



The Effect of Medical Face Masks on First Impressions Across Race and Time: Testing Social and Perceptual Explanations

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Abstract

A growing body of research shows medical face masks to affect face perception and recognition. Although face masks negatively impact recognition of face identities and emotion expressions, they largely positively affect trait impressions. Here, focusing on impressions of trustworthiness and responsibility, we bridge between various lines of inquiry in the extant literature. First, among American perceivers, we test whether the effect of masks varies by target faces' race, crucially including targets from three racial groups: Asian, Black, and White. Next, we examine the extent to which effects can be explained by the *presence* of masks versus the *absence* of lower facial information. Finally, we examine the role of temporal context, testing masks' effect on trustworthiness and responsibility judgments in early 2021 and mid 2023. Altogether, we find face masks to have a positive effect on trustworthiness and responsibility judgments. Lack of lower facial information explained some, but not all, of the effect of masking, indicating that masks provide a specific social signal that affects trait judgments beyond the effect of occlusion. Finally, we found the positive effect of masking on trait judgments to persist in 2023 but decrease in magnitude compared to 2021, indicating that the social meaning of masks has waned over time. Masking effects were moreover stronger for White than Black (2021, 2023) and Asian targets (2023) and among perceivers with more positive attitudes toward masking (especially in 2023). Altogether, we provide evidence that both bottom-up perceptual and top-down social factors influence social perceptions of masked faces.

Keywords Face mask · Trustworthiness · Race · Person perception · First impression

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Introduction

The face is a focal point of person perception, providing a wealth of social information—including cues to age, race, gender, and emotion—and influencing a broad range of social judgments (e.g., Zebrowitz, 1997). Despite the richness of the face as a source of social cues, there are clear limitations to relying on the face to form social judgments. For example, facial impressions are often inaccurate (e.g., personality impressions; Jaeger et al., 2024) and can be disrupted if the face is not perceived holistically (e.g., Abbas & Duchaine, 2008; Calder et al., 2000; Santos & Young, 2011). This latter point is especially relevant to consider in the context of widespread adoption of face masks during the height of COVID-19.

Recent research has examined the effects of (medical/surgical) face masks on social perception (for reviews, see Pavlova & Sokolov, 2022; Wang et al., 2023; for overviews of special issues/collections, see Lander & Saunders, 2023; Pavlova et al., 2023). Emotion recognition research finds diminished accuracy in recognizing the expressions of masked faces, compared to unmasked faces (e.g., Carbon, 2020; Freud et al., 2020; Grundmann et al., 2021). Other findings show that masks impede face recognition and memory (e.g., Carragher & Hancock, 2020; Freud et al., 2020; Marini et al., 2021; Ritchie et al., 2024). Research has also examined the impact of face masks on trait judgments (e.g., Lau, 2021; Pinto & Albuquerque, 2024; Stosic et al., 2024), which are important given their downstream consequences (e.g., voting, criminal sentencing; Todorov et al., 2005; Wilson & Rule, 2015). Much of this work has tested perceptions of trustworthiness, given the central nature of trustworthiness to person perception (e.g., Oosterhof & Todorov, 2008; Sutherland et al., 2013). We expand on this body of work here, comparing perceptions of masked and unmasked faces from multiple racial/ethnic groups at two different timepoints during and following the height of the COVID-19 pandemic. We explore moderation by perceivers' attitudes and test a basic perceptual explanation for the effect of face masking (lower-face occlusion).

Trustworthiness Judgments of Masked Faces

Extant research indicates that face masks may lead to more positive social judgments, including boosting perceived trustworthiness (e.g., Cartaud et al., 2020; Di Crosta et al., 2023; Guo et al., 2022; Oldmeadow & Koch, 2021; Olivera-La Rosa et al., 2020). This stands in contrast to the detrimental effects masks have on recognition of emotion expressions and face identities. Face masks' positive effect on social judgments likely results from the social signals these masks convey—namely, that the wearer is engaged in prosocial, responsible public health behavior (Betsch et al., 2020; Schönweitz et al., 2022). Although most studies examining trustworthiness judgments find masked faces to appear more trustworthy than unmasked faces, this pattern is not entirely consistent across studies, with some finding opposing (e.g., Biermann et al., 2021; Gabrieli & Esposito, 2021; Takehara et al., 2023) or null effects (e.g., Bennetts et al., 2022; Grundmann et al., 2021; Twele et al., 2022).

Some inconsistencies may be explained by the initial trustworthiness of the stimuli. For example, Marini et al. (2021) found that masking increased trustworthiness of initially untrustworthy-looking faces, but already highly trustworthy-looking faces did not improve their trustworthiness by masking. Oldmeadow and Koch (2021) similarly found masking to increase trustworthiness overall, but more so for untrustworthy than highly trustwor-

thy faces. More extremely, other work has found masking to increase trustworthiness of untrustworthy faces but *decrease* trustworthiness of highly trustworthy faces (Oldmeadow & Gogan, 2024; Oliveira & Garcia-Marques, 2022). Although there is no complete consensus in the literature, it does appear that overall, face masks improve *most* faces' perceived trustworthiness. In the current work, we test whether this is the case across faces from different racial groups, or whether faces' race moderates the relation between masking and perceived trustworthiness. We furthermore explore perceptions of responsibility, in addition to trustworthiness, due to its relevance to masking behavior in the context of the COVID-19 pandemic. Public health messaging promoted masking as a socially responsible behavior—we therefore explored whether masking could make faces appear more responsible.

Face Masks and Race

Whether face masks impact trait judgments similarly across faces of different (perceived) racial backgrounds is important to test for several reasons. First, testing perceptions of a diverse array of faces increases generalizability (see Cook & Over, 2021). Next, mask-wearing could plausibly have different consequences by perceived race, due to factors beyond masks' general positive public health-related signals. In the U.S., both Black and Asian participants reported experiencing social identity threat when masked (Kahn & Money, 2022), and these mask-wearers could potentially experience different consequences than White mask-wearers, for divergent reasons. For Black Americans, there is a pervasive stereotype of criminality and threat (Devine & Elliot, 1995; Eberhardt et al., 2004), which certain clothing types may magnify.

For example, the U.S. Centers for Disease Control recommended cloth face coverings early in the pandemic (CDC, 2020), but certain cloth face coverings, such as bandannas, are strongly associated with threat-related stereotypes of Black people (see, e.g., Gurung et al., 2021). In Kahn and Money's (2022) research, Black participants (surveyed in May and August 2020) worried about the negative impact masking could have in interactions with police. Other work conducted in the U.S. in 2020 found that Black men wearing bandannas and cloth masks were seen by non-Black perceivers as more threatening and less trustworthy than unmasked targets, but that surgical masks did not result in such negative perceptions (Christiani et al., 2022). Research in Canada in 2020–2021 found medical face masks to improve primarily-White perceivers' impressions of White but not Black faces (Kawakami et al., 2023), but other work with an international online sample and an Australian undergraduate sample in 2020 found face masks to increase trustworthiness of both Black and White faces, though to a greater extent for White faces (Oldmeadow & Koch, 2021).

It is also important to test perceptions of masked Asian faces. Asian mask-wearers may face scapegoating and blame for the spread of disease (Tessler et al., 2020). In the first year of the COVID-19 pandemic, there was a widespread increase in hate crimes directed against Asian people in Western nations (e.g., Human Rights Watch, 2020), and in some cases, people may have been targeted because they were wearing masks (e.g., Choi & Lee, 2021; Ren & Feagin, 2021). Testing how masks affect basic trait impressions of Asian faces—and whether these effects differ from those for White and Black faces—is therefore crucial. Stosic et al. (2024) tested this in the U.S. among primarily-White perceivers during 2020, finding masked faces to be rated as warmer and more competent than unmasked faces, but the size of this effect to be smaller for Asian than Black and White faces. Research by Light

et al. (2024) in early 2021 found masks to decrease primarily-White American participants' threat evaluations of faces, but to a lesser extent for Black faces, compared to Asian and White faces. In contrast, although masking increased judgments of faces' responsibility and trustworthiness, this did not vary by face race. This pattern of findings is mixed, leaving open the question of how faces' race may moderate masks' effects on trait evaluations. The bulk of this work does show, though, that masks are likely to have a positive effect across race.

