Effects of Mask Use and Race on Face Perception, Emotion Recognition, and Social Distancing During the COVID-19 Pandemic

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Article

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Abstract

This investigation used three experiments to test the effect of mask use and other-race effect (ORE) on face perception in three contexts: (a) face recognition, (b) recognition of facial expressions, and (c) social distance. The first, which involved a matching-to-sample paradigm, tested Caucasian subjects with either masked or unmasked faces using Caucasian and Asian samples. The participants exhibited the best performance in recognizing an unmasked face condition and the poorest when asked to recognize a masked face that they had seen earlier without a mask. Accuracy was also poorer for Asian faces than Caucasian faces. The second experiment presented Asian or Caucasian faces having different emotional expressions, with and without masks. The results for this task, which involved identifying which emotional expression the participants had seen on the presented face, indicated that emotion recognition performance decreased for faces portrayed with masks. The emotional expressions ranged from the most accurately to least accurately recognized as follows: happy, neutral, disgusted, and fearful. Emotion recognition performance was poorer for Asian stimuli compared to Caucasian. Experiment 3 used the same participants and stimuli and asked participants to indicate the social distance they would prefer to observe with each pictured person. The participants preferred a wider social distance with unmasked faces compared to masked faces. Social distance also varied by the portrayed emotion: ranging from farther to closer as follows: disgusted, fearful, neutral, and happy. Race was also a factor; participants preferred wider social distance for Asian compared to Caucasian faces. Altogether, our findings indicated that during the COVID-19 pandemic face perception and social distance were affected by mask use, ORE.

Introduction

The face provides a rich source of information about its owner's gender, race, age, physical health, attractiveness, and emotional state. However, following the spread of the COVID-19 pandemic throughout the globe, humans' daily routines have changed, involving three major precautions: face-mask wearing, hand washing, and social distancing. Two of these precautions—using face masks and maintaining social distance—affect individuals' perceptions of faces due to the associated restriction of their visual field.

Masks cover specific areas of the face, including the nose, mouth, chin, and most of the cheeks. Before the current pandemic, prior research had focused on the impairing effects of facial parts occlusion in the context of face recognition and recognition of emotional expressions. For example, Bassili (1979) demonstrated negative effects resulting from the partial occlusion of the face using a cardboard rectangle. According to the researcher's findings, occlusion of the "lower-facial" part negatively affected participants' ability to recognize happiness and sadness. In contrast, recognition of anger, which mostly relies on the eye region, was less affected. Another study (Roberson et al., 2012) using sunglasses and masks as partial occluders showed that occlusion decreased emotion recognition performance. In a similar vein, Dhamecha et al. (2014) indicated that hiding facial parts with accessories such as glasses and masks impaired face recognition ability since they reduced subjects' uniqueness. The authors also found recognition accuracy was better for faces from the same ethnicity of the participants. Other studies investigated the effects of covering the face and head in the context of the Islamic headdress (Fischer et al., 2012; Megreya & Bindemann, 2009; Toseeb et al., 2014) Headscarves which covers external features such as hair did not influence face recognition dramatically while Fisher et al. (2012) shown that wearing niqab which covers some internal facial areas such as mouth and nose impaired positive emotion recognition but not negative emotion recognition. Kret and De Gelder (2012) indicated that although the expressions of fear and anger were still recognizable in the niqab and two different burqa conditions (20% and 10% transparency conditions), reduced accuracy was observed for happy and sad expressions in all of these conditions. A more recent study, researchers (Noyes et al., 2021) investigated the effects of masks and sunglasses on familiar and unfamiliar face-matching and emotion categorization performance in super-recognizers and control subjects. The researchers found that although super-recognizers' accuracy in performance was higher than that of the controls, both masks and sunglasses reduced subjects' performance in all of the experimental tasks.

Multiple studies have shown that an individual's face recognition system depends on holistic processing rather than partial characteristics of faces (Farah et al., 1998; Tanaka & Farah, 1993; Yin, 1969; Young et al., 1987). More recently, Freud et al. (2020) showed that face recognition performance and holistic face processing decreased when participants were exposed to faces with masks during the COVID-19 pandemic. Another recent study (Carragher & Hancock, 2020) found that surgical face masks decreased human face matching performance, and the impairment is similar for both familiar and unfamiliar faces. While Carbon (2020) focused on the effects of face masks on emotion recognition and indicated that although face masks reduced participants' recognition accuracy for some emotions (angry, disgusted, happy, and sad), neutral and fearful faces were still recognizable when masked.

Although previous studies have shown that mask use decreases the recognition of faces and emotional expressions, how mask use affects individuals' perceptions of faces from other races remains unclear. In 2001, Meissner and Brigham defined “own-race bias” (ORB) as humans' ability to recognize own-race faces better than other-race faces. ORB has also been shown to affect the holistic face processing system (Michel et al., 2006; Tanaka et al., 2004). Since people perceive faces holistically, facial identification is remarkably more efficient for faces that share the same environment as the viewer while less powerful regarding the faces of other ethnicities that viewers have less experience with (Hancock & Rhodes, 2008; Tanaka et al., 2004). Moreover, some studies have shown that exposure to the faces of people from other ethnic groups plays a critical role in facial recognition for other-race faces. For example, Heron-Delaney et al. (2011) demonstrated that increased exposure to faces belonging to other races could reduce the other-race effect in infants. On another note, Cavazos et al. (2018) observed the interaction effects of expertise and socio-cognitive factors in their study, finding that Caucasian participants demonstrated own-race advantages in a multi-image learning task, while East Asian participants showed enhanced learning for other-race identities during a matching task. Dal Martello and Maloney (2006) showed that upper face side (mostly eye region) contributed kin recognition more than the lower face side. To our knowledge, no existing study has investigated whether mask use affects ORB. Accordingly, the current study examines other-race effects in processing faces with masks in addition to face recognition and recognition of emotional expressions.

Social distancing after the COVID-19 pandemic is the second factor that this study considers. In humans, detecting the identity of another person and interacting usually begin with face perception. People can quickly identify whether a person is familiar or unfamiliar or a threat or not due to humans' superior face recognition ability. Thus, individuals may tend to remain close to someone or keep their distance from others depending on their perception of others as friends or threats. In one prior study, after collecting data from 42 countries, Sorokowska et al. (2017) showed that average interpersonal distance varied based on the type of distance, with an average of 135.1 cm for social distance. The participants' gender and country's average temperature also served as factors that predicted the preferred social distance. The researchers' results revealed that people prefer to be closer to strangers in warmer countries while preferring to be farther from their partners. Nevertheless, the emergence of the COVID-19 pandemic caused people to readjust their preferred interpersonal distances to avoid exposure to the virus. Although health authorities have suggested that social distancing is a pro-social behavior in response to COVID-19, involving separation of at least 1.5–2 meters (Chu et al., 2020), some researchers have noted that this minimum distance conflicts with people's norms (Welsch et al., 2020).

Since the emergence of COVID-19, masked faces have come to be associated with the "pandemic" situation. Hence, face masks may be considered an essential signal for adjusting social distance with others. Until the COVID-19 pandemic, only people who had particular medical reasons wore face-covering masks in public. Therefore, at the beginning of the COVID-19 pandemic, wearing facemasks might have led to a negative perception of mask wearers. However, once health authorities informed the public that facial masks increased the protection against COVID-19, mask use became more prevalent, potentially leading to a more positive perception of individuals wearing masks.

In summary, facial masks may pose a threat or a safety signal to adjust social distance with other people. One recent study demonstrated that wearing a facial mask reduced social distancing (Cartaud et al., 2020). In that study, the participants' perceptions toward people wearing facial masks changed as they considered the latter safer than non-mask wearers. Another variable that masks might affect and that might modulate social distancing is the perception of risk. For example, a recent study conducted with Chinese residents demonstrated that social distancing behavior significantly increased with increasing perceived risk (Xie et al., 2020). On the other hand, emotional expression studies have demonstrated that behaviors that are linked to social distance depend on the ability to perceive other people's facial expressions. For instance, one study demonstrated that perceiving positive emotions (such as happiness) rather than negative emotions (e.g., anger) led to a reduced social distance toward other people (Ruggiero et al., 2017). Since a mask covers part of the wearer's face, mask wearing potentially detracts from recognizing emotional expressions. Presumably, people seek to adjust their social distance to avoid virus exposure, a process that may also be influenced by mask use, emotional expressions, and the race of the other person.

In light of these new conditions during the COVID-19 pandemic, we conducted three experiments with Caucasian participants to test the effect on face perception of mask use and other-race effect in three contexts: (a) how mask use influences face recognition, (b) how mask use influences the recognition of facial expressions, and (c) how mask use interacts with the facial expression and race of the other person to influence social distance. The first experiment used a matching to sample paradigm. Masked or unmasked faces from the same or different races were presented as samples; the subjects were tested with both masked or unmasked faces. In the second experiment, faces from the same or different races with the participants and with and without masks were presented having different emotional expressions, and the participants were asked to identify which emotional expression they saw. In Experiment 3, following the second experiment, the same faces with and without masks were shown individually, and the participants in Experiment 2 were asked to indicate the social distance they preferred to maintain with that person.

