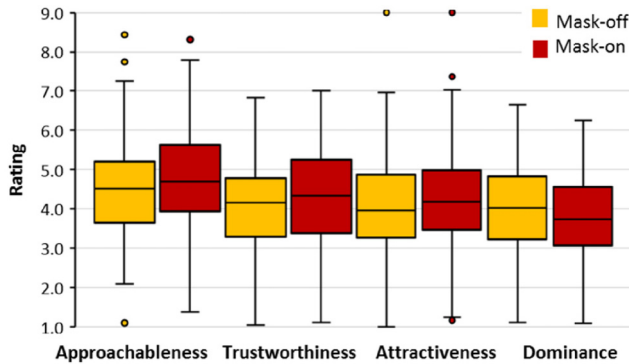


Figure 3. Boxplot with distribution of the perceived approachableness, trustworthiness, attractiveness, and dominance ratings for unfamiliar faces without and with face masks. Whiskers represent minimum and maximum, boxes include median and interquartile range, and dots represent outlier points.

analysis using G*power software. With a conservative effect size of 0.3, a sample of 121 participants in this study would have been large enough for this face mask effect to be detected with a power of 0.95 at alpha level 0.05 in a matched pairs *t*-test design. Also with a conservative effect size of 0.3, a sample of 84 participants would have been large enough for the correlation between social anxiety and first impression traits to be detected with a power of 0.8 at alpha level 0.05 in a two-tailed Pearson correlation design. These participants were mainly recruited from university student and staff population. The Ethical Committee in Department of Psychology, Bournemouth University approved this study. Written informed consent was obtained from each participant, and all procedures complied with the British Psychological Society Code of Ethics and Conduct.

As 15 faces in each gender from a single face database used in Experiment 1 could have limited generalizability, a different set of faces were used in Experiment 2 to enhance research validity. Forty high-resolution full-color Caucasian faces in full frontal view with neutral expressions were selected from Chicago Face Database (Ma et al., 2015). All images have the same background and clothing. A typical surgical face mask was then placed on these faces via Adobe® Photoshop 2017 CC. In total, 80 images, 40 faces (20 male + 20 female) × 2 face mask conditions (mask-off vs. mask-on), were created for the testing (see Figure 4 for example).

Most participants completed this online experiment via Testable on their mobile phones. During the self-paced data collection, 80 face images were displayed once in a random order in two blocks with identical arrangement as those described in Experiment 1. For each face, participants rated the perceived approachableness and trustworthiness on a 9-point scale (1 represents “none of the listed trait” and 9 represents “full of the listed trait”). Participants were required to complete the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) after face presentation to avoid potential influence the social anxiety questionnaire might have on their judgements of face traits. The questionnaire included 20 items to measure social interaction anxiety characteristics on a 5-point Likert-scale (0 represents “not at all a characteristic of me” and 4 represents “extremely characteristic of me”).

Results

As analysis in Experiment 1 did not reveal any interaction effects between face mask, face gender, and participant gender, analysis in Experiment 2 was focused on the effect of face mask on



Figure 4. Examples of a female face displaying neural facial expressions without and with wearing a surgical face mask.

approachableness and trustworthiness judgements. In agreement with observation in Experiment 1, significant higher ratings in both approachableness and trustworthiness were reported in mask-on than in mask-off condition (approachableness: 5.16 ± 1.31 vs. 4.67 ± 1.28 , $t(201) = 5.97$, $p < .001$, $d = 0.38$; trustworthiness: 5.21 ± 1.24 vs. 4.73 ± 1.21 , $t(201) = 6.12$, $p < .001$; $d = 0.39$).

Participants' SIAS scores were negatively correlated with their face approachableness ratings in both mask-off ($r(200) = -0.21$, $p = .003$) and mask-on conditions ($r(200) = -0.18$, $p = .01$; Table S3 in Electronic Supplemental Materials), but not with trustworthiness ratings (mask-off: $r(200) = -0.09$, $p = .22$; mask-on: $r(200) = -0.1$, $p = .16$). Furthermore, face covering showed no impact on the relations between participants' social anxiety level and their face approachableness and trustworthiness judgements. There was no correlation between SIAS and the changes in approachableness or trustworthiness ratings between mask-off and mask-on conditions (approachableness: $r(200) = -0.03$, $p = .68$; trustworthiness: $r(200) = 0.02$, $p = .82$).