In the present research, we include Asian, Black, and White faces in our three studies, specifically comparing effects of wearing a surgical mask for Asian and Black faces to those for White faces. Any muted effects of masking for Asian or Black faces, compared to White faces, could suggest interference from racial stereotypes (e.g., Asian foreignness, Black threat; see Light et al., 2024 for discussion of racial stereotypes and masking). Among White perceivers, greater effects of masking for White faces could alternatively reflect either ingroup favoritism (i.e., a greater boost in positive perceptions of masked own-race faces) or harsher ingroup punishment (i.e., more negative evaluations of unmasked own-race faces; e.g., van Kleef et al., 2015). Because of the mixed results from previous studies, we made no directional hypotheses about the impact of race in the current work, but we did expect that masks would increase ratings of trustworthiness and responsibility across all three racial groups.

Masks Versus Occlusion

Some research has also examined whether changes in trait judgements (e.g., increased trustworthiness) occur specifically due to the *presence* of face masks (e.g., because of the social signal of mask-wearing as a trustworthy and responsible public health behavior, due to e.g., government, health organizations, and media messaging; see Betsch et al., 2020; Chen et al., 2025), or to another confounding factor, namely the *absence* of information from the lower face. Earlier (pre-pandemic) research found higher trustworthiness judgments of faces whose lower half was obscured by a rectangle (Santos & Young, 2011), suggesting that the occlusion or absence of the lower face, rather than the presence of masks, could explain increased trustworthiness perceptions of masked faces observed in some recent research (e.g., Kawakami et al., 2023; Oldmeadow & Koch, 2021). In line with this reasoning, Oliveira and Garcia-Marques (2022) found in research conducted in 2020 with primarily-Colombian participants that face masks and lower-face occlusion had similar effects on White faces' perceived trustworthiness, compared to whole face images: They decreased trustworthiness discriminability (masking and occlusion increased trustworthiness of untrustworthy-looking faces and decreased trustworthiness of highly trustworthy-looking faces).

Similarly, Stosic et al. (2024) found that displaying only the top halves of faces and asking participants to look into unaltered faces' eyes had similar positive effects on American perceivers' warmth and competence judgments as masking did (albeit with some variation in this pattern between Asian, Black, and White faces) in 2020. Other research, however, found that occluding the lower half of the face with an image of a laptop led to lower trustworthiness ratings compared to a masked face among a sample of Black and White faces rated by primarily-Australian perceivers in 2022–2023 (ratings of occluded faces were not directly compared to unmasked faces; Oldmeadow & Gogan, 2024). Some work shows

mixed results: For example, German perceivers in 2020 did not show consistent patterns in perceptions of threat from White faces across different facial expressions and face occlusion conditions (a mask; showing only the top half of the face; obstructing the lower part of the face with a circle; Grahlow et al., 2022).

Using occluded/cropped stimuli in Study 2, we test the question of whether a lack of lower-half facial information can explain effects of masking on trustworthiness and responsibility judgments. That is, we test whether masks' effect on these trait judgments has a purely bottom-up perceptual explanation, or whether masks' social meaning may drive effects. We also test for interactions with faces' race, as when examining perceptions of masked faces.

Face Masks Over Time

Within the context of the COVID-19 pandemic, mask-wearing had a specific social meaning that may have first increased and then attenuated over time, in line with the introduction of other measures to limit the spread of infection (e.g., vaccination), masking mandates, and the prevalence of COVID-19 infection. Although masking is currently far less widespread than during the height of the pandemic, it remains an important behavior among certain vulnerable groups (e.g., immunocompromised individuals); medically-masked individuals can thus still be encountered in everyday life. Research examining the effect of face masks on trustworthiness, competence, and attractiveness ratings across three timepoints in 2020 and 2021 revealed no effect of timepoint or interaction between timepoint and masking in predicting British participants' trait judgments of White faces (masks improved competence, but not trustworthiness or attractiveness ratings; Bennetts et al., 2022). That work involved participants who, by the final study, had regularly interacted with people wearing masks for approximately a year, and the pandemic was still in effect. Similarly, research in Japan did not find timepoint (2020 vs. 2022) to moderate effects of masking on trustworthiness judgments of East Asian faces (here, masks decreased ratings of trustworthiness but are more culturally common; Takehara et al., 2023).

Other research comparing Canadian participants' various trait judgments of White faces in 2020, 2021, and 2022 found a positive effect of masks on trustworthiness and warmth judgments and a negative effect on dominance judgments, which increased over time, whereas positive effects on attractiveness and considerateness and negative effects on anxiousness were temporally stable (Fang & Kawakami, 2024). Again here, the global health emergency was still in effect throughout all data collection timepoints, but by the final study, a nationwide mask mandate had been lifted. Most recently, research with Italian participants found face masks to improve judgments of trustworthiness, morality, sociability, competence, and altruism but less so in 2022 than 2021 (Tumino et al., 2024). These authors noted that mask use had become "largely unusual" by their latter wave of data collection. Similarly, a set of Australian studies found masking effects on trustworthiness judgments to decrease from 2020 to 2022 and 2023 (with significant differences between masked and unmasked faces only in 2020; Oldmeadow & Gogan, 2024). Like in other similar work, data collection in those studies took place first when masks were ubiquitous and mandatory in most public spaces, and then later when masks were less common and no longer mandated.

The society-wide reduction in mask-wearing since the pandemic's height suggests that, on average, people are less likely to believe that it is important to wear medical masks. This

nearly self-evident supposition also suggests that perceptions of others wearing masks may be less positive than they previously were. Apart from possible changes in individual perceptions, there is also evidence of emerging hostility toward mask-wearing. In the United States specifically, some localities even banned wearing face masks (Associated Press, 2024a, b). Although such bans are couched in language about preventing protest-related violent crime, such laws suggest that people in some places have become increasingly suspicious of others who cover their faces in public, even if for health reasons. Due to such changing social conditions, at least in the U.S., we thought it plausible that a mask-related boost in perceived trustworthiness and responsibility might be reduced in a sample collected over two years after Study 1. We thus test whether effects of masking on trustworthiness and responsibility judgments, and interactions with face race, persist across time in Study 3.

Individual Attitudes

To complement the time-based approach, we also include a measure of individual attitudes toward mask-wearing. Although some research shows mask-wearing to be perceived as a prosocial behavior (Betsch et al., 2020), other work demonstrates that as the COVID-19 pandemic progressed, mask-wearing increasingly took on more complex meaning and became closely linked to polarized moral, political, and social identities (Powdthavee et al., 2021; Schönweitz et al., 2022). Indeed, attitudes toward masking vary broadly (Rieger, 2020; Xu & Cheng, 2021), and some extant work has found masking- and COVID-related attitudes to moderate trait evaluations of masked faces (e.g., Dudarev et al., 2022; Leder et al., 2022; Oldmeadow & Gogan, 2024). Although we expected that faces donning masks would be perceived as more trustworthy and responsible overall, a measure of individual differences in mask attitudes enabled us to explore the potential heterogeneity in these effects. This also provided another tool to examine the extent to which perceptions of masked faces are driven by the social signal of masks.

The Present Research

Here, we expand upon the existing literature by testing impressions of masked and unmasked women's and men's faces from three broad racial groups. We focus our investigation on trustworthiness, due to its central role in person perception (e.g., Todorov, 2008), and responsibility, as mask-wearing should be perceived as a responsible behavior in the context of COVID-19. Critically, we augment the existing literature by (1) examining judgments of Asian, Black, and White faces (with a larger and more diverse stimulus set than extant studies; Studies 1–3), (2) testing whether the apparent effect of masks on impressions is due to the presence of masks or merely to the absence of lower facial information (Study 2), and (3) examining the effects of masking and face race at two different timepoints (2021 and 2023 in Studies 1 and 3, respectively). We additionally (4) test whether impressions of masked faces differ based on individual attitudes regarding mask wearing (Studies 1 and 3). By testing effects of face race alongside examining perceptual and social explanations of the effects of masking on trait impressions, this research unifies various questions that have previously been separately addressed. All data and analysis scripts are available on the

Open Science Framework (OSF; <https://osf.io/8eydg>). Montclair State University provided ethical approval for all studies.

Study 1

We tested the effect of mask-wearing on perceived trustworthiness and responsibility, examining whether patterns vary by target race. We also explored moderation by perceivers' attitudes towards mask-wearing. We preregistered this study on the OSF (<https://osf.io/pq3m>) and collected data in February 2021.