Experiment 1

Method

Participants

A total of 102 undergraduate students (80 females and 22 males) with a mean age of 20.4 years (M = 20.4, SD = 2.8) participated in the study. They had no neurological or psychological disorders, nor were they receiving any medical treatment at the time of the research, according to their self-report.

The study was approved by the Akdeniz University Ethical Committee for Social Sciences.

Procedure

Stimuli

Twenty-four Asian and 24 Caucasian facial stimuli (24 female and 24 male) were used from the racially diverse affective expression (RADIATE) face stimulus set (Conley et al., 2018) and the MR2 (a multi-racial mega-resolution database of facial stimuli; Strohminger, 2016). We used neutral faces in Experiment 1. All stimuli were processed using the SHINE toolbox in MATLAB to control luminance and spatial frequency (Dal Ben, 2019). Facial photographs were cropped under the chin region, and a white background was used.

Surgical face mask images were superimposed on all of the facial stimuli using Adobe Photoshop software to create faces with masks. The same surgical face mask image was used for all the masked stimuli. The mask was positioned to cover each image’s chin, nose, and most of the cheek area. Figure 1 provides two examples of samples with and without the mask.

Experimental Procedure

Experiment 1 involved a matching to sample procedure. A face without a mask was presented, followed by two faces (including the target face). The participants were asked to choose the face that had been presented as a sample. The experimental sessions incorporated four conditions:

1. The sample was an unmasked face; the test faces were also unmasked.
2. The sample face was masked; the test faces were also masked.
3. The sample face was unmasked, but the test faces were masked.
4. The sample face was masked, but the test faces were unmasked.

Figure 2 illustrates all four experimental conditions. Nine practice trials were conducted before the original experimental trials. The participants received feedback in the practice trials. A total of 80 experimental trials were conducted. The stimuli were presented in a pseudo-random order.

A fixation cross was presented for 500 ms. Next, the sample face was presented for 500 ms. Following the sample face, two faces were presented for 800 ms, and the participants were asked to decide which face was the sample. The participants pressed "1" on the keyboard to choose the stimulus on the left side of the screen and "0" to choose the stimulus on the right side of the screen. No feedback was given in the experimental trials. Figure 3 illustrates the experimental procedure.

Due to the pandemic conditions, data collection employed an online platform. Fifty participants were tested using the online experiment platform Testable, and 52 participants were tested via E-Prime Go. The same procedures were applied on both platforms. Participants' responses and accuracy were recorded.

Results

Accuracy

A 4 × 2 × 2 (mask conditions [(1) unmasked sample–unmasked test, (2) masked sample–masked test, (3) unmasked sample–masked test, (4) masked sample–unmasked test] × race [Asian, Caucasian] × sex [female, male]) repeated measures ANOVA was conducted to determine the effects of mask conditions, race, and sex of facial stimuli on discrimination accuracy. Since the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. Table 1 displays the within-subject factor results, which indicate a significant main effect of race. Accuracy for Caucasian faces (n = 102, M = .96, SD = .08) was higher than for Asian faces (n = 102, M = .92, SD = .09; see also Figure 4a). The mask condition also had a significant effect on accuracy (Figure 4b). The participants demonstrated the highest performance when they were shown an unmasked sample and tested with unmasked faces. In comparison, they produced the worst performance when shown an unmasked sample and tested with masked faces. Table 2 presents descriptive statistics for mask conditions. Bonferroni pairwise comparison results appear in Table 3. The main effect of sex of the stimulus was not significant (p > .05).

Table 1

Repeated Measures ANOVA Results for Accuracy

Predictor	df_{Num}	df_{Den}	*Epsilon*	SS_{Num}	SS_{Den}	*F*	*P*	ηp^2
Intercept	1	101		1440.38	10.27	141.25	.000	.99
Race	1	101	1	.94	1.05	90.28	.000	.47
Mask condition	2.6	263.08	.87	.46	.008	60.79	.000	.38
Race × Mask condition	2.61	263.50	.87	.345	.009	37.84	.000	.27
Sex × Mask condition	2.74	227.49	.92	.261	.009	29.59	.000	.23
Race × Sex × Mask condition	3	303	.95	.131	.008	16.33	.000	.14

Table 2

Descriptive Statistics (Means and Standard Deviations) for Accuracy in Respect to Mask Conditions

	M	*SD*
Unmasked sample–Unmasked test	.97	.09
Unmasked sample–Masked test	.89	.07
Masked sample–Unmasked test	.94	.09
Masked sample–Masked test	.95	.09

Table 3

Results of Bonferroni Pairwise Comparison Tests for Mask Conditions

	UM sample– UM test	UM sample–M test	M sample– UM test	M sample– M test
UM sample–UM test				
UM sample–M test	.001			
M sample–UM test	.001	.001		
M sample–M test	.002	.001	n. s.	

Note. UM indicates unmasked faces; M indicates masked faces.

Following the significant interaction of race and mask conditions, two repeated ANOVAs were conducted to determine the effects of mask conditions for Asian and Caucasian faces separately (Table 4, Figure 5). Since the sphericity assumption was violated, the Greenhouse–Geisser corrections were applied in these analyses. Within-subject factor results for Asian faces indicated a significant main effect of the mask condition (Table 4). The participants yielded the highest performance when they were shown an unmasked sample and tested with unmasked faces. Meanwhile, they demonstrated the worst performance when they were shown an unmasked sample and tested with masked faces. Within-subject factor results for Caucasian faces also indicated a significant main effect of the mask condition (Table 4). Pairwise comparison tests indicated that the participants performed better in the unmasked sample–unmasked test condition than they did in all the other conditions. However, the performance difference among the other conditions was not significantly different for Caucasian stimuli. Table 5 presents descriptive statistics for Asian and Caucasian faces, while Tables 6 and 7 display Bonferroni pairwise comparison test results.

Table 4

Results of Separate Repeated Measures ANOVAs for Asian and Caucasian Faces

Predictor	df_{Num}	df_{Den}	*Epsilon*	SS_{Num}	SS_{Den}	*F*	*P*	ηp^2
Intercept	1	101		341.92	3.16	1927.61	.000	.99
Mask conditions for Asian faces	1.02	278.16	.92	1.02	1.34	76.62	.000	.43
Intercept	1	101		378.74	2.50	15280.74	.000	.99
Mask conditions for Caucasian faces	2.34	236.79	.78	.038	.865	4.405	.009	.04

Table 5

Descriptive Statistics [Mean (SD)] for Accuracy with Respect to Race and Mask Conditions

	Asian	Caucasian
Unmasked sample–Unmasked test	0.95 (.11)	0.98 (.08)
Unmasked sample–Masked test	0.83 (.11)	0.96 (.08)
Masked sample–Unmasked test	0.93 (.09)	0.95 (.09)
Masked sample–Masked test	0.94 (.11)	0.96 (.01)

Table 6

Results of Bonferroni Pairwise Comparison Tests for Accuracy Scores for Asian Faces Among Mask Conditions

	Asian–UM–UM	Asian–UM–M	Asian M–UM
Asian UM–UM			
Asian UM–M	.001		
Asian M–UM	.04	.001	
Asian M–M	*ns*	.001	*ns*

Note. UM = unmasked faces; M = masked faces.

Table 7

Results of Bonferroni Pairwise Comparison Tests for Accuracy Scores for Caucasian Faces Among Mask Conditions

	Caucasian–UM–UM	Caucasian–UM–M	Caucasian M–UM
Caucasian UM–UM			
Caucasian UM–M	*ns*		
Caucasian M–UM	.001	*ns*	
Caucasian M–M	.05	*ns*	*ns*

Note. UM = unmasked faces; M = masked faces.

Following the significant interaction of sex and mask conditions, two repeated ANOVAs were conducted to determine the effects of mask conditions for female and male faces separately. Table 8 and Figure 9 display the results, while Tables 10 and 11 provide pairwise comparison test results.