Overall, results from this experiment also showed that wearing a face mask could enhance the perceived face approachableness and trustworthiness. In addition, participants with higher social anxiety scores found faces were less approachable irrespective of masks.

General Discussion

These two online experiments aimed to examine the effect of face covering and participants' anxiety level on their evaluation of first impression traits. The results revealed that face masks would significantly enhance the perceived face approachableness and trustworthiness ratings while showing little impact on attractiveness and dominance judgements; but such mask-enhanced trustworthiness ratings were less evident for participants with higher trait anxiety. Furthermore, both trait and state anxiety scores were negatively correlated with approachableness and trustworthiness ratings in both mask-off and mask-on conditions. Social anxiety scores, on the other hand, were only negatively correlated with approachableness but not with trustworthiness ratings. It appears that the presence of a face mask can alter our first impressions of strangers. Although the ratings for approachableness, trustworthiness, attractiveness, and dominance were positively correlated, they appeared to be distinct constructs that were differentially influenced by face coverings and participants' anxiety types and levels.

A couple of recent studies have observed that "untrustworthy" faces or faces with negative facial expressions could be rated as more trustworthy when wearing face masks (Grundmann et al., 2021; Marini et al., 2021). These findings demonstrate a decrease of perceived negativity or negative valence in emotional expressions in the masked faces. Here we extended this mask-induced

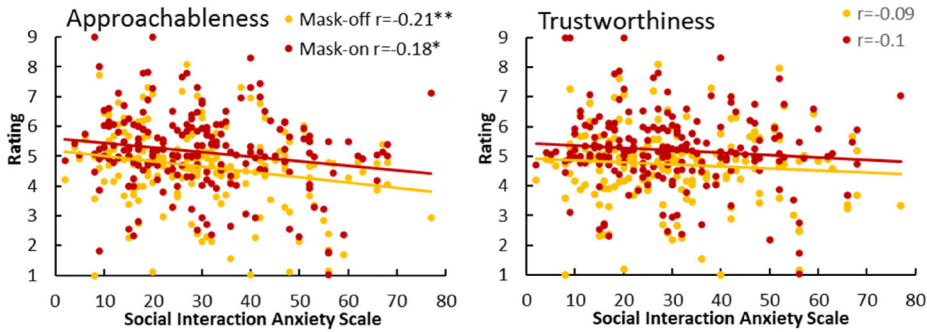


Figure 5. Approachableness and trustworthiness ratings for unmasked and masked faces from individual participants of varying social interaction anxiety scores. Solid lines in each plot represent trendlines between first impression trait ratings for different face conditions and anxiety scores. r value represents correlation coefficient. * $p < .05$, ** $p < .01$.

enhancement in face evaluation from “negative” faces to average young adult faces with neutral facial expressions, and from trustworthiness to both trustworthiness and approachableness judgements.

Across our two experiments masked faces on average attracted significantly higher trustworthiness and approachableness ratings than their unmasked counterparts. As face masks tend to increase emotional expression ambiguity (even) in neutral faces by concealing bottom half of the face, this uncertainty might induce a positivity bias in face evaluation process (Voss et al., 2008) and subsequently increase the perceived trustworthiness and approachableness. Hence, the face masks may show an indirect impact on assessing face trustworthiness and approachableness, possibly through the manipulation of the perceived facial expressions. Alternatively, this mask-enhanced trustworthiness and approachableness could be due to current practice and social conformity. Prior to the pandemic, people wearing surgical masks (the same style of masks used in our study) typically work in national health service, such as nurse, doctor, and dentist, who are perceived as trustworthy and approachable by the general public. During the pandemic, there are also ethical implications of mask wearing. Mask-wearers are likely to be viewed as those who are more considerate law binding and rule followers, are care for their own health and less harmful to others. Consequently, they were rated as more trustworthy and approachable than those without wearing masks by our participants. From this perspective, it is plausible the mask-enhanced judgements observed in this study are mainly due to current pandemic context and our participants’ own experience.