Method

Stimuli

We collected 180 neutral face images from the Chicago Face Database (CFD; Ma et al., 2015), split evenly by race (Asian, Black, White) and gender¹ (i.e., 30 face identities of each race and gender subgroup). Norming data available from the CFD revealed no race differences in baseline trustworthiness or attractiveness (see norming data analysis script on OSF; <https://osf.io/8eydg/files/ch8w7>).² We created copies of all stimuli and added a standard blue medical-type face mask to each face, using photo editing software. We fitted masks to cover targets' noses and mouths (see Fig. 1). This resulted in a stimulus set of 360 images (one masked and one unmasked/original image of each face identity). This target sample size afforded over 80% power to detect a within-between interaction in a target-level ANOVA, anticipating the average effect size in social psychology ($r = 0.21$; Richard et al., 2003) and an alpha level of 0.05.



Fig. 1 Example masked and unmasked stimuli. *Note* Face image is a composite and does not represent any individual

¹Due to a programming error, one of the Black male targets loaded incorrectly throughout Studies 1–2. We therefore exclude this target from analysis in those studies.

²There were, however, race differences in perceived threat (such that Asian targets were perceived as less threatening than Black or White targets; see norming data analysis script on OSF).

Perceivers

We aimed to recruit 40 American participants (perceivers) from the recruitment platform Prolific to rate each version (masked, unmasked) of each target. This sample size has resulted in good inter-rater reliability and stable averages in previous research on first impressions from faces (e.g., Hehman et al., 2025). We recruited perceivers for four between-subjects groups (see Design, below), for a total of 160 perceivers. This sample size afforded 80% power to detect effects of $r \geq 0.30$ in perceiver-level correlations for each judgment. Together, perceiver and target sample sizes provided over 80% power to detect small-to-medium effects in cross-classified multilevel models (with $\alpha = 0.05$; Westfall, 2016; Westfall et al., 2014).

One hundred sixty-three perceivers completed the study. We excluded data from 21 perceivers, eight of whom rated all targets identically and 13 of whom reported issues with stimuli loading or responding before stimuli loaded. This left 142 perceivers (76 female/women, 63 male/men, 2 non-binary, 1 unreported gender; $M_{\text{age}} = 31.50$ years, $SD = 11.52$; 93 White, 21 Asian, 9 Black, 9 Hispanic/Latinx, 10 multiracial).

Design

In each study, we followed the same basic 2 (Target Masking) $\times 2$ (Trait) $\times 2$ (Counterbalancing Condition) mixed design, with the first variable manipulated within-subjects (all perceivers rated both masked and unmasked faces). Perceivers were randomly assigned to one of four between-subjects groups reflecting combinations of Trait (trustworthiness vs. responsibility) and Counterbalancing Condition (of which there were two; these conditions determined which face identities appeared masked and which appeared unmasked). Each perceiver viewed each of the 180 target identities once, judging either its masked or unmasked version on the trait to which they were assigned for the entire study. This design ensured that each perceiver viewed each face identity in the stimulus set, and that half of the faces viewed by each perceiver were masked and half were unmasked. See Table S1 in the Supplementary Information for N s per between-subjects condition across studies.

Procedure

Perceivers rated targets' trustworthiness or responsibility on scales ranging from 1 (*very untrustworthy/very irresponsible*) to 7 (*very trustworthy/very responsible*), based on their first impression (we did not provide them with definitions of trustworthiness or responsibility). Perceivers rated targets at their own pace, with the targets split into four randomly-ordered blocks. Each block contained either female or male targets and either masked or unmasked (i.e., original) targets, with targets appearing in random order. The subset of face identities that appeared masked was counterbalanced across perceivers, and each perceiver saw each face identity only once (either masked or unmasked).

After rating all 180 targets, perceivers answered five questions about their attitudes toward mask-wearing (see Table 1). We generated these questions for this study, assessing perceivers' perceived importance of mask-wearing and their views on the trustworthiness and responsibility of mask wearers and non-wearers (similar to Oldmeadow & Gogan,

Table 1 Mask attitude questions and descriptive statistics

Question	Response options	<i>M</i> (<i>SD</i>) Study 1	<i>M</i> (<i>SD</i>) Study 3
In your opinion, how important is it to wear a mask in public right now?	Very unimportant, somewhat unimportant, neither important nor unimportant, somewhat important, very important	4.63 (0.97)	2.68 (1.29)
In your opinion, how trustworthy are mask wearers in general?	Very untrustworthy, somewhat untrustworthy, neither trustworthy nor untrustworthy, somewhat trustworthy, very trustworthy	3.92 (0.73)	3.76 (0.82)
In your opinion, how trustworthy are people who do not wear masks in general? (R)	Very untrustworthy, somewhat untrustworthy, neither trustworthy nor untrustworthy, somewhat trustworthy, very trustworthy	1.92 (0.94)	2.96 (0.66)
In your opinion, how responsible are mask wearers in general?	Very irresponsible, somewhat irresponsible, neither responsible nor irresponsible, somewhat responsible, very responsible	4.33 (0.82)	4.07 (0.80)
In your opinion, how responsible are people who do not wear masks in general? (R)	Very irresponsible, somewhat irresponsible, neither responsible nor irresponsible, somewhat responsible, very responsible	1.60 (0.92)	2.77 (0.73)
Overall scale		4.27 (0.61)	3.35 (0.61)

Responses ranged from 1 to 5. Items marked (R) were reverse scored

2024).³ Perceivers provided basic demographic information (gender, age, race/ethnicity) and reported any issues with stimuli loading and whether they provided any responses without waiting for stimuli to load, before debriefing.

Results

We preregistered separate target-level and perceiver-level analyses (which appear in the Supplementary Information) but report cross-classified multilevel modelling here to simultaneously account for target and perceiver variance. Throughout the main text, we report models including both trustworthiness and responsibility judgments (i.e., all data points; but see Supplementary Information for results of models separated by trait), both for parsimony and because judgments of targets' trustworthiness and responsibility correlated strongly across all studies ($0.52 \leq r \leq 0.79$; see Figs. S1–S3).

For each perceiver, we averaged across the five mask attitude items (Cronbach's $\alpha = 0.73$) to calculate a masking attitude score. We then modelled target masking (effect coded: unmasked = -0.5, masked = 0.5), target race (deviation coded with White as the reference

³ Our measure differs from Stosic et al.'s (2024) scale assessing beliefs in mask *effectiveness*, Dudarev et al.'s (2022) assessing self-reported masking *behavior*, and Leder et al.'s (2022) assessing attitudes towards various measures to prevent the spread of COVID-19.

category = $-1/3$, and Asian and Black = $2/3$ in respective contrasts), trait (effect coded: responsibility = -0.5 , trustworthiness = 0.5), perceiver masking attitudes (grand mean centered), and the interactions between target masking, target race, and trait and between target masking and perceiver masking attitudes as predictors of perceiver ratings. We included random intercepts for targets and perceivers and random slopes for target masking (grouped by target and perceiver), target race (grouped by perceiver), and their interaction (grouped by perceiver), and for trait and its interaction with target masking (grouped by target). We used *lmer* from the *lme4* package, along with *lmerTest* to evaluate significance in R version 4.4.3 (Bates et al., 2015; Kuznetsova et al., 2017; R Core Team, 2025).

Target Masking and Target Race Predicting Perceived Trustworthiness and Responsibility

This revealed main effects of target masking, target race (both contrasts), and trait, qualified by interactions between masking and race (Black vs. White contrast), and between masking and trait (see Table 2).