Table 8

Results of Separate Repeated Measures ANOVA for Female and Male Faces

Predictor	df_{Num}	df_{Den}	*Epsilon*	SS_{Num}	SS_{Den}	*F*	*P*	ηp^2
Intercept	1	101		360.47	3.73	9770.44	.000	.99
Mask conditions for female faces	2.68	270.92	.89	.13	1.23	10.35	.000	.09
Intercept	1	101		359.75	1.94	18748.28	.000	.99
Mask conditions for male faces	2.56	258.73	.85	.84	.99	84.54	.000	.46

Table 9

Descriptive Statistics [Mean (SD)] for Accuracy with Respect to Sex and Mask Conditions

	Female	Male
Unmasked sample–Unmasked test	0.96 (.10)	0.97 (.09)
Unmasked sample–Masked test	0.93 (.11)	0.86 (.07)
Masked sample–Unmasked test	0.92 (.12)	0.97 (.08)
Masked sample–Masked test	0.95 (.11)	0.95 (.09)

Table 10

Results of Bonferroni Pairwise Comparison Tests for Accuracy Scores for Female Faces Among Mask Conditions

	Female–UM–UM	Female–UM–M	Female M–UM
Female–UM–UM			
Female –UM–M	.001		
Female M–UM	.001	*ns*	
Female M–M	*ns*	.01	.001

Note. UM = unmasked faces; M = masked faces.

Table 11

Results of Bonferroni Pairwise Comparison Tests for Accuracy Scores for Male Faces Among Mask Conditions

	Male–UM–UM	Male–UM–M	Male–M–UM
Male–UM–UM			
Male–UM–M	.001		
Male–M–UM	*ns*	.001	
Male–M–M	.002	.001	*ns*

Note. UM = unmasked faces; M = masked faces.

Following the three-way interaction of sex, race, and mask condition, four repeated measures ANOVA (Asian female faces, Asian male faces, Caucasian female faces, and Caucasian male faces) were conducted. Table 12 and Figure 7 present the results, while Table 13 provides descriptive statistics.

Table 12

Results of Separate Repeated Measures ANOVA for Asian Female, Asian Male, Caucasian Female, and Caucasian Male Faces

	Repeated measures ANOVA results	Conditions indicating significant differences ($p < .05$)
Asian female	$F(2.65, 267.41) = 5.9$, $p = .001$, $\eta p2 = .06$	1–3, 1–4, 2–3, 2–4
Caucasian female	$F(2.6, 261.68) = 5.36$, $p = .002$, $\eta p2 = .05$	1–4, 2–4, 3–4
Asian male	$F(3, 303) = 137.45$, $p = .001$, $\eta p2 = .58$	1–2, 1–3, 2–3, 3–4
Caucasian male	$F(2.34, 236.79) = 4.41$, $p = .009$, $\eta p2 = .04$	1–2, 1–3, 1–4

Note. 1 = UM sample–UM test, 2 = UM sample–M test, 3 = M sample–UM test, and 4 = M sample–UM test.

Table 13

Descriptive Statistics [Mean (SD)] for Accuracy With Respect to Race, Stimulus Sex, and Mask Condition

	C1 (Unmasked sample–Unmasked test)	C2 (Masked sample–Masked test)	C3 (Unmasked sample–Masked test)	C4 (Masked sample–Unmasked test)
Asian female	.95 (.13)	.94 (.13)	.89 (.19)	.90 (.13)
Asian male	.97 (.12)	.95 (.12)	.77 (.09)	.97 (.11)
Caucasian female	.98 (.11)	.97 (.12)	.96 (.11)	.94 (.14)
Caucasian male	.98 (.09)	.96 (.11)	.96 (.09)	.97 (.08)

Experiment 2

Method

Participants

A total of 134 undergraduate students (105 females and 29 males) with a mean age of 21 years (M = 21.3, SD = 1.6) participated in the study. They had no neurological or psychological disorders, nor were they receiving any medical treatment at the time of the research, according to their self-report. All participants were tested using the online experiment platform Testable.

The study was approved by Akdeniz University Ethical Committee for Social Sciences.

Experimental Procedure

Stimuli

Facial stimuli were chosen from the racially diverse affective expression (RADIATE) face stimulus set. In total, we used eight Asian (four female, four male) and eight Caucasian (four female, four male) faces. Four emotional expressions (neutral, happy, fear, and disgust) were used among the 16 faces. Since our aim was to test the effect of mask use on emotion recognition, surgical face mask images were superimposed on all facial stimuli using Adobe Photoshop software, as in Experiment 1. The same surgical face mask image was used for all the stimuli. In total, we had 128 experimental stimuli: 64 unmasked faces and 64 masked versions of those faces.

A fixation cross was presented for 500 ms. Next, a neutral face or a face with an emotional expression (happy, fear, disgust) was presented on the center of the screen for 1,000 ms. The participants were asked to indicate which expression appeared on the presented face. Figure 8 illustrates the experimental procedure.

Eight practice trials were conducted before starting the test trials. The experiment consisted of 128 trials in total. The stimuli were presented in pseudo-random order. No feedback was given in the experimental trials. Response accuracy was measured as the dependent variable.

Results

Accuracy

A 2 × 2 × 2 × 4 (mask conditions [unmasked, masked] × race [Asian, Caucasian] × sex [female, male] × emotion [neutral, happy, fear, disgust]) repeated measures ANOVA was conducted to determine the effects of mask wearing, emotions, race, and sex of facial stimuli on discrimination accuracy. Table 14 presents within-subject factor results. Since the sphericity assumption was violated, the Greenhouse–Geisser correction was applied in the required analysis. The results indicated a significant main effect of mask, race, emotion, and stimulus sex (Figure 9).

Table 14

Repeated Measures ANOVA Results for Accuracy

Predictor	df_{Num}	df_{Den}	*Epsilon*	SS_{Num}	SS_{Den}	*F*	*p*	ηp^2
Intercept	1	132		1770.19	24.78	9428.55	.000	.99
Sex	1	132	1	1.25	5.67	28.95	.000	.18
Race	1	132	1	18.65	6.23	395.35	.000	.75
Emotion	2.74	361.1	.91	93.18	59.98	205.06	.000	.61
Mask	1	132	1	43.38	7.25	789.96	.000	.86
Race × Sex	1	132	1	3.83	6.008	84.18	.000	.39
Race × Emotion	2.51	331.4	.90	5.59	16.49	44.75	.000	.25
Sex × Emotion	2.51	331.4	.84	5.61	17.40	42.52	.000	.24
Race × Sex × Emotion	2.51	331.2	.84	2.55	15.90	21.19	.000	.14
Sex × Mask	1	132	1	.50	3.79	17.45	.000	.12
Race × Sex × Mask	1	132	1	.88	4.02	28.89	.000	.18
Emotion × Mask	2.94	388.7	.98	33.88	21.24	210.52	.000	.62
Race × Emotion × Mask	2.67	352.9	.89	1.42	15.58	12.07	.000	.08
Sex × Emotion × Mask	2.66	351.4	.89	1.08	14.03	10.16	.000	.07
Race × Emotion × Mask × Sex	2.85	376.6	.95	.93	12.18	10.02	.000	.07

Table 15

Descriptive Statistics [Mean (SD)] for Discrimination Accuracy Related to Emotion, Mask Condition, Race, and Stimulus Sex

	Neutral unmasked	Neutral masked	Happy unmasked	Happy masked	Fear unmasked	Fear masked	Disgust unmasked	Disgust masked
Asian female	.64 (.52)	.66 (.24)	.94 (.17)	.66 (.23)	.44 (.22)	.71 (.22)	.74 (.19)	.28 (.26)
Asian male	.80 (.23)	.76 (.24)	.90 (.20)	.60 (.24)	.36 (.27)	.25 (.24)	.69 (.19)	.16 (.17)
Caucasian female	.75 (.24)	.59 (.18)	.96 (.17)	.84 (.25)	.52 (.26)	.41 (.26)	.83 (.18)	.39 (27)
Caucasian male	.79 (.20)	.86 (.19)	.94 (.19)	.78 (.23)	.64 (.21)	.66 (.28)	.97 (.12)	.44 (.22)

After observing the significant interaction of race and sex, we conducted two separate repeated measures ANOVA for Asian and Caucasian faces. The results indicated that the participants' performance was better for male Caucasian faces (n = 134, M = .76, SD = .09) than female Caucasian faces (n = 134, M = .66, SD = .10), $F(1, 133) = 6.44$, p = .012, ηp2 = .05. In contrast, their performance was better for female Asian faces (n = 134, M = .59, SD = .11) than male Asian faces (n = 134, M = .56, SD = .09), $F(1, 133) = 133.21$, p = .001, ηp2 = .50 (Figure 10).

Based on our observation of an interaction effect of race and emotion on discrimination accuracy, we conducted two separate repeated measures ANOVA for Asian and Caucasian faces. The results indicated that emotion had a significant effect on discrimination accuracy for both Caucasian faces, $F(3, 399) = 82.8$, p = .001, ηp2 = .38, and Asian faces, $F(3, 399) = 205.65$, p = .001, ηp2 = .61. Bonferroni corrected pairwise comparison tests indicated that the discrimination scores for each of the Asian and Caucasian expressions differed significantly, $p < .05$. Discrimination scores for all emotional expressions were higher for Caucasian faces than Asian faces (Table 16, Figure 11).