Interestingly, face masks showed little impact on increasing face attractiveness and decreasing dominance ratings. Although masks could partially cover “imperfect” facial characteristics associated with attractiveness judgement (e.g., face symmetry, sexually dimorphic shape and feature cues, and skin color and texture; Little et al., 2011; Hahn & Perrett, 2014) and masculinity facial cues typically associated with higher dominance ratings (e.g., red skin coloration in cheek, jawline shape, and facial width-to-height ratio; Oosterhof & Todorov, 2008; Richardson et al., 2021), the overall face attractiveness and dominance ratings were not significantly altered by concealing facial cues at the bottom half of the face.

Taken together, although the ratings for trustworthiness, approachableness, attractiveness, and dominance were positively correlated, they were subject to different influences from face coverings. Face masks showed more evident impact on the judgement of trustworthiness and approachableness than attractiveness and dominance. Perhaps the perception of the latter two first impression traits reply more facial cues from the top half of the face, hence are less susceptible to face

mask influence. In agreement with previously well-reported findings (e.g., Buchan et al., 2008; Little et al., 2011; Hahn & Perrett, 2014), our analysis also revealed that female faces were perceived with higher trustworthiness, approachableness, and attractiveness, but with lower dominance than male faces. However, as majority of our participants were female (~76%) who may show a positive same-sex bias in judging other women's facial traits (DeBruine, 2004; Chaudhuri et al., 2013), future research could re-examine this potential interactive effect between face gender and participant gender on the ratings of first impression traits with a more balanced participant gender distribution.

Another novelty in this study is we further examined the effect of participants' anxiety type and level on their evaluation of both masked and unmasked faces. Our correlation analysis revealed that participants with higher trait and state anxiety scores tended to judge faces as less trustworthy or approachable. However, these anxiety scores were not correlated with attractiveness and dominance ratings. Limited previous research on this topic had mixed findings, ranging from noncorrelation between trait or state anxiety and trustworthiness (Mattarozzi et al., 2015) or approachableness judgement (Willis et al., 2013) to similar negative correlation between trait anxiety and trustworthiness judgement like ours (Willis et al., 2013). These discrepancies may be (at least partly) explained by methodological differences between studies, such as stimuli (e.g., expressive vs. neutral faces), tasks (e.g., face evaluation with vs. without context), and participant groups (e.g., different distribution range of anxiety levels). Considering that individuals with higher generalized anxiety tend to show negativity bias in interpreting facial cues, such as categorizing neutral or ambiguous facial expression as more negative (Green & Guo, 2018) or perceiving greater hostility from faces (Knyazev et al., 2008), it would be reasonable that they also judge unfamiliar faces without clear approaching signals (e.g., unmasked and masked neutral faces in our study) as less trustworthy and approachable. In comparison with attractiveness and dominance judgements which were not influenced by participants' generalized anxiety, it appears that trustworthiness and approachableness judgements are more closely related to both our underlying anxious disposition and current anxious state.

Interestingly, only trait anxiety was further positively correlated with changes in trustworthiness rating between unmasked and masked faces. In other words, individuals with higher trait anxiety tended to perceive unmasked and masked faces as similarly trustworthy (rather than perceiving masked faces as more trustworthy). Although tightly linked together, trustworthiness and approachableness might be differentially influenced by the interaction between trait anxiety and face covering. It has been proposed the evaluation of trustworthiness and approachableness may be driven more by individuals' social cognition and anticipation of their social behavior, respectively (Willis et al., 2013).

In experiment 2, we further observed that social anxiety was only negatively correlated with approachableness but not with trustworthiness evaluation. These findings are largely in agreement with previous observation of reduced face approachableness ratings (Campbell et al., 2009; Kivity & Huppert, 2016) but comparable trustworthiness ratings for neutral faces (Cooper et al., 2014) in individuals with higher social anxiety compared to nonanxious individuals. Given that socially anxious people tend to interpret neutral face as uncertainty and ambiguity around a person's intention and emotion (Kuckertz et al., 2017), and approachableness rating is directly related to assessors' expectancy of own social action (Willis et al., 2013), it is likely that social anxiety would be more sensitive to face approachableness rather than trustworthiness evaluation. However, a couple of studies have reported that higher social anxiety was associated with reduced trustworthiness in both unmasked (Meconi et al., 2014) and masked neutral faces (Olivera-La Rosa et al., 2020). These discrepancies between studies may be due to differences in participant groups. Most of our participants had low SIAS scores and probably very few (if any) of them were suffering from social anxiety disorder or social phobia, which may have reduced this experiment's sensitivity to study the relation between social anxiety and face trustworthiness evaluation. Furthermore, there was no interaction between social anxiety and face covering on approachableness and

trustworthiness judgements, suggesting that our participants tended to use similar strategy to sample and interpret these facial traits in unmasked or masked faces irrespective of their social anxiety levels.