Examining the main effects revealed perceived trustworthiness and responsibility to be greater for masked than unmasked targets and higher for both Black and Asian targets,

Table 2 Target masking, target race, trait, and perceiver masking attitudes predicting perceived trustworthiness and responsibility in study 1

Predictors	<i>b</i>	<i>SE</i>	95% <i>CI</i>	<i>t</i>	<i>p</i>
Intercept	4.27	0.07	4.13–4.41	60.39	<0.001
Target masking	0.62	0.08	0.47–0.78	7.69	<0.001
Target race (Black vs. White)	0.23	0.08	0.06–0.39	2.69	0.007
Target race (Asian vs. White)	0.32	0.08	0.17–0.47	4.09	<0.001
Trait	–	0.13	–0.73–0.21	–3.56	<0.001
Perceiver masking attitudes	0.00	0.10	–0.20–0.20	0.00	0.99
Target masking × target race (Black vs. White)	–	0.06	–0.26–0.04	–2.71	0.007
Target masking × target race (Asian vs. White)	–	0.06	–0.20–0.01	–1.70	0.09
Target masking × trait	–	0.16	–0.64–0.01	–2.05	0.04
Target masking × perceiver masking attitudes	0.27	0.13	0.03–0.52	2.17	0.03
Target race (Black vs. White) × trait	0.02	0.10	–0.18–0.23	0.20	0.84
Target race (Asian vs. White) × trait	–	0.08	–0.17–0.16	–0.04	0.97
Target masking × target race (Black vs. White) × trait	–	0.07	–0.18–0.11	–0.50	0.62
Target masking × target race (Asian vs. White) × trait	0.06	0.07	–0.08–0.20	0.83	0.40

Target masking coded as -0.5 = unmasked, 0.5 = masked; target race coded as White = $-1/3$, Asian and Black = $2/3$ in respective contrasts; trait coded as responsibility = -0.5 , trustworthiness = 0.5 . Perceiver masking attitudes grand-mean centered. *p* values in bold indicate significant effects. See OSF for results of model without perceiver masking attitudes (<https://osf.io/8eydg/files/c3f5s>)

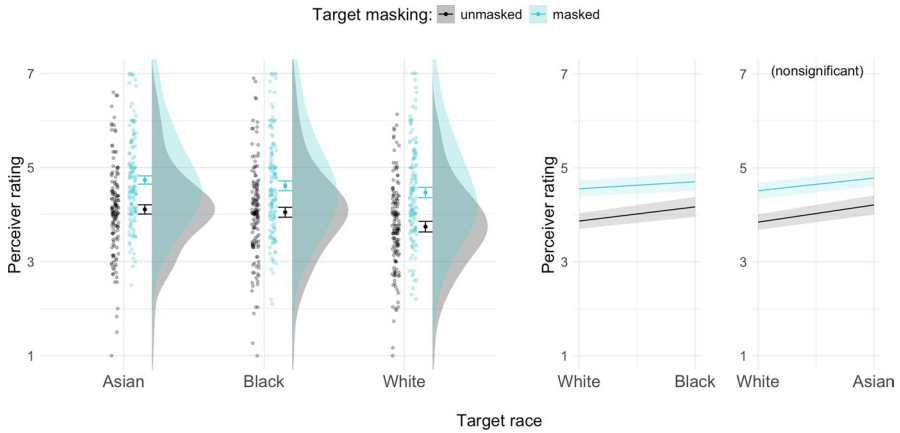
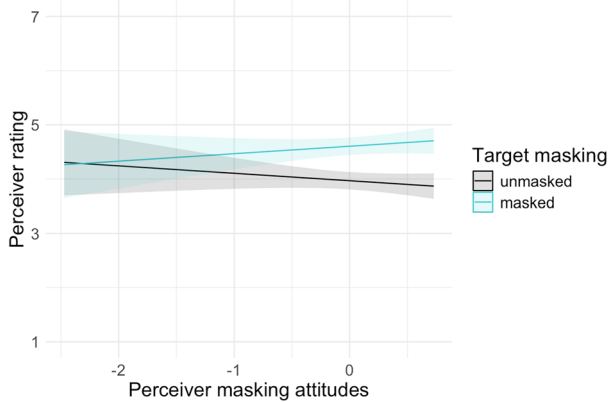


Fig. 2 Target masking and target race predicting perceived trustworthiness and responsibility in study 1. *Note* Panel on left displays perceiver-level data (ratings averaged across targets), with translucent points representing individual perceivers, solid points with error bars representing means and 95% CIs, and shading representing the distribution of data. Panels on the right are as predicted by the MLMs, with shaded bands representing 95%. Note the Asian vs. White contrast is nonsignificant

Fig. 3 Perceiver masking attitudes moderating the effect of target masking in study 1. *Note* Perceiver masking attitudes are grand-mean centered. Shaded bands represent 95% CIs



compared to White targets. Across masking conditions, ratings were furthermore more positive for responsibility than trustworthiness. Decomposing the interactions showed a larger effect of masking for responsibility than trustworthiness judgments (see Fig. S4) and for White than Black targets (see Fig. 2, which displays perceiver-level data on the left and MLM results on the right). This latter effect appeared largely driven by White targets' lower unmasked trustworthiness/responsibility ratings.

Moderation by Perceiver Masking Attitudes

Finally, masking attitudes significantly interacted with target masking (see Table 2), such that perceivers with more positive attitudes towards masking showed larger effects of masking on their ratings (see Fig. 3). However, this interaction was not robust to a series of exploratory steps: (1) when testing the above model but excluding nine outliers (with the

most negative attitude scores), and (2) when including the outliers but modelling masking attitudes' interactions with target masking, target race, and trait (vs. just with target masking; see OSF <https://osf.io/8eydg/files/c3f5s>), so we caution against strong interpretations of this interaction.

Discussion

Here we found masked faces to be perceived more positively, on average, than unmasked faces, in terms of trustworthiness and responsibility, replicating and extending existing findings on trustworthiness judgments (e.g., Cartaud et al., 2020; Marini et al., 2021; Oldmeadow & Koch, 2021; Olivera-La Rosa et al., 2020).⁴ This suggests that mask-wearing does not negatively impact trait impressions, even for members of racial groups targeted for harassment or violence during the COVID-19 pandemic. These findings may reflect overall positive attitudes towards masks as a public health measure (as indicated by the high mean scores on the masking attitudes scale) and/or a more basic perceptual explanation (tested below in Study 2). We also found masks to benefit ratings of responsibility somewhat more than ratings of trustworthiness. This suggests that responsibility may more directly tap into the social message conveyed by masks—that is, of masking as a socially responsible public health measure.

Overall, masking effects were stronger for White than Black targets. This pattern is consistent with extant findings (e.g., Oldmeadow & Koch, 2021). Given that the perceiver sample was predominantly White, this could reflect ingroup favoritism.⁵ However, the lack of difference in masking effects between White and Asian faces stands in some contrast to this explanation. Negative stereotypes about Black people may instead have dampened the positive effect of masking (see, e.g., Light et al., 2024), though this explanation is speculative. However, our interaction contrasts with the lack of race-by-masking interaction in Light et al. (2024)'s findings for trustworthiness and responsibility impressions (though those authors did find masks to decrease *threat* judgments more for White faces than Black faces). That work may have been limited by its small target sample, as perceivers rated only 12 targets (vs. 180 in our study). We also found some evidence that perceivers' masking attitudes moderate effects of masking, with perceivers possessing more positive attitudes towards masking showing a greater difference in their ratings of masked versus unmasked faces. This pattern is consistent with recent findings: Oldmeadow and Gogan (2024) assessed masking attitudes with items similar to those in our scale, finding those with more positive attitudes toward masking to show a greater difference in trustworthiness ratings of masked compared to unmasked faces. However, the moderation effect we observed did not hold once we excluded perceivers with outlier attitude scores, nor when we modelled interactions

⁴Note that masks did not improve perceptions of every individual face identity. Some targets were perceived as less trustworthy and/or responsible when masked, compared to unmasked, but these targets were in the minority and there were no clear systematic differences between these targets and the rest of the target sample (e.g., in terms of baseline trustworthiness; see Study 1 supplemental analysis file on OSF; <https://osf.io/8eydg/files/ge8va>).

⁵In an exploratory step, we tested perceiver race/ethnicity (White vs. non-White) as a moderator (see Supplementary Information). We found no significant moderation of interactions between masking and target race by perceiver race/ethnicity in either Study 1 or Study 3, but caution against interpreting these null findings too strongly, given the unbalanced samples of perceivers (i.e., roughly twice as many White as non-White perceivers). Note that the studies were designed with a focus on target, rather than perceiver, race.

between all of our predictors. This suggests that the moderating effect of masking attitudes may not be robust in this sample. We therefore interpret these findings with caution.

The null finding following outlier exclusions may be attributable to a ceiling effect in pro-mask attitudes in our sample, with mean responses in Oldmeadow and Gogan's (2024) sample closer to the scale midpoint. Additionally, their data were collected later than ours (in 2022 and 2023, rather than 2021). It could therefore be the case that in the context of early 2021, with infection and death rates in the U.S. high (CDC, 2025), that individual attitudes may simply not have been particularly predictive, except in extreme cases. We return to this question in Study 3. However, some previous research has failed to find moderation by mask-related beliefs (Stosic et al., 2024; who assessed beliefs about mask efficacy in preventing COVID-19 transmission) and other individual difference variables (e.g., pathogen disgust sensitivity; Olivera-La Rosa et al., 2020) on the effect of masks on social perception. This suggests that positive evaluations of masked faces may simply have a more basic, perceptual explanation (i.e., occlusion of the lower face, which we directly test in Study 2). Finally, an unexpected finding was that Asian and Black targets were perceived as more trustworthy and responsible than White targets. As the original stimuli did not differ on baseline trustworthiness by race (as per CFD norming data), these effects do not appear to be attributable to our specific target sample but could instead reflect social desirability biases in this majority-White perceiver sample. This explanation is speculative, however, and investigating any main effect of race is peripheral to the aims of this paper.