Table 16

Descriptive Statistics [Mean (SD)] for Accuracy Related to Emotion and Race

	Happy	Neutral	Disgust	Fear
Asian	.79 (.16)	.71 (.21)	.47 (.12)	.34 (.16)
Caucasian	.83 (.17)	.75 (.14)	.66 (.12)	.56 (.18)

Seeing the interaction effect of emotion and sex, we conducted two separate ANOVA for female and male faces. The results indicated that the discrimination accuracy for different emotions were significantly different for female, $F(3, 399) = 167.45$, $p = .001$, ηp2 = .56, and male faces, $F(3, 399) = 168.86$, $p = .001$, ηp2 = .56. Bonferroni corrected pairwise comparison tests indicated that the participants' discrimination scores for each emotional expression using female faces were significantly different, $p < .05$. In comparison, discrimination scores for happy and neutral male faces were not significantly different, $p > .05$, while the differences related to the other expressions were significant, $p < .05$ (Table 17).

Table 17

Descriptive Statistics [Mean (SD)] for Accuracy Regarding to Emotion, and Stimulus Sex

	Neutral	Happy	Fear	Disgust
Female	.66 (.20)	.87 (.17)	.43 (.16)	.56 (.14)
Male	.80 (15)	.81 (.17)	.48 (.17)	.57 (.10)

Based on the interaction effect of emotion and mask wearing on accuracy, two repeated measures ANOVA were conducted to reveal the effects of emotion on accuracy for masked and unmasked faces. A Greenhouse–Geisser correction was applied. The results indicated that the participants' emotion recognition performance for unmasked faces was significantly different than their performance for each emotion for unmasked faces, $F(2.56, 340.55) = 179.99$, $p = .001$, ηp2 = .58. The range of expressions from most recognized to least recognized was happiness, neutral, disgust, and fear. The repeated measures ANOVA results for masked faces indicated that the participants' emotion recognition performance was also significantly different for each emotion, $F(3, 399) = 228.1$, $p = .001$, ηp2 = .63. Although the same recognition pattern was valid for masked faces (happiness > neutral > disgust > fear), the difference between the happiness and neutral expressions was not statistically significant, $p > .05$.

In addition, we conducted paired *t*-tests to compare recognition performance for masked and unmasked faces. The results indicated that accuracy for each expression decreased when seen with masks, neutral $t(133) = 1.94$, $p = .05$; happiness $t(133) = 15.29$, $p = .001$; fear $t(133) = 6.15$, $p = .001$; disgust $t(133) = 15.29$, $p = .001$ (Figure 13).

We found a significant interaction of race, sex, and mask. Therefore, a repeated measures ANOVA was conducted to determine the significant differences among the accuracy scores for those conditions. Since the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. We found a significant difference among the conditions, $F(5.73, 761.47) = 239.684$, $p = .001$, ηp2 = .64 (Figure 14). Accuracy for unmasked Caucasian male faces was significantly higher than for the other stimulus types. The second most accurately identified stimulus type was Caucasian female faces. On the other hand, accuracy responses for masked Asian male faces were significantly worse than for all the other stimulus types. The second worst performance was for masked Asian female faces. Table 18 displays the results of the Bonferroni pairwise test. Most of the differences among the conditions were significant, $p < .05$. However, the accuracy of responses for masked male Caucasian faces was not significantly different from that for unmasked male and female Asian faces.

Table 18

Results of Bonferroni Pairwise Comparison Tests for Accuracy Scores Among Race, Sex, and Mask Conditions

	Asian–Male	MAsian–Male	Caucasian–Male	MCaucasian–Male	Caucasian–Female	MCaucasian–Female	Asian–Female
Asian–Male							
MAsian–Male	.001						
Caucasian–Male	.001	.001					
MCaucasian–Male	*ns*	.001	.001				
Caucasian–Female	.001	.001	.001	.001			
MCaucasian–Female	.001	.001	.001	.001	.001		
Asian–Female	*ns*	.001	.001	*ns*	.001	.001	
MAsian–Female	.001	.001	.001	.001	.001	.001	.001

Note. M = masked faces.

We found a significant interaction effect for race, sex, and emotion. Therefore, a repeated measures ANOVA was conducted to determine the significant differences among the accuracy scores for those conditions. Since the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. We found a significant difference among the conditions, $F(7.7, 1022.08) = 134.03$, $p = .001$, $\eta p2 = .50$ (Figure 15). The participants appeared to recognize the Caucasian expressions better than Asian expressions. That said, the recognition performance for neutral faces was not significantly different between female Asian and Caucasian faces. The same pattern was observed for neutral male Asian and Caucasian faces. The least accurately recognized expression was fear for both female and male Asian faces.

Table 19

Results of Bonferroni Pairwise Comparison Tests for Accuracy Scores Among Race, Sex, and Emotion Conditions

	AM NEUT	CM NEUT	AF NEUT	CF NEUT	AM HAPPY	CM HAPPY	AF HAPPY	CF HAPPY	AM FEAR	CM FEAR	AF FEAR	CF FEAR	AM DISG	CM DISG	AF DISG
AM NEUT															
CM NEUT	*ns*														
AF NEUT	.001	.001													
CF NEUT	.001	001	*ns*												
AM HAPPY	*ns*	.001	*ns*	*ns*											
CM HAPPY	.04	*ns*	.001		.001										
AF HAPPY	*ns*	*ns*	.001	.001	.001	*ns*									
CF HAPPY	.001	.02	.001	.001	.001	.007	.001								
AM FEAR	.001	.001	.001	.001	.001	.001	.001	.001							
CM FEAR	.001	.001	*ns*	.001	.02	.001	.001	.001	.001						
AF FEAR	.001	.001	.001	.001	.001	.001	.001	.001	.03	.001		.			
CF FEAR	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001				
AM DISG	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	*ns*	*ns*			
CM DISG	.04	.001	*ns*	*ns*	*ns*	.001	.001	.001	.001	*ns*	.001	.001	.001		
AF DISG	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	*ns*	.001	.001	
CF DISG	*ns*	.001	*ns*	*ns*	.001	.001	.001	.001	.001	*ns*	.001	.001	.001	.001	.001

Note. AM = Asian male, AF = Asian female, CM = Caucasian male, CF = Caucasian female; NEUT = neutral, DISG = disgust.

Upon observing the significant interaction of race, emotion, and mask wearing, we conducted a repeated measures ANOVA to determine the significant differences among the accuracy scores for those conditions. Since the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. We found a significant difference among the conditions, $F(7.98, 1061.48) = 197.56$, $p = .001$, $\eta p2 = .60$ (Figure 16). Table 15 presents Bonferroni pairwise comparison test results. The best recognized expressions were unmasked Caucasian faces in all conditions. Although happiness was the most accurately recognized expression among all expressions for both unmasked Caucasian and Asian faces, performance decreased when the masked happy face was Asian. Fear was the least accurately recognized expression on both Caucasian and Asian faces. Interestingly, the participants could not recognize fear on Asian faces even when presented without a mask. Moreover, although disgust could be easily recognized on unmasked faces, recognition performance decreased when the faces were masked.

Table 20

Results of Bonferroni Pairwise Comparison Tests for Accuracy Scores Among Mask, Race, and Emotional Conditions

	UMA NEUT	MA NEUT	UMA HAPPY	MA HAPPY	UMA FEAR	MA FEAR	UMA DISG	MA DISG	UMC NEUT	MC NEUT	UMC HAPPY	MC HAPPY	UMC FEAR	MC FEAR	UMC DISG
UMA NOTR		*ns*													
MA NEUT	*ns*														
UMA HAPPY	.001	.001													
MA HAPPY	*ns*	*ns*	.001												
UMA FEAR	.001	.001	.001	.001											
MA FEAR	.001	.001	.001	.001	.001										
UMA DISG	*ns*	*ns*	.001	*ns*	.001	.001									
MA DISG	.001	.001	.001	.001	.001	*ns*	.001								
UMC NEUT	*ns*	*ns*	.001	.002	.001	.001	*ns*	.001							
MC NEUT	*ns*	*ns*	.001	*ns*	.001	.001	.001	.001	*ns*						
UMC HAPPY	.001	.001	*ns*	.001	*ns*	.001	.001	.001	.001	.001					
MC HAPPY	*ns*	.001	.001	.001	.001	.001	.005	.001	*ns*	.005	.001				
UMC FEAR	.003	.001	.001	*ns*	.001	.001	.001	.001	.001	.001	.001	.001			
MC FEAR	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	*ns*		
UMC DISG	.001	.001	*ns*	.001	.001	.001	.001	.001	.001	.001	*ns*	.001	.001	.001	
MCDISG	.001	.001	.001	.001	*ns*	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001

Note. UMA = unmasked Asian, MA = masked Asian, UMC = unmasked Caucasian, MC = unmasked Caucasian; DISG = disgust, NEUT = neutral.