This study was set out to identify the psychological repercussions of face coverings because there was concern for the negative implications they may have on social interaction. Though face identities and facial expressions are harder to read when wearing face masks, more positive first impression traits tend to be perceived from masked strangers. Detailed analysis further suggests these traits are subject to different influences from face coverings and participants' anxiety levels. It should be noted the generalization of these novel research findings might be constrained by our limited participant population (i.e., dominated by female young adults).

Acknowledgments

We thank Kelly Talmage for the help with data collection.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship and/or publication of this article.

ORCID iD

Kun Guo  <https://orcid.org/0000-0001-6765-1957>

Supplemental Material

Supplemental material for this article is available online.

References

- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (DSM-5)* (Fifth Edition). Washington, DC: American Psychiatric Association.
- Bar, M., Neta, M., & Linz, H. (2006). Very first impressions. *Emotion, 6*(2), 269–278. <https://doi.org/10.1037/1528-3542.6.2.269>
- Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology, 56*(6), 893–897. <https://doi.org/10.1037/0022-006X.56.6.893>
- Boccardo, L. (2021). Viewing distance of smartphones in presbyopic and non-presbyopic age. *Journal of Optometry, 14*(2), 120–126. <https://doi.org/10.1016/j.optom.2020.08.001>
- Bruce, Y., & Young, A. (2012). *Face perception*. Psychology Press.
- Buchan, N. R., Croson, R. T., & Solnick, S. (2008). Trust and gender: An examination of behavior and beliefs in the investment game. *Journal of Economic Behavior & Organization, 68*(3–4), 466–476. <https://doi.org/10.1016/j.jebo.2007.10.006>
- Campbell, D. W., Sareen, J., Stein, M. B., Kravetsky, L. B., Paulus, M. P., Hassard, S. T., & Reiss, J. P. (2009). Happy but not so approachable: The social judgments of individuals with generalized social phobia. *Depression and Anxiety, 26*(5), 419–424. <https://doi.org/10.1002/da.20474>
- Carbon, C.-C. (2020). Wearing face masks strongly confuses counterparts in reading emotions. *Frontiers in Psychology, 11*, 566886. <https://doi.org/10.3389/fpsyg.2020.566886>
- Chaudhuri, A., Paichayontvijit, T., & Shen, L. (2013). Gender differences in trust and trustworthiness: Individuals, single sex and mixed sex groups. *Journal of Economic Psychology, 34*, 181–194. <https://doi.org/10.1016/j.joep.2012.09.013>