Altogether, the results of Study 1 indicate that masked faces are perceived as more responsible and trustworthy than unmasked faces, consistent with much of the research in this area. However, the presence of masks in this study is confounded with the absence of lower facial information, preventing us from ascribing these findings specifically to the presence of medical face masks. We conducted Study 2 to address this confound.

Study 2

In Study 1, we found that medical masks increased targets' perceived trustworthiness and responsibility. In Study 2, we tested whether this effect can be explained merely by the *absence* of the lower half of the face, rather than by the *presence* of masks. We therefore asked perceivers to rate face images that showed either the entire face or just the top half of the face (preregistered: <https://osf.io/rs8j9>).

In this study, more positive trustworthiness and responsibility perceptions for the top half of the face, compared to the full face, would suggest that our previous effects are not fully accounted for by masks, but at least partly by obscuring lower facial information. Extant findings give reason to expect that occluding the lower face may increase ascriptions of positive traits: Santos and Young (2011) found that faces were perceived more positively when the upper half was presented in isolation. Similarly, more recent research found that faces were judged as more attractive if perceivers viewed partial photographs, perhaps because they made positively-biased inferences regarding the appearance of missing information (Orghian & Hidalgo, 2020; see also Kramer & Jones, 2022). On the other hand, if trustworthiness and responsibility perceptions are similar or more positive for full faces than for top halves of faces, this would indicate that masks boost these perceptions above and beyond the confounding factor of face visibility. Research on trustworthiness (Oldmeadow

& Gogan, 2024; Oliveira & Garcia-Marques, 2022) has yielded somewhat mixed findings, leaving this question open to further testing.

We tested the effect of the visibility of the lower half of the face (i.e., occlusion) on perceived trustworthiness and responsibility, examining whether any patterns varied by target race. We collected data in May 2021.

Method

Stimuli

We used the same 180 face identities as in Study 1. Rather than using their masked images, we created copies of the original face images and cropped them to show only the upper half of the face (i.e., the part of the face visible when wearing a face mask; see Fig. 4). This resulted in a total stimulus set of 360 images (one cropped upper half and one full face/original image of each face identity).

Perceivers

As in Study 1, we aimed to recruit 40 American participants (perceivers) from Prolific for each of four between-subjects groups (varying in trait and counterbalancing condition), resulting in 160 total perceivers, and over 80% power to detect small-to-medium effects in cross-classified multilevel models.

One hundred fifty-eight perceivers provided complete data. We excluded data from 22 perceivers: 21 of whom reported either trouble viewing the stimuli or having provided responses without waiting for the faces to load, and two of whom responded identically to all targets (one perceiver was excluded for both reasons; remaining $n = 136$; 82 male/men, 46 female/women, 4 nonbinary, 2 genderqueer/fluid, 2 other; $M_{\text{age}} = 26.28$ years, $SD = 7.88$; 87 White, 36 Latinx/Hispanic, 6 Asian, 4 mixed-race, 2 Black, 1 Middle Eastern).

Procedure

Study design followed that of Study 1, with target face visibility within-subjects and trait rating and counterbalancing condition between-subjects. We thus randomly assigned perceivers to rate targets' trustworthiness or responsibility on scales ranging from 1 (*very untrustworthy/very irresponsible*) to 7 (*very trustworthy/very responsible*), based on their first impression, in one of two counterbalancing conditions. Perceivers rated targets at their own pace, with the targets split into four randomly ordered blocks. Each block contained either female or male targets and either full faces or upper halves of faces. Which face identities appeared with full faces (vs. upper halves) was counterbalanced across perceivers, with each perceiver seeing only one version of each face identity. After rating all targets, perceivers reported basic demographic information (gender, age, race/ethnicity). Perceivers

Fig. 4 Example occluded/cropped stimulus. *Note* Face is a composite and does not represent any individual



then reported any issues with stimuli loading or whether they provided any responses without waiting for stimuli to load, before debriefing.

Results

As in Study 1, we report results of a multilevel model here, with the preregistered target-level analyses in the Supplementary Information.

Target Face Visibility and Target Race Predicting Perceived Trustworthiness and Responsibility

We modeled trustworthiness/responsibility ratings as a function of target face visibility (effect coded: full face = -0.5, top half = 0.5), target race (deviation coded with White as the reference category = -1/3, and Asian and Black = 2/3 in respective contrasts), trait (effect coded: responsibility = -0.5, trustworthiness = 0.5), and their interaction. We included random intercepts for targets and perceivers and random slopes for target visibility (grouped

Table 3 Target face visibility, target race, and trait predicting perceived trustworthiness and responsibility in study 2

Predictors	<i>b</i>	<i>SE</i>	95% <i>CI</i>	<i>t</i>	<i>p</i>
Intercept	3.83	0.06	3.71–3.96	61.24	< 0.001
Target face visibility	0.14	0.04	0.07–0.22	3.73	< 0.001
Target race (Black vs. White)	0.19	0.10	0.00–0.39	1.97	0.049
Target race (Asian vs. White)	0.36	0.09	0.17–0.54	3.78	< 0.001
Trait	-0.33	0.11	-0.54–0.13	-3.17	0.002
Target face visibility × target race (Black vs. White)	-0.05	0.07	-0.19–0.08	-0.80	0.423
Target face visibility × target race (Asian vs. White)	-0.03	0.07	-0.16–0.10	-0.43	0.665
Target face visibility × trait	-0.02	0.06	-0.13–0.10	-0.29	0.769
Target race (Black vs. White) × trait	0.21	0.11	-0.00–0.41	1.95	0.051
Target race (Asian vs. White) × trait	0.08	0.09	-0.10–0.26	0.84	0.403
Target face visibility × target race (Black vs. White) × trait	0.04	0.07	-0.10–0.18	0.56	0.575
Target face visibility × target race (Asian vs. White) × trait	0.00	0.07	-0.13–0.14	0.06	0.950

Target face visibility coded as -0.5 = full face, 0.5 = top half; target race coded as White = -1/3, Asian and Black = 2/3 in respective contrasts; trait coded as responsibility = -0.5, trustworthiness = 0.5. *p* values in bold indicate significant effects.

by target and perceiver), target race (grouped by perceiver), and trait (grouped by target).⁶ This revealed main effects of face visibility, target race, and trait (see Table 3). That is, top halves of faces were rated more positively than full faces, Black and Asian targets more positively than White targets, and responsibility ratings were more positive than trustworthiness ratings.

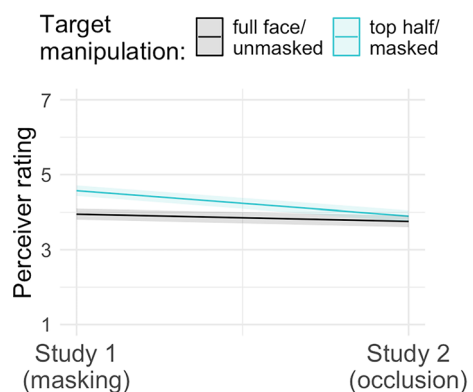
Manipulation Comparison

Next, in an unplanned step, we directly compared the effect of face visibility and masking by aggregating Study 1 and Study 2 data. We modelled ratings as a function of manipulation type (occlusion/cropping= -0.5 , masking= 0.5), target manipulation (full face/unmasked= -0.5 , top half/masked= 0.5), trait (responsibility= -0.5 , trustworthiness= 0.5), and their interaction. We treated perceivers and targets as random and included random slopes for manipulation (grouped by perceiver and target), manipulation type, and trait (grouped by target). All main effects were significant (see Table S2) and, crucially, the interaction between manipulation and manipulation type was significant, $b=0.49$, $SE=0.09$, 95% CI [0.32–0.66], $t=5.60$ $p<0.001$. Examining this interaction revealed the effect of masking in Study 1 to be greater than the effect of occlusion/cropping in Study 2 (Fig. 5; see Fig. S5 for perceiver-level plot).