We found a significant interaction of mask wearing, sex, and emotion. Therefore, a repeated measures ANOVA was conducted to determine the significant differences among the accuracy scores for those conditions. Since the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. We found a significant difference among the conditions, $F(8.09, 1076.03) = 179.34$, $p = .001$, ηp2 = .57 (Figure 17). No significant difference emerged between masked and unmasked neutral male faces, $p > .05$. The difference between masked and unmasked neutral female faces was also not significant, $p > .05$. However, neutral male faces were better recognized than neutral female faces, $p < .05$. Moreover, although happiness was recognized better on unmasked male and female faces overall, this emotion was more accurately detected on female faces than male faces. In terms of fear, the unmasked expression was significantly better recognized than when masked. No sex-related difference was seen in the recognition accuracy of fear on faces without a mask. However, the expression of fear was better detected on masked male faces than masked female faces. Meanwhile, the recognition of disgust decreased sharply when the face had a mask, and the effect of mask wearing was most obvious for the disgust expression. While this emotion was better detected on male faces than female faces if there was no mask, there was no sex difference in recognition performance for masked male and female disgust expressions.

Table 21

Results of Bonferroni Pairwise Comparison Tests for Accuracy Scores Among Mask, Sex, and Emotional Conditions

	UMM NEUT	MM NEUT	UMM HAPPY	MM HAPPY	UMM FEAR	MM FEAR	UMM DISG	MM DISG	UF NEUT	MF NEUT	UMF HAPPY	MF HAPPY	UMF FEAR	MFF FEAR	UMF DISG
MM NEUT	*ns*														
UMM HAPPY	.001	.001													
MM HAPPY	.006	.001	.001												
UMM FEAR	.001	.001	.001	.001											
MM FEAR	.001	.001	.001	.001	*ns*										
UMM DISG	*ns*	*ns*	.001	.001	.001	.001									
MM DISG	.001	.001	.001	.001	.001	.001	.001								
UMF NEUT	.03	.005	.001	*ns*	.001	.001	.001	.001							
MF NEUT	.001	.001	.001	*ns*	.001	.001	.001	.001	*ns*						
UMF HAPPY	.001	.001	.01	.001	.001	.001	.001	.001	.001	.001					
MF HAPPY	*ns*	*ns*	.001	.001	.001	.001	*ns*	.001	*ns*	.001	.001				
UMF FEAR	.001	.001	.001	.001	*ns*	*ns*	.001	.001	.001	.001	.001	.001			
MFF FEAR	.001	.001	.001	.001	.001	.001	.001	*ns*	.001	.001	.001	.001	.001		
UMF DISG	*ns*	*ns*	.001	.03	.001	.001	*ns*	.001	*ns*	.001	.001	*ns*	.001	.001	
MF DISG	.001	.001	.001	.001	.001	.001	.001	*ns*	.001	.001	.001	.001	.001	*ns*	.001

Note. UMM = unmasked male, MM = masked male, UMF = unmasked female, MF = masked female; NEUT = neutral, DISG = disgust.

A significant interaction of mask wearing, race, sex, and emotion was observed. Therefore, eight repeated measures ANOVA were conducted to determine the significant differences among the accuracy scores for each condition. Greenhouse–Geisser correction was applied when the sphericity assumption was violated. Table 22 displays the repeated measures ANOVA results.

Table 22

Results of Repeated Measures ANOVA Results for Each Condition and Conditions Indicating Significant Differences

	Repeated measures ANOVA results	Conditions indicating significant differences
Unmasked neutral	$F(1.68, 222.73) = 8.5$, $p = .001$, ηp2 = .06	AM–AF, AM–CF, CM–AF, AF–CF ($p < .05$)
Masked neutral	$F(2.81, 373.35) = 54.42$, $p = .001$, ηp2 = .49	All conditions ($p < .05$)
Unmasked happy	$F(2.36, 311.46) = 8.49$, $p = .001$, ηp2 = .06	AM–AF, AM–CF ($p <.05$)
Masked happy	$F(3, 399) = 53.19$, $p = .001$, ηp2 = .29	All conditions ($p < .05$)
Unmasked fear	$F(3, 399) = 42.44$, $p = .001$, ηp2 = .24	All conditions ($p < .05$)
Masked fear	F(2,77, 369.14) = 155,72 $p = .001$, ηp2 = .54	All conditions ($p < .05$)
Unmasked disgust	F(2,84, 377.95) = 80,55, $p = .001$, ηp2 = .38	All conditions ($p < .05$)
Masked disgust	$F(3, 399) = 54.91$, $p = .001$, ηp2 = .29	AM–AF, AM–CM, AF–CF, AF–CM ($p < .05$)

Note. AM = Asian male, AF = Asian female, CM = Caucasian male, CF = Caucasian female.

The participants' accuracy was higher in recognizing unmasked male neutral faces than unmasked female faces. Meanwhile, accuracy for Asian female neutral faces was lower than for Caucasian female neutral faces. No significant difference was found between Asian and Caucasian neutral male faces. However, mask use changed the accuracy pattern for the neutral expression. The participants' performance was better for male faces than female faces, while accuracy was higher concerning masked male Caucasian faces than masked male Asian faces. Lastly, accuracy for masked Caucasian female faces was lower than that of masked Asian female faces.

Happiness was the most accurately detected expression in unmasked faces for all race and sex conditions. However, participants' performance regarding Asian happy male faces was lower than for

Asian and Caucasian happy female faces. Lastly, performance decreased for all stimulus groups when masks were superimposed on the happy faces.

The responses for unmasked fearful faces ranged from the most accurate to least accurate in the following order: Caucasian male, Caucasian female, Asian female, and Asian male. In comparison, fear was most accurately recognized on masked Asian female, Caucasian male, Caucasian female, and Asian male faces, in order from highest to lowest accuracy.

Disgust was the most accurately recognized on unmasked Caucasian male, Caucasian female, Asian female, and Asian male faces, in order from most to least accurate responses. However, the participants' worst recognition performance among masked faces was observed for the expression of disgust. From highest to lowest performance, the participants recognized disgust on masked Caucasian male, Caucasian female, Asian female, and Asian male faces.

Experiment 3

Method

Participants

The participants in Experiment 2 were also included in Experiment 3. They were tested using the online experiment platform Testable.

The study was approved by Akdeniz University Ethical Committee for Social Sciences.

Experimental Procedure

Stimuli

The same facial stimuli from Experiment 2 were used in Experiment 3. In all, eight Asian (four female, four male) and eight Caucasian (four female, four male) faces, four emotional expressions (neutral, happy, fear, and disgust), and mask conditions (masked and unmasked) were manipulated within 16 faces. A total of 128 stimuli (64 unmasked faces and 64 masked faces) were used in this experiment.

A fixation cross was presented for 500 ms. Next, a neutral face or a face with an emotional expression (happy, fear, disgust) was presented on the center of the screen. The participants were asked to use a slider to indicate the social distance that they would prefer to keep with that person (0–8 meters). Figure 19 illustrates the experimental procedure.

Results

Social Distance

A 2 × 2 × 2 × 4 (mask conditions [unmasked, masked] × race [Asian, Caucasian] × sex [female, male] × emotion [neutral, happy, fear, disgust]) repeated measures ANOVA was conducted to determine the effects of mask conditions, emotions, race, and sex of the facial stimuli on social distance. Since the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. Table 18 displays within-subject factor results. The results indicated a significant main effect of mask wearing, race, and emotion (Figure 20). The participants tended to indicate a preference for a wider social distance from Asian faces and unmasked faces in comparison to Caucasian faces and masked faces. In addition, they tended to prefer greater social distances to faces having an expression of disgust or fear. Table 3 presents descriptive statistics for mask conditions, race, and emotions. The main effect of stimulus sex was not significant, $p > .05$.