- Cooper, R., Doehrmann, O., Fang, A., Gerlach, A. L., Hoijtink, H. J. A., & Hofmann, S. G. (2014). Relationship between social anxiety and perceived trustworthiness. *Anxiety, Stress & Coping*, 27(2), 190–201. <https://doi.org/10.1080/10615806.2013.834049>
- DeBruine, L. M. (2004). Facial resemblance increases the attractiveness of same-sex faces more than other-sex faces. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, 271(1552), 2085–2090. <https://doi.org/10.1098/rspb.2004.2824>
- Green, C., & Guo, K. (2018). Factors contributing to individual differences in facial expression categorization. *Cognition and Emotion*, 32(1), 37–48. <https://doi.org/10.1080/02699931.2016.1273200>
- Grundmann, F., Epstude, K., & Scheibe, S. (2021). Face masks reduce emotion-recognition accuracy and perceived closeness. *PLoS ONE*, 16(4), e0249792. <https://doi.org/10.1371/journal.pone.0249792>
- Gunaydin, G., Selcuk, E., & Zayas, V. (2017). Impressions based on a portrait predict, 1-month later, impressions following a live interaction. *Social Psychological and Personality Science*, 8(1), 36–44. <https://doi.org/10.1177/1948550616662123>
- Günther, V., Kropidowski, A., Schmidt, F. M., Koelkebeck, K., Kersting, A., & Suslow, T. (2021). Attentional processes during emotional face perception in social anxiety disorder: A systematic review and meta-analysis of eye-tracking findings. *Progress in Neuropsychopharmacology & Biological Psychiatry*, 111, 110353. <https://doi.org/10.1016/j.pnpbp.2021.110353>
- Guo, K. (2012). Holistic gaze strategy to categorize facial expression of varying intensities. *PLoS One*, 7(8), e42585. <https://doi.org/10.1371/journal.pone.0042585>
- Gutiérrez-García, A., & Calvo, M. G. (2016). Social anxiety and trustworthiness judgments of dynamic facial expressions of emotion. *Journal of Behavior Therapy and Experimental Psychiatry*, 52, 119–127. <https://doi.org/10.1016/j.jbtep.2016.04.003>
- Gutiérrez-García, A., Calvo, M. G., & Eysenck, M. W. (2018). Social anxiety and detection of facial untrustworthiness: Spatio-temporal oculomotor profiles. *Psychiatry Research*, 262, 55–62. <https://doi.org/10.1016/j.psychres.2018.01.031>
- Hahn, A. C., & Perrett, D. I. (2014). Neural and behavioral responses to attractiveness in adult and infant faces. *Neuroscience and Biobehavioral Reviews*, 46, 591–603. <https://doi.org/10.1016/j.neubiorev.2014.08.015>
- Kivity, Y., & Huppert, J. D. (2016). Emotional reactions to facial expressions in social anxiety: A meta-analysis of self-reports. *Emotion Review*, 8(4), 367–375. <https://doi.org/10.1177/1754073915594436>
- Knyazev, G. G., Bocharov, A. V., Slobodskaya, H. R., & Ryabichenko, T. I. (2008). Personality-linked biases in perception of emotional facial expressions. *Personality and Individual Differences*, 44(5), 1093–1104. <https://doi.org/10.1016/j.paid.2007.11.001>
- Kuckertz, J. M., Strege, M. V., & Amir, N. (2017). Intolerance for approach of ambiguity in social anxiety disorder. *Cognition and Emotion*, 31(4), 747–754. <https://doi.org/10.1080/02699931.2016.1145105>
- Little, A. C., Jones, B. C., & DeBruine, L. M. (2011). Facial attractiveness: Evolutionary based research. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366(1571), 1638–1659. <https://doi.org/10.1098/rstb.2010.0404>
- Ma, D. S., Correll, J., & Wittenbrink, B. (2015). The Chicago face database: A free stimulus set of faces and norming data. *Behavior Research Methods*, 47(4), 1122–1135. <https://doi.org/10.3758/s13428-014-0532-5>
- Marini, M., Ansani, A., Paglieri, F., Caruana, F., & Viola, M. (2021). The impact of facemasks on emotion recognition, trust attribution and re-identification. *Scientific Reports*, 11(1), 5577. <https://doi.org/10.1038/s41598-021-84806-5>
- Martinez, A. M., & Benavente, R. (1998). The AR Face Database. CVC technical Report #24. June 1998.
- Mattarozzi, K., Todorov, A., Marzocchi, M., Vicari, A., & Russo, P. M. (2015). Effects of gender and personality on first impression. *PLoS ONE*, 10(9), e0135529. <https://doi.org/10.1371/journal.pone.0135529>
- Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy*, 36(4), 455–470. [https://doi.org/10.1016/S0005-7967\(97\)10031-6](https://doi.org/10.1016/S0005-7967(97)10031-6)
- Meconi, F., Luria, R., & Sessa, P. (2014). Individual differences in anxiety predict neural measures of visual working memory for untrustworthy faces. *Social Cognitive and Affective Neuroscience*, 9(12), 1872–1879. <https://doi.org/10.1093/scan/nst189>