Discussion

In Study 2, trustworthiness and responsibility ratings for the top halves of faces (i.e., occluded/cropped faces) were higher than ratings for full faces, suggesting that some of the positive effect of masking on these perceptions is due to obscuring the lower face. This aligns with findings from Stosic et al. (2024) and Oliveira and Garcia-Marques (2022). Our findings support the possibility, observed in previous research (e.g., Santos & Young, 2011), that obscuring the lower face results in more positive social judgments. Of course, it

Fig. 5 Masking Vs. occlusion/cropping effects in studies 1 and 2. Note Shaded bands represent 95% CIs



⁶ We initially specified random effects maximally. However, including random slopes for interactions between target visibility and target race and between target visibility and trait led to singular fit (model overfitting). We therefore inspected the variance explained by the random effects and removed those with variance closest to 0 (see Barr, 2021). Note that fixed effects and their significance in the simplified model did not differ from those in the more complex model.

is unlikely that people truly prefer incomplete faces. It may instead be that perceivers report positive perceptions of incomplete faces because they make positive inferences about missing facial information (e.g., via averaging; Kramer & Jones, 2022), consistent with recent findings in which participants judged faces in incomplete photographs to be more physically attractive than complete faces (Orghian & Hidalgo, 2020). Recent findings from Li et al. (2025) also show the top half of the face to guide trust judgments and behavior more strongly than the bottom half of the face, with the top half of the face containing more of the cues that perceivers use to make such judgments.

Importantly, we also found that the effect of occlusion observed here was not as strong as the effect of masking observed in Study 1. This indicates that lower face absence cannot *fully* explain masking effects on trustworthiness and responsibility judgments, but that the presence of masks also confers positive social information (e.g., wearing a mask is a prosocial behavior during a pandemic). This is consistent with Oldmeadow and Gogan's (2024) results for trustworthiness judgments and Hies and Lewis's (2022) findings for attractiveness judgments. Altogether, the results of Study 2 indicate that the benefits of mask-wearing for perceptions of trustworthiness and responsibility cannot entirely be attributed to either the positive social signal conveyed by the act of wearing a mask or the positive perceptual effects of lower-face occlusion. Rather, both top-down and bottom-up processes appear to contribute.

We also observed a main effect of race on judgments, similar to the patterns observed for masked and unmasked faces in Study 1. Black and Asian targets were judged more positively than White targets. We would again caution against overinterpreting this main effect. However, in contrast to Study 1, here there was no interaction between target race and face visibility. The previously observed interaction between target race and masking thus cannot be explained through a perceptual lens. Rather, target race appears to moderate the strength of masks' social meaning (vs. perceptual effects of obscuring lower facial information). We discuss this further in Study 3.

Study 3

In Study 3, we tested whether the positive effects of masking on trustworthiness and responsibility judgments persist across time, outside of the height of the COVID pandemic and thus with changing norms around mask-wearing (preregistered: <https://osf.io/w7c2x>). We therefore replicated Study 1, both testing judgments of masked and unmasked faces and measuring perceivers' attitudes toward masking. We hypothesized that we would replicate the effects of masking and race observed in Study 1.⁷ However, we anticipated that the magnitude of the effect of masking would be weaker than in Study 1, in line with existing findings (e.g., Oldmeadow & Gogan, 2024; Tumino et al., 2024). We collected data in July 2023, over two years after Study 1.

⁷Our preregistration hypothesized no interaction between target masking and race, based on the findings of the original preregistered target-level analysis of the Study 1 data.

Method

Stimuli

We used the same 360 stimuli (180 face identities, each with masked and unmasked versions) as in Study 1.

Perceivers

As in Studies 1 and 2, we aimed to recruit 160 American participants (perceivers) from Prolific, for an average of 40 perceivers in each of four between-subjects groups (varying trait and counterbalancing condition). This sample size, combined with the target sample, afforded over 80% power to detect small-to-medium effects in cross-classified multilevel models.

One hundred fifty-nine perceivers provided complete data. We excluded data from eight perceivers, of whom three reported issues with stimuli loading or providing responses before stimuli loaded and five responded identically to all targets (remaining $n = 151$; 91 female/women, 56 male/men, 2 nonbinary, 1 agender, 1 trans man; $M_{\text{age}} = 37.64$ years, $SD = 13.26$; 110 White, 12 Black, 10 Asian, 9 Hispanic/Latinx, 7 mixed race, 3 unspecified ethnicity).

Procedure

The design and procedure followed that of Study 1 exactly. We randomly assigned perceivers to rate targets' trustworthiness or responsibility. Each perceiver saw each face identity only once (either masked or unmasked), and which face identities appeared masked was counterbalanced across perceivers. Perceivers answered five questions evaluating their attitudes toward mask wearing, provided demographic information, and reported any stimulus viewing issues prior to debriefing.

Results

The preregistered target- and perceiver-level analyses appear in the Supplementary Information, and we report the results of a multilevel model accounting for both perceiver and target variance here.

Target Masking and Target Race Predicting Perceived Trustworthiness and Responsibility

We averaged across the five mask attitude items (Table 1; Cronbach's $\alpha = 0.71$) to calculate a mask attitude score for each perceiver. We tested target masking, target race, trait, perceiver masking attitudes, and the interactions between target masking, target race, and trait and between target masking and perceiver masking attitudes as predictors of trustworthiness and responsibility ratings (with the same variable coding and random effects as in Study 1).

Similar to Study 1, main effects of target masking, target race (Asian vs. White), and trait, as well as an interaction between masking and race (both contrasts) emerged (see Table 4). Masked targets (compared to unmasked targets) and Asian targets (compared to White tar-

Table 4 Target masking, target race, trait, and perceiver masking attitudes predicting perceived trustworthiness and responsibility in study 3

Predictors	<i>b</i>	<i>SE</i>	95% <i>CI</i>	<i>t</i>	<i>p</i>
Intercept	4.15	0.07	4.01–4.30	57.32	< 0.001
Target masking	0.41	0.07	0.29–0.54	6.31	< 0.001
Target race (Black vs. White)	0.13	0.09	– 0.04–0.30	1.47	0.142
Target race (Asian vs. White)	0.24	0.08	0.10–0.39	3.23	0.001
Trait	–	0.14	–	– 2.79	0.005
Perceiver masking attitudes	0.09	0.11	– 0.13–0.31	0.81	0.417
Target masking × target race (Black vs. White)	–	0.06	–	– 3.05	0.002
Target masking × target race (Asian vs. White)	0.18	0.06	0.30–0.07	–	0.039
Target masking × trait	–	0.06	–	– 2.06	0.039
Target masking × trait	0.12	0.13	0.24–0.01	–	0.238
Target masking × trait	0.15	0.10	0.40–0.10	–	0.238
Target masking × perceiver masking attitudes	0.31	0.10	0.11–0.51	3.01	0.003
Target race (Black vs. White) × trait	–	0.13	–	– 0.36	0.721
Target race (Asian vs. White) × trait	0.05	0.09	0.30–0.20	–	0.561
Target race (Asian vs. White) × trait	0.06	0.09	0.24–0.13	–	0.561
Target masking × target race (Black vs. White) × trait	–	0.07	–	– 0.84	0.400
Target masking × target race (Black vs. White) × trait	0.06	0.07	0.20–0.08	–	0.400
Target masking × target race (Asian vs. White) × trait	–	0.07	– 0.17 to 0.09	– 0.57	0.571
Target masking × target race (Asian vs. White) × trait	0.04	0.07	– 0.17 to 0.09	– 0.57	0.571

Target masking coded as – 0.5 = unmasked, 0.5 = masked; target race coded as White = – 1/3, Asian and Black = 2/3 in respective contrasts; trait coded as responsibility = – 0.5, trustworthiness = 0.5. Perceiver masking attitudes grand-mean centered. *p* values in bold indicate significant effects. See OSF for results of model without perceiver masking attitudes (<https://osf.io/8eydg/files/x62w7>)