Table 23

Repeated Measures ANOVA Results

Predictor	df_{Num}	df_{Den}	*Epsilon*	SS_{Num}	SS_{Den}	*F*	*p*	ηp^2
Intercept	1	133		68489.25	9218.23	988.16	.000	.88
Race	1	133	1	14.73	343.15	5.71	.018	.04
Emotion	3	399	.53	1555.09	1550.25	133.42	.000	.50
Mask	1	133	1	1081.67	2215.76	64.93	.000	.33
Race × Sex	1	133	1	1.81	60.85	35125	.05	.03
Sex × Emotion	2.79	372.32	.93	12.76	128.79	13.17	.000	.09
Race × Emotion	3	399	.97	35.95	119.43	40.04	.000	.23
Race × Sex × Emotion	2.68	356.43	.89	15.54	114.05	18.12	.000	.12
Sex × Mask	1	133	1	4.64	37.69	16.4	.000	.11
Emotion × Mask	3	292.35	.73	35.37	276.72	17	.000	.11
Sex × Emotion × Mask	3	399	.98	10.28	99.40	13.76	.000	.09
Race × Emotion × Mask	2.83	375.81	.94	12.44	95.93	17.24	.000	.12

Table 24

Descriptive Statistics [Mean (SD)] for Social Distance With Respect to Emotion, Mask, Race, and Stimulus Sex

	Neutral UM	Neutral M	Happy UM	Happy M	Fear UM	Fear M	Disgust UM	Disgust M
Asian female	4.06 (2.04)	3.32 (1.79)	3.0 (1.68)	3.73 (2.21)	5.04 (1.83)	3.76 (1.69)	5.27 (1.81)	4.25 (1.89)
Asian male	4.14 (.208)	3.16 (1.74)	3.87 (2.16)	3.08 (1.72)	5.11 (1.85)	3.91 (1.74)	5.29 (1.91)	3.86 (1.79)
Caucasian female	3.87 (1.98)	3.04 (1.64)	3.49 (2.20)	2.69 (1.54)	4.99 (1.79)	4.04 (1.63)	5.10 (1.81)	3.94 (1.68)
Caucasian male	3.68 (2.04)	2.75 (1.48)	3.73 (2.21)	2.77 (1.56)	5.01 (1.88)	4.27 (1.79)	5.58 (1.95)	4.02 (1.75)

Note. UM = Unmasked, M = Masked

Upon observing the significant interaction of race and sex, we conducted two separate repeated measures ANOVA for Asian and Caucasian faces. The results indicated that the social distance for Asian male (n = 134, M = 4.05, SD = 1.59) and female faces (n = 134, M = 4.06, SD = 1.55) was not significantly different, p > .05 (n = 134, M = 3.89, SD = .09). However, the social distance for Caucasian male and female faces differed significantly, F(1, 133) = 5.94, p = .016, ηp2 = .04 (Figure 22). The participants preferred to maintain a wider distance from Caucasian male faces (n = 134, M = 3.98, SD = 1.46) than female Caucasian faces (n = 134, M = 3.89, SD = 1.46).

We found a significant emotion–sex interaction. Four paired t-tests were conducted to determine the emotions showing sex differences. The t-test results indicated a sex difference for the neutral, t(133) = -3.2, p = .002; happy, t(133) = 2.95, p = .004; and fear expressions, t(133) = 2.73, p = .007, but not for the disgust expression, p > .05. Interestingly, while the participants tended to select a wider distance for male faces having the expressions of happiness and fear, their preferred distance was greater in the case of neutral female faces.

Table 25

Descriptive Statistics [Mean (SD)] for Social Distance Related to Emotion and Sex

	Neutral	Happy	Fear	Disgust
Male	3. 4 (1.62)	3.4 (1.65)	4.6 (1.61)	4.7 (1.61)
Female	3.6 (1.62)	3.2 (1.64)	4.5 (1.54)	4.6 (1.59)

After noting the significant interaction of race and emotion, we conducted four paired *t*-tests to discover the effect of race on social distance for each emotion. The *t*-test results indicated a race difference for neutral, $t(133) = 5.19$, $p = .001$; happy, $t(133) = 4.28$, $p = .001$; and fear expressions, $t(133) = -2.29$, $p = .02$, but not for the expression of disgust, $p > .05$ (Figure 23). The preferred social distance from Asian faces was wider for happy and neutral expressions, while participants indicated a preference for a wider separation from fearful Caucasian faces (Table 26).

Table 26

Descriptive Statistics [Mean (SD)] for Social Distance With Respect to Emotion and Race

	Neutral	Happy	Fear	Disgust
Asian	3.67	3.42	4.46	4.67
Caucasian	3.34	3.17	4.58	4.66

Following the significant interaction of mask wearing and sex, we conducted four paired *t*-tests to determine the effect of mask wearing and sex on social distance. Table 27 displays the *t*-test results. Table 8 presents the descriptive statistics. The preferred distance from masked faces was shorter than the distance from unmasked faces for both sexes. Meanwhile, the preferred distance from unmasked male faces was wider than the distance from unmasked female faces. However, the distance from masked male and masked female faces was not significantly different.

Table 27

Results of Paired t-tests for Masked and Unmasked Female and Male Faces

Conditions	Paired *t*-test results
Masked male–Unmasked male	$t(133) = 8.49, p = .001$
Unmasked female–Masked female	$t(133) = 7.49, p = .001$
Unmasked male–Unmasked female	$t(133) = 2.89, p = .004$
Masked male–Masked female	$p > .05$

Table 28

Descriptive Statistics [Mean (SD)] for Social Distance with Respect to Masked and Unmasked Male and Female Faces

	Male	Female
Unmasked	4.55 (1.79)	4.44 (1.75)
Masked	3.48 (1.52)	3.51 (1.52)

After noting the significant interaction of mask and emotion, we conducted two repeated measures ANOVA for unmasked and masked faces. Since the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. We found that emotion had a significant effect on social distance for unmasked faces, $F(1.61, 214.46) = 114.65$, $p = .001$, $\eta p^2 = .46$ (Figure 25). The repeated measures ANOVA results for masked faces indicated that there was also a significant effect of emotions on social distance, $F(1.68, 22.86) = 115.02$, $p = .001$, $\eta p^2 = .46$. Table 29 shows the descriptive statistics, while Tables 30 and 31 display the results of Bonferroni corrected pairwise comparison tests for masked and unmasked faces. The participants chose a closer distance for masked faces than unmasked faces. They tended to prefer to maintain the maximum distance from fearful and disgusted faces for both masked and unmasked faces. The preferred social distance for all expressions in order from wider to closer was disgusted, fearful, neutral, and happy faces.

Table 29

Descriptive Statistics [Mean (SD)] for Social Distance With Respect to Masked and Unmasked Faces for Different Emotional Expressions

	Neutral	Happy	Fear	Disgust
Unmasked	3.94 (1.95)	3.71 (2.12)	5.03 (1.76)	5.31 (1.79)
Masked	3.37 (1.52)	2.89 (1.54)	3.99 (1.63)	4.02 (1.68)

Table 30

Bonferroni Corrected Pairwise Comparison Test Results for Unmasked Faces Having Different Emotional Expressions

	UM NEUTRAL	UM HAPPY	UM FEAR	UM DISGUST
UM NEUTRAL				
UM HAPPY	.032			
UM FEAR	.001	.001		
UM DISGUST	.001	.001	.001	

Note. UM = Unmasked

Table 31

Bonferroni Corrected Pairwise Comparison Test Results for Masked Faces Having Different Emotional Expressions

	MASKED NEUTRAL	MASKED HAPPY	MASKED FEAR	MASKED DISGUST
MASKED NEUTRAL				
MASKED HAPPY	.001			
MASKED FEAR	.001	.001		
MASKED DISGUST	.001	.001	.001	

We found an interaction effect of race, sex, and emotion. Accordingly, we conducted paired *t*-tests for each emotional condition. Tables 32–35 present the results of these tests.

Table 32

Results of Paired t-tests for Female and Male Asian and Caucasian Neutral Faces

Conditions	Paired *t*-test results
Asian male–Caucasian male	$t(133) = 5.91$, $p = .001$
Asian male–Asian female	$p > .05$
Asian female–Caucasian female	$t(133) = 3.2$, $p = .002$
Caucasian male–Caucasian female	$t(133) = -4.77$, $p = .001$

Table 33

Results of Paired t-tests for Female and Male Asian and Caucasian Happy Faces

Conditions	Paired t-test results
Asian male–Caucasian male	$t(133) = 3.38$, $p = .001$
Asian male–Asian female	$p > .05$
Asian Female–Caucasian female	$t(133) = 4.18$, $p = .001$
Caucasian male–Caucasian female	$t(133) = 3.15$, $p = .002$

Table 34

Results of Paired t-tests for Female and Male Asian and Caucasian Fearful Faces

Conditions	Paired t-test results
Asian male–Caucasian male	$p > .05$
Asian male–Asian female	$t(133) = 2.14$, $p = .034$
Asian female–Caucasian female	$t(133) = -2.11$, $p = .037$
Caucasian male–Caucasian female	$t(133) = 2.31$, $p = .02$

Table 35

Results of Paired t-tests for Female and Male Asian and Caucasian Disgusted Faces

Conditions	Paired t-test results
Asian male–Caucasian male	$t(133) = -3.22$, $p = .002$
Asian male–Asian female	$t(133) = -3.23$, $p = .002$
Asian female–Caucasian female	$t(133) = 3.75$, $p = .001$
Caucasian male–Caucasian female	$t(133) = 4.67$, $p = .001$

Table 36

Descriptive Statistics [Mean (SD)] for Social Distance with Respect to Asian and Caucasian Male and Female Faces for Different Emotional Expressions

	Asian male	Asian female	Caucasian male	Caucasian female
Neutral	3.65 (1.75)	3.69 (1.74)	3.21 (1.59)	3.46 (1.62)
Happy	3.47 (1.72)	3.37 (3.37)	3.26 (1.66)	3.09 (1.64)
Fear	4.51 (1.63)	4.40 (1.59)	4.64 (1.67)	4.52 (1.56)
Disgust	4.58 (1.68)	4.76 (1.7)	4.80 (1.64)	4.52 (1.56)

The participants' social distance was wider for both female and male neutral Asian faces than their social distance for the corresponding Caucasian faces. Moreover, in the case of neutral Caucasian faces, they preferred a wider distance from females compared to male faces.