- Mogg, K., Bradley, B. P., De Bono, J., & Painter, M. (1997). Time course of attentional bias for threat information in non-clinical anxiety. *Behaviour Research and Therapy*, 35(4), 297–303. [https://doi.org/10.1016/S0005-7967\(96\)00109-X](https://doi.org/10.1016/S0005-7967(96)00109-X)
- Moukheiber, A., Rautureau, G., Perez-Diaz, F., Soussignan, R., Dubal, S., Jouvent, R., & Pelissolo, A. (2010). Gaze avoidance in social phobia: Objective measure and correlates. *Behaviour Research and Therapy*, 48(2), 147–151. <https://doi.org/10.1016/j.brat.2009.09.012>
- Noyes, E., Davis, J. P., Petrov, N., Gray, K. L. H., & Ritchie, K. L. (2021). The effect of face masks and sunglasses on identity and expression recognition with super-recognizers and typical observers. *Royal Society Open Science*, 8(3), 201169. <https://doi.org/10.1098/rsos.201169>
- Olivera-La Rosa, A., Chuquichambi, E. G., & Ingram, G. P. D. (2020). Keep your (social) distance: Pathogen concerns and social perception in the time of COVID-19. *Personality and Individual Differences*, 166, 110200. <https://doi.org/10.1016/j.paid.2020.110200>
- Oosterhof, N. N., & Todorov, A. (2008). The functional basis of face evaluation. *Proceedings of the National Academy of Sciences of the United States of America*, 105(32), 11087–11092. <https://doi.org/10.1073/pnas.0805664105>
- Richards, A., French, C. C., Calder, A. J., Webb, B., Fox, R., & Young, A. W. (2002). Anxiety-related bias in the classification of emotionally ambiguous facial expressions. *Emotion*, 2(3), 273–287. <https://doi.org/10.1037/1528-3542.2.3.273>
- Richardson, T., Waddington, M., & Gilman, R. T. (2021). Young, formidable men show greater sensitivity to facial cues of dominance. *Evolution and Human Behavior*, 42(1), 43–50. <https://doi.org/10.1016/j.evolhumbehav.2020.07.004>
- Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, 5(4), 296–320. https://doi.org/10.1207/S15327957PSPR0504_2
- Schneier, F. R., Rodebaugh, T. L., Blanco, C., Lewin, H., & Liebowitz, M. R. (2011). Fear and avoidance of eye contact in social anxiety disorder. *Comprehensive Psychiatry*, 52(1), 81–87. <https://doi.org/10.1016/j.comppsy.2010.04.006>
- Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the state-trait anxiety inventory*. Palo Alto: Consulting Psychologists Press.
- Sutherland, C. A., Oldmeadow, J. A., Santos, I. M., Towler, J., Burt, D. M., & Young, A. W. (2013). Social inferences from faces: Ambient images generate a three-dimensional model. *Cognition*, 127(1), 105–118. <https://doi.org/10.1016/j.cognition.2012.12.001>
- Todorov, A., Baron, S. G., & Oosterhof, N. N. (2008). Evaluating face trustworthiness: A model based approach. *Social Cognitive and Affective Neuroscience*, 3(2), 119–127. <https://doi.org/10.1093/scan/nsn009>
- Todorov, A., Mende-Siedlecki, P., & Dotsch, R. (2013). Social judgements from faces. *Current Opinion in Neurobiology*, 23(3), 373–380. <https://doi.org/10.1016/j.conb.2012.12.010>
- Tyrer, P., & Baldwin, D. (2006). Generalised anxiety disorder. *The Lancet*, 368(9553), 2156–2166. [https://doi.org/10.1016/S0140-6736\(06\)69865-6](https://doi.org/10.1016/S0140-6736(06)69865-6)
- Voss, A., Rothermund, K., & Brandtstadter, J. (2008). Interpreting ambiguous stimuli: Separating perceptual and judgmental biases. *Journal of Experimental Social Psychology*, 44(4), 1048–1056. <https://doi.org/10.1016/j.jesp.2007.10.009>
- Willis, M. L., Dodd, H. F., & Palermo, R. (2013). The relationship between anxiety and the social judgements of approachability and trustworthiness. *PLoS ONE*, 8(10), e76825. <https://doi.org/10.1371/journal.pone.0076825>
- Xu, F., Wu, D., Toriyama, R., Ma, F., Itakura, S., & Lee, K. (2012). Similarities and differences in Chinese and caucasian adults' use of facial cues for trustworthiness judgments. *PLoS ONE*, 7(4), e34859. <https://doi.org/10.1371/journal.pone.0034859>