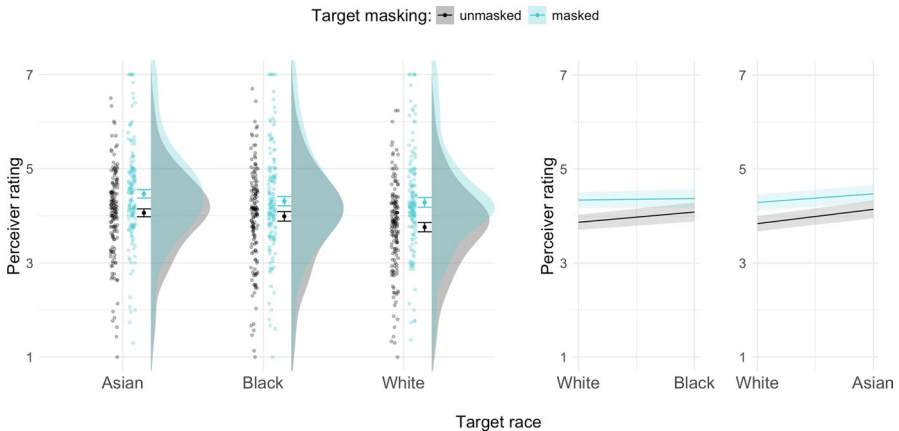
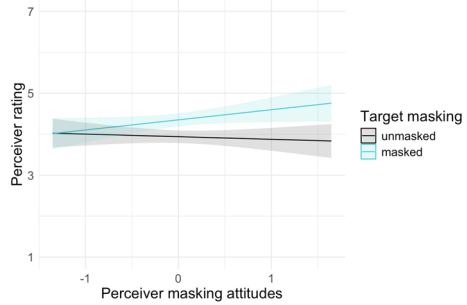


Fig. 6 Target masking and target race predicting perceived trustworthiness and responsibility in study 3. Panels on left display perceiver-level data (ratings averaged across targets), with translucent points representing individual perceivers, solid points with error bars representing means and 95% CIs, and shading representing the distribution of data. Panels on the right are as predicted by the MLMs, with shaded bands representing 95% CIs

Fig. 7 Perceiver masking attitudes moderating the effect of target masking in study 3. Perceiver masking attitudes are grand-mean centered. Shaded bands represent 95% CIs



gets) again appeared more trustworthy and responsible. Responsibility ratings were furthermore more positive than trustworthiness ratings. Examining the interactions showed the effect of masking to be greater for White than Black and Asian targets (see Fig. 6).

Moderation by Perceiver Masking Attitudes

The interaction between perceiver masking attitudes and target masking was significant, such that those with more positive masking attitudes showed greater effects of masking (see Fig. 7, Table 4). This effect furthermore held when modelling interactions between masking attitudes, target masking, target race, and trait (see OSF <https://osf.io/8eydg/files/x62w7>), in contrast to Study 1 (there were also no outliers in Study 3).

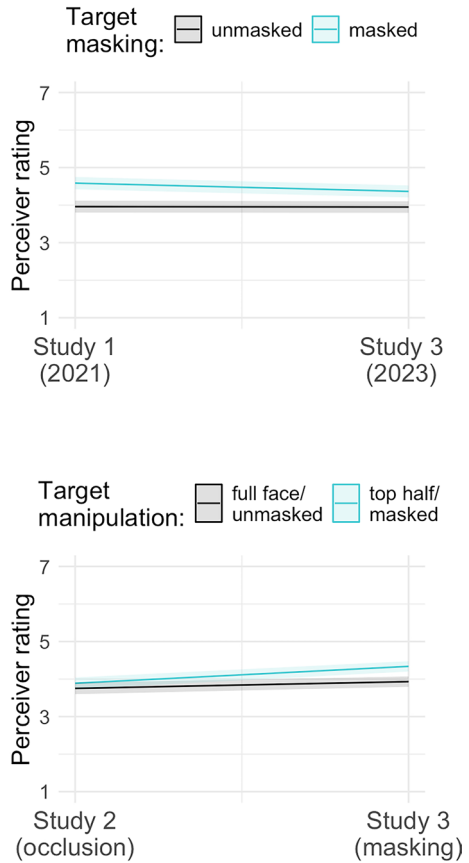
Comparisons Across Time and Manipulations

Masking, trait, and timepoint We compared effects of masking across Studies 1 and 3. We tested a model with target masking (unmasked = -0.5, masked = 0.5), trait (responsibility = -0.5, trustworthiness = 0.5), timepoint/study (2021/Study 1 = -0.5, 2023/Study 3 = 0.5), and their interaction predicting ratings, with random intercepts for targets and perceivers and random slopes for target masking (grouped by target and perceiver), trait (grouped by perceiver), and their interaction (grouped by perceiver).⁸ This revealed main effects of target masking (masked > unmasked) and trait (responsibility > trustworthiness), and an interaction between masking and trait (greater effect of masking for responsibility than trustworthiness; see Table S3 for full model estimates). Most central, there was an interaction between masking and timepoint, $b = -0.21$, $SE = 0.10$, 95% CI [-0.41, -0.01], $t = -2.07$, $p = 0.04$, such that effects of masking were greater in 2021 (Study 1) than 2023 (Study 3; see Fig. 8, upper panel; see also Fig. S5 for perceiver-level plot).

Masking, race, and timepoint We further modeled, in an unplanned step, target masking, target race, timepoint/study, and their interaction as predictors of perceiver ratings, with random intercepts for targets and perceivers and random slopes for target masking (grouped by target and perceiver), target race (grouped by perceiver), and their interaction (grouped by perceiver). Main effects of masking (masked > unmasked) and target race

⁸In this and the next model, including a random slope for timepoint led to singular fit. This random slope furthermore accounted for the smallest amount of variance, so we removed it from the models. Note that the fixed effects (including significance) do not differ between the models we report here and the original models with more complex random slopes.

Fig. 8 Masking effects over time in studies 1 and 3 (upper panel) and occlusion/cropping Vs. masking effects in studies 2 and 3 (lower panel). note. shaded bands represent 95% CIs



(both contrasts; Black and Asian > White), and interactions between masking and timepoint (masking effects in 2021 > 2023) and masking and race (both contrasts; masking effects for White targets > Black and Asian targets) emerged (see Table S4 for full model estimates). Crucially, the interactions between timepoint and race and between timepoint, masking, and race were not significant, $bs \leq |0.10|$, $ts \leq |1.28|$, $ps \geq 0.20$. This could suggest that the discrepancies in the significance of race effects between Studies 1 and 3 (e.g., interaction between masking and the Asian vs. White contrast in Study 3 but not Study 1) may not be particularly meaningful. Rather, the overall pattern across the two studies indicates a stronger effect of masking for White than Black and Asian targets.

Manipulation type In a final unplanned step, we also tested whether masking in Study 3 had a greater effect than occlusion/cropping in Study 2, by aggregating across the data from these studies and testing manipulation, manipulation type, trait, and their interaction as predictors of ratings. As with the Study 1 and Study 2 data, manipulation and manipulation type interacted, $b = 0.28$, $SE = 0.07$, 95% CI [0.14, 0.42], $t = 3.84$, $p < 0.001$, such that the effect of masking in Study 3 was greater than the effect of occlusion/cropping in Study 2 (Fig. 8, lower panel; see also Fig. S5 for perceiver-level plot and Table S5 for full model estimates).

Discussion

Over two years after Study 1, we replicated the positive effect of masking on trustworthiness and responsibility judgments. This effect was, however, smaller than it was in Study 1, in line with other recently-published findings (Oldmeadow & Gogan, 2024; Tumino et al., 2024). This suggests that the social signal conveyed by masks has dampened over time. This is perhaps unsurprising due to the emergence and spread of other preventative measures against COVID (i.e., vaccination), lowered infection and death rates, decreased media focus, overall reduced salience of COVID in 2023 compared to 2021, and polarization of masking attitudes (Powdthavee et al., 2021).

We additionally found an interaction between masking and target race, such that masking had a smaller effect on impressions of Black and Asian faces, compared to White faces. The observed interaction between masking and race is in line with Stosic et al., (2024; mostly-White perceiver sample) and Oldmeadow and Koch (2021; perceiver race/ethnicity not reported), who respectively found the magnitude of masking effects on trait impressions to be stronger for White than Asian and Black faces. The pattern of our interaction is also consistent with Kawakami et al., (2023; with mostly White perceivers) and Oldmeadow and Koch's (2021), with interactions between masking and race driven by more negative impressions of unmasked White faces. Our observed interaction could thus be interpreted as less a reflection of ingroup *favoritism* for masking behavior, but rather harsher ingroup *punishment* for failing to wear a mask (i.e., violating a social norm, van Kleef et al., 2015, see also the Black Sheep Effect, Marques et al., 1988).