The social distance for happy faces, ranging from closest to farthest, was Caucasian female, Caucasian male, Asian female, and Asian male. However, the difference between female and male Asian faces was not statistically significant.

Social distance for fearful faces was wider for male faces than that of female faces for both races. However, the difference between Caucasian and Asian fearful male faces was not statistically different.

There was a sex difference in social distance for disgust expression in both races. The distance was wider for male Caucasian faces; however, it was wider for female Asian faces.

We found a significant interaction effect of mask, sex, and emotion. Therefore, we conducted paired *t*-tests for each emotional condition. Tables 37–40 present the results of the paired *t*-tests.

Table 37

Results of Paired t-tests for Masked and Unmasked Male and Female Neutral Faces

Conditions	Paired *t*-test results
Unmasked male–Masked male	$t(133) = 7.15$, $p = .001$
Unmasked Female–Masked female	$t(133) = 5.76$, $p = .001$
Unmasked male–Unmasked female	$p > .05$
Masked male–Masked female	$t(133) = -4.48$, $p = .001$

Table 38

Results of Paired t-tests for Masked and Unmasked Male and Female Happy Faces

Conditions	Paired *t*-test results
Unmasked male–Masked male	$t(133) = 5.63$, $p = .001$
Unmasked female–Masked female	$t(133) = 4.8$, $p = .001$
Unmasked male–Unmasked female	$t(133) = 3.62$, $p = .001$
Masked male–Masked female	$p > .05$

Table 39

Results of Paired t-tests for Masked and Unmasked Male and Female Fearful Faces

Conditions	Paired *t*-test results
Unmasked male–Masked male	$t(133) = 7.89$, $p = .001$
Unmasked Female–Masked female	$t(133) = 9.52$, $p = .001$
Unmasked male–Unmasked female	$p > .05$
Masked male–Masked female	$t(133) = 3.62$, $p = .001$

Table 40

Results of Paired t-tests for Masked and Unmasked Male and Female Disgusted Faces

Conditions	Paired *t*-test results
Unmasked male–Masked male	$t(133)= 11.07$ $p = .001$
Unmasked female–Masked female	$t(133)= 8.98$ $p = .002$
Unmasked male–Unmasked female	$t(133)= 4.68$ $p = .001$
Masked male–Masked female	$t(133)= -2.82$ $p = .006$

The mask condition main effect on social distance was evident for all emotional expressions. The participants tended to indicate a preference to remain far from unmasked faces. As already observed in the discussion of the emotion's main effect on social distance, the participants preferred to maintain the maximum distance from fearful and disgusted faces. Nevertheless, the paired *t*-test results revealed no sex difference in social distance to unmasked neutral and fearful faces. The results indicated no significant difference in social distances to happy masked male and female faces.

Table 41

Descriptive Statistics [Mean (SD)] for Social Distance With Respect to Masked and Unmasked Male and Female Faces for Different Emotional Expressions

	Neutral	Happy	Fear	Disgust
Unmasked male	3.91 (2.01)	3.8 (2.14)	5.06 (1.82)	5.43 (1.87)
Masked male	2.96 (1.55)	2.92 (1.58)	4.09 (1.69)	3.95 (1.7)
Unmasked female	3.97 (1.94)	3.61 (2.15)	5.02 (1.75)	5.19 (1.76)
Masked female	3.18 (1.65)	2.85 (1.55)	3.9 (1.62)	4.09 (1.71)

To explore the last significant interaction effect—mask, race, and emotion—we conducted paired *t*-tests for each emotional condition. Tables 42–45 display the results of these tests.

Table 42

Results of Paired t-tests for Masked and Unmasked Asian and Caucasian Neutral Faces

Conditions	Paired *t*-test results
Unmasked Asian–Masked Asian	$t(133) = 6.5$, $p = .001$
Unmasked Caucasian–Masked Caucasian	$t(133) = 4.79$, $p = .001$
Unmasked Asian–Unmasked Caucasian	$t(133) = 8.09$, $p = .001$
Masked Asian–Masked Caucasian	$t(133) = -3.81$, $p = .001$

Table 43

Results of Paired t-tests for Masked and Unmasked Asian and Caucasian Happy Faces

Conditions	Paired *t*-test results
Unmasked Asian–Masked Asian	$t(133) = 4.84$, $p = .001$
Unmasked Caucasian–Masked Caucasian	$t(133) = 5.37$, $p = .001$
Unmasked Asian–Unmasked Caucasian	$p > .05$
Masked Asian–Masked Caucasian	$t(133) = 3.84$, $p = .001$

Table 44

Results of Paired t-tests for Masked and Unmasked Asian and Caucasian Fearful Faces

Conditions	Paired *t*-test results
Unmasked Asian–Masked Asian	$t(133) = 10.33$, $p = .001$
Unmasked Caucasian–Masked Caucasian	$t(133) = 7.22$, $p = .001$
Unmasked Asian–Unmasked Caucasian	$p > .05$
Masked Asian–Masked Caucasian	$t(133) = -5.27$, $p = .001$

Table 45

Results of Paired t-tests for Masked and Unmasked Asian and Caucasian Disgusted Faces

Conditions	Paired *t*-test results
Unmasked Asian–Masked Asian	$t(133) = 9.99$, $p = .001$
Unmasked Caucasian–Masked Caucasian	$t(133) = 10.15$, $p = .001$
Unmasked Asian–Unmasked Caucasian	$p > .05$
Masked Asian–Masked Caucasian	$p > .05$

Table 46

Descriptive Statistics [Mean (SD)] for Social Distance With Respect to Masked and Unmasked Asian and Caucasian Faces for Different Emotional Expressions

	Neutral	Happy	Fear	Disgust
Unmasked Asian	4.1 (1.99)	3.8 (2.15)	5.07 (1.81)	5.28 (1.82)
Masked Asian	3.24 (1.73)	3.04 (1.65)	3.84 (1.66)	4.06 (1.78)
Unmasked Caucasian	3.39(1.62)	3.74 (1.99)	4.99 (1.77)	5.34 (1.83)
Masked Caucasian	3.78 (1.99)	2.89 (1.56)	4.16 (1.67)	3.98 (1.66)

The *t*-test results and descriptive statistics demonstrate that social distance changed as a function of emotion and mask wearing. Notably, the participants preferred to keep a long distance from unmasked faces, whether Asian or Caucasian. The stimuli showing fearful and disgusted faces sparked the longest social distance for both masked and unmasked faces. No significant race difference in social distance emerged for unmasked happy, fearful, or disgusted faces. However, the social distance for fearful or disgusted unmasked faces was significantly longer than that for neutral or happy unmasked faces. We also found no significant difference between masked disgusted Asian and Caucasian faces. Lastly, the social distance for masked fearful and neutral Caucasian faces was longer than the distance for the corresponding Asian faces.

Discussion

In this investigation, we conducted three experiments to explore the effects of mask wearing on face perception, emotion recognition, and social distance during the COVID-19 pandemic. The other race effect on these dependent variables was also investigated. The first experiment aimed to build an understanding of how interacting with masked faces might change face recognition. Accordingly, four conditions were used to compare face recognition: (a) seeing an unmasked face–recognizing the unmasked face, (b) seeing a masked face–recognizing the masked face, (c) seeing an unmasked face–recognizing the same face with a mask, and (d) seeing a masked face–recognizing that face without the mask.

Face Perception

Mask Impact

The experimental results indicated a significant mask impact on accuracy. The participants' performance was the best when they were asked to recognize an unmasked face that they had seen previously. Because the participants processed the faces holistically in the unmasked conditions, this strategy might have helped them recognize the unmasked faces accurately. Meanwhile, seeing and recognizing a masked face was the second condition that the participants could perform well. The participants were able to remember a masked face well if they had seen it with a mask beforehand. However, their performance decreased when they first saw an unmasked face and then had to recognize that face with a mask. Presumably, the participants processed the unmasked sample faces holistically but found it difficult to match the whole face with a part of that face (e.g., eyes in a masked face). Interestingly, the participants' performance was better when matching a sample masked face with the unmasked form of that face in the testing stage. These results are similar to Noyes et al.'s (2021) finding that mask use impaired face recognition even in super-recognizers.