We found that perceivers' attitudes toward masking predicted differences in their evaluations of masked compared to unmasked faces' responsibility and trustworthiness. Those with more positive masking attitudes showed a greater positive difference in ratings between masked and unmasked targets. This aligns with Oldmeadow and Gogan's (2024) findings (for masking attitudes and trustworthiness ratings of faces) from a similar timepoint (2022 and 2023, albeit in Australia). This pattern appeared more robust than in Study 1, suggesting that individual masking attitudes may have become more reliably predictive of evaluations of masked and unmasked faces. In the time between data collection for Study 1 (early 2021) and Study 3 (mid 2023), COVID-19 vaccinations became prevalent, and infection and death rates dropped substantially (CDC, 2025). Possibly reflecting this and suggesting that masks seemed less essential in 2023 than 2021, scores on the masking attitudes scale were notably lower (and not as close to ceiling) in Study 3 than in Study 1 (see Table 1 and Supplementary Information).

Finally, consistent with Study 1, we again found the effect of masking to exceed the effect of occlusion/cropping found in Study 2. Thus, although the magnitude of masking effects decreased between 2021 and 2023, it consistently remained greater than that of occlusion.

General Discussion

In three studies, we comprehensively tested the impact of medical face masks on perceptions of the trustworthiness and responsibility of White, Black, and Asian target faces, exploring social and perceptual explanations for masks' effects. We did so at multiple timepoints, during and after the height of the global COVID-19 pandemic. This work extends a host of

studies that have been published in the last few years. Most such studies have found that face masks boost the perceived trustworthiness of faces. Here, we confirmed this general finding and found that perceptions of responsibility (strongly intercorrelated with perceptions of trustworthiness) are also benefitted by mask-wearing. We added to the generalizability of this work by including perceptions of Asian, Black, and White targets. Further, we gathered evidence indicating that the positive effect of masking on trustworthiness and responsibility perceptions is partially, but not fully, explained by the obscuring of the lower face, regardless of the social and health implications of wearing a surgical mask. Finally, we observed that the positive benefit of masking on these trait evaluations was moderated by both perceivers' masking attitudes and temporal context, with masking effects declining between 2021 and 2023 in our study population of U.S. adults.

The patterns we observed varied in magnitude by target race, such that the effect of masks on perceptions of responsibility and trustworthiness tended to be greater for White targets. This could be interpreted as an ingroup effect, due to the majority-White perceiver samples. However, these differences appear primarily driven by especially *low* evaluations of unmasked White faces, rather than especially high evaluations of masked White faces, and we did not find significant interactions with perceiver race in exploratory analyses (see Supplementary Information). It is possible that White and non-White perceivers alike punished White unmasked targets, but we also note that the magnitude of the interaction between target race and masking was much weaker than the main effect of masking itself. Further, White faces were rated less positively than Asian and Black faces in Study 2, a study that did not involve masks at all. Perhaps the most parsimonious explanation for the observed race effects is that the participants we sampled did not respond particularly positively to White targets at baseline, and that the relative negative perceptions of these faces were mitigated by the presence of masks.

In general, these findings are consistent with much of the recent body of work on perceptions of masked faces in the COVID-19 era. Various papers have found that masks result in more positive social judgments (e.g., Cartaud et al., 2020; Di Crosta et al., 2023; Guo et al., 2022; Oldmeadow & Koch, 2021; Olivera-La Rosa et al., 2020) despite objectively impeding perceptual access to facial information. There has been some question, however, as to whether this effect is separable from the effect of occluding the lower portion of the face, which has resulted in higher trustworthiness judgments in previous research (Santos & Young, 2011). Some recent work found the effect of masking to be similar to the effect of merely occluding the lower face (e.g., Oliveira & Garcia-Marques, 2022). Other work using a different technique (replacing the lower face with a laptop; Oldmeadow & Gogan, 2024) resulted in lower trustworthiness ratings for occluded faces than masked faces. Here, we obtained similar results using a method that more straightforwardly removes the lower face. Comparing Studies 1 and 2, as well as Studies 3 and 2, the positive effect of masking was larger than that of face occlusion, indicating that the effect of masking is not solely due to the absence of the lower face, but also to the presence of masks. Combined with the finding that perceivers with more positive attitudes towards masking showed greater differences in their evaluations of masked and unmasked faces, these results clarify that *both* bottom-up perceptual and top-down social explanations underlie surgical masks' positive effects on perceived trustworthiness and responsibility.

Another contribution of the present work is the analysis of potential change over time, from the pre-vaccination peak period of COVID-19 in early 2021 to mid-2023. By this later

timepoint, the World Health Organization had declared an end to the global pandemic and mask-wearing was much less common throughout most of the world than it had been two years prior (World Health Organization, 2023). We found that the effect of mask-wearing did change over time, with weaker effects in 2023 than 2021. It is likely that this change in the perceived trustworthiness and responsibility of individual targets tracks with perceivers' own attitudes and mask-wearing behaviors. Indeed, in Study 3, perceivers' mean pro-mask attitudes were less positive and moderated the effect of target masking on responsibility and trustworthiness ratings more robustly, compared to in 2021.

Finally, our examination of perceived responsibility alongside trustworthiness revealed that, although judgments of the two traits correlated strongly, perceptions of responsibility were more affected by masking (as seen in Study 1 and the aggregate analysis of Studies 1 and 3). This pattern did not appear for occlusion in Study 2, indicating that perceptions of responsibility may be more closely tied to masks' social meaning than perceptions of trustworthiness are. These traits both share conceptual overlap and are judged similarly from faces (Stolier et al., 2018), but masking may serve as a more direct signal of responsibility (e.g., due to public health messaging around masking or associations with normative behavior) than of trustworthiness (which individuals may associate more with reliable or honest behavior).

Limitations and Future Directions

We designed these studies with a focus on exploring effects of target race, but not perceiver race. Thus, although perceivers viewed a relatively diverse group of target faces, the perceiver samples were majority-White in each study. Our interpretations of interactions between masking and target race (e.g., ingroup effects) therefore remain speculative. Future work could more systematically test for interactions between perceiver and target race with balanced samples of perceivers to better illuminate the mechanisms underlying moderations of masking effects by race. Relatedly, future research could directly measure possible mechanisms, including perceivers' stereotyping (e.g., of Asian foreignness, Black threat), relevant norm perceptions, and ingroup favoritism or punishment. It could also be useful to cross target and perceiver race with mask type (e.g., surgical mask, bandanna) to build on some of the previous work that illuminated how certain negative racial stereotypes might be particularly strongly activated by the presence of non-medical facial coverings (Christiani et al., 2022). More broadly, examining perceptions of masks worn for non-health reasons and conveying different social meanings (e.g., among Immigration and Customs Enforcement agents or protestors; McFadden, 2025; Tucker, 2025) remains a fruitful avenue for future research.

Although testing participants at different timepoints during the pandemic (2021 in Study 1, 2023 in Study 3) represents a strength of this work, the literature would benefit from more systematic testing of the trajectory of the social perception of mask-wearers. The present work cannot yield causal conclusions regarding the specific factors that produced the different results we observed across studies, due to the numerous changes in the broader social context between the two timepoints (e.g., vaccine availability, political polarization around masking). Indeed, this was neither the aim nor within the scope of this work. Future research interested in social perceptions across time (mask-related or otherwise) could consider employing longitudinal designs, testing more than two timepoints, measuring more

specific attitudes (e.g., toward particular policies), and collecting relevant local contextual information (e.g., regional infection rates, in the case of medical masks).

Conclusion

This work contributes to the recent body of literature on perceptions of masked faces since the COVID-19 pandemic. Consistent with much of the previous research, we found that targets depicted wearing a surgical mask were perceived as more trustworthy and responsible than unmasked targets. This advantage was larger than the advantage that we observed from merely removing the lower half of the face, and it was not only a function of positive pro-masking attitudes. Among our American, majority-White sample, target race moderated the impact of face masks, such that White targets benefitted more from masks compared to Asian and Black targets. Finally, the benefit of masking did diminish over time. This latter finding is consistent with a concomitant reduction in societal masking and pro-mask attitudes and changes in public health conditions (e.g., prevalence of infection). Overall, our work provides evidence that there are both perceptual and social factors influencing perceivers' assessments of masked faces. The benefit of masking has apparently ebbed as COVID-19 has faded as a public health emergency, but such findings remain relevant as we consider how society will respond to future public health crises. These results may additionally serve as a useful point of comparison for investigations of perceptions of face coverings with different purposes and social meanings.

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Data Availability All data and analysis scripts are available on the Open Science Framework at <https://osf.io/8eydg/>.

Declarations

Conflict of interest The authors declare no competing interests.

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