Race Impact

Race was another critical factor in face recognition. The participants recognized Caucasian faces better than Asian faces. Since our subjects were Caucasian, Meissner and Brigham's (2001) ORB was also valid for our data. Moreover, we discovered a significant race and mask interaction effect. The participants' performance for the Caucasian unmasked sample–unmasked test condition was better than that for the masked sample–unmasked test and masked sample–masked test conditions. That said, the Caucasian unmasked–unmasked performance did not differ significantly from that for the unmasked sample–masked test condition. On the other hand, for Asian faces, participants showed the highest performance in the unmasked sample–unmasked test condition, while their performance for unmasked sample–masked test condition was lower than all the other conditions. Conceivably, race changes the effect of a mask on face recognition. The most difficult condition for Caucasian faces was matching a sample masked face to the unmasked form of that face. In comparison, the most difficult condition for Asian faces was matching a sample unmasked face with a masked face. These results are consistent with Dhamecha et al.'s (2014) findings that hiding facial parts by accessories impaired face recognition ability, and recognition accuracy was better for faces from the same ethnicity. In a similar vein, Tanaka et al. (2004) and Michel et al. (2006) indicated that holistic face processing is affected by the other-race effect. Moreover, Hancock and Rhodes (2008) and Tanaka et al. (2004) proposed that facial identification is more efficient for faces that individuals experience more frequently but is less powerful for faces of other races that people have less experience with. Therefore, holistic face processing during the coding or testing phase involving Asian faces might have been less powerful than the holistic processing for Caucasian faces. Our results are consistent with Freud et al.'s (2020) study indicating that face recognition performance and holistic face processing decreased when participants were exposed to faces with masks during the COVID-19 pandemic.

Although the sex of the stimulus had no main effect on face recognition, a significant interaction of stimulus sex and mask condition emerged in the results. The unmasked sample–unmasked test condition and masked sample–masked condition did not significantly differ for female and male faces. However, recognition performance in the unmasked sample–masked test condition was better for female than male faces. Contrariwise, the participants' performance in the masked sample–unmasked test condition was better for male than female faces.

We also observed a significant mask, race, and sex interaction effect. Our results showed that the participants' lowest performance in the unmasked sample–unmasked test and masked sample–masked test conditions was for Asian female faces. Evidently, the participants could not process Asian female faces well in either a holistic or a partial condition. Their performance for female and male Asian faces was also lower than that for Caucasian female and male faces in the unmasked sample–masked test condition. Presumably, they could not encode Asian faces accurately since they were not familiar with them. Furthermore, they showed the lowest performance for female Asian faces in the unmasked sample–masked test and the lowest performance for male Asian faces in the masked sample–unmasked test. Therefore, it can be concluded that the participants found holistic processing of female Asian faces harder than that of male Asian faces and partial processing of Asian male faces more difficult than that of female Asian faces.

Emotion Recognition

Experiment 2 was designed to investigate the effects of mask, race, and stimulus sex on emotion recognition accuracy. Listed from the most accurate to the least accurate, the participants recognized the emotional expressions under consideration as follows: happy, neutral, disgusted, and fearful.

Mask Impact

Mask wearing decreased recognition accuracy for all emotional expressions. Although the order of recognition accuracy for the various emotions did not change for masked faces, the accuracy for happy and neutral masked faces did not differ significantly It seems that the participants had difficulty in discriminating happy and neutral faces in the masked condition since happiness is mostly recognized via cues taken from the lower part of a person's face. This finding concurs with Bassili's (1979) demonstration that the recognition of happiness was reduced when the lower facial part was occluded with a rectangular piece of cardboard. Along the same lines, Carbon (2020) also indicated that wearing a face mask decreased the recognition accuracy of angry, disgusted, happy, and sad emotions but not neutral and fearful faces. Although our results concerning disgusted and happy expressions were consistent with the results of Carbon, mask use significantly decreased participants' recognition of the fear expression. This outcome might be due to using a stimulus set that included different ethnicities.

Race Impact

Race was also a crucial factor in emotion recognition. The participants could recognize all Caucasian expressions better than the corresponding Asian expressions. However, the same recognition order was valid for both Caucasian and Asian expressions: happy, neutral, disgusted, and fearful (from the most to the least accurately recognized). Also, the participants recognized male Caucasian expressions better than female Caucasian expressions. However, the recognition pattern was the opposite for Asian faces.

The sex of the stimulus was a noteworthy factor interacting with emotion recognition. In general, male expressions were recognized more accurately than female expressions. Happiness was better recognized on female faces, while fearful and neutral expressions were better recognized on male faces. On the other hand, recognition performance for the disgust expression on male and female faces was not different. Evolutionary explanations can be speculated to explain sex differences in recognized expressions. Since disgust is a fundamental expression for survival, it can be discriminated equally well in female and male faces. However, because happiness can be interpreted as a receptivity signal in women, it might be discriminated better on female faces.

The effects of mask wearing on female and male Asian and Caucasian emotional expressions were different. Fear was the least accurately recognized expression on both Caucasian and Asian faces. The participants could not recognize fear on Asian faces, whether masked or unmasked. The least accurately identified stimulus was the Asian male fear expression. On the other hand, happiness was the most accurately recognized expression. However, the participants' performance decreased when the face was masked and Asian. Although disgust could be recognized relatively easily on unmasked faces, recognition performance sharply decreased when the same face was seen with a mask. Also, while this emotion was better detected on male faces than female faces if there was no mask, recognition performance was similarfor masked male and female disgust.

Social Distance

In Experiment 3, we investigated the effects of mask, race, and emotions on preferred social distance with other people. Sorokowska and colleagues' (2017) data from 42 countries showed that average interpersonal social distance was 135.1 cm, in general, and around 120 cm for the Turkish sample. In contrast, we found that the closest distance was 2.69 meters for masked Caucasian happy female faces during the current COVID-19 pandemic and above 2.69 meters for all other stimulus types. The participants preferred to maintain a wider social distance with unmasked faces than masked faces. Conceivably, the pandemic has had a significant effect on social distance. Before the COVID-19 pandemic began, people tended to perceive facial masks as a sign of illness. However, the recent precautionary measures have called for everyone to use facial masks in social environments. Therefore, an unmasked person could be perceived as a potential virus carrier, causing people to avoid close contact with those not wearing facial masks. Thus, preferred social distance may have grown due to an increase in perceived risk of contamination, as indicated by Xie et al. (2020).

Our findings are also consistent with Cartaud et al.'s (2020) results showing that facial mask wearing reduced social distancing. The participants preferred to keep away from unmasked faces, in general.

However, the distance was larger when the unmasked faces were male compared to female faces. On the other hand, we found no sex difference in social distance to masked faces. The participants seemed to be convinced that a mask could protect them from exposure to the virus.

Mask use also interacted with emotions. The participants mostly tended to stay away from fearful and disgusted faces, both masked and unmasked. The preferred social distance for each emotional expression from farther to closer ranged in order from disgusted, fearful, and neutral to happy faces. The data were consistent with Ruggiero et al. (2017), who showed that perceiving positive emotions rather than negative emotions led to reducing social distance toward other people. The threatening nature of particular emotional expressions may also be crucial in social distancing. The stimuli featuring fearful and disgusted faces prompted the greatest social distance for both masked and unmasked faces. These two expressions signal an environmental threat via another person who conveys such information. A person signaling some kind of threat via a facial expression displaying a negative emotion may be interpreted as the threat being in close proximity to the signaler. Therefore, maintaining a large distance from that face can help the viewer cope with a potential threat. An expression evincing disgust may also result from experiencing poisoned food or illness. Therefore, a person showing this expression might potentially be ill or poisoned and could transmit illness by vomiting, sneezing, or coughing. In this event, observing a large distance can keep the viewer from being contaminated by any hazardous content.

In the case of emotions paired with unmasked faces, social distance was significantly greater for fearful and disgusted than neutral and happy faces. No significant race difference emerged regarding social distance for unmasked happy, fearful, and disgusted faces. There was also no significant difference between masked, disgusted Asian and Caucasian faces. However, the participants chose a larger social distance for masked fearful and neutral Caucasian faces than similar Asian faces. Presumably, the participants were better able to interpret the facial cues on the upper portion of each face when presented with Caucasian stimuli than they were able to with Asian faces due to the familiarity effect.

Although the stimulus sex had no main effect on social distance, our participants tended to choose larger social distance for male Caucasian faces. In contrast, the distance they chose was not significantly different for male and female Asian faces in that they preferred to maintain a larger social distance from both. Stimulus sex and emotion also had an interaction effect. The participants tended to have a greater distance for happy and fearful male faces. Meanwhile, their preferred distance was wider for neutral female faces. However, there was no significant difference for disgusted faces since the source of an expression of disgust could be common to both men and women. Social distance was likely predominantly determined by the current pandemic conditions. Accordingly, because either a man or a woman could be a potential virus carrier, no stimulus sex difference was observed in social distance to unmasked neutral and fearful faces. Nor did any significant sex difference arise in the participants' chosen social distance from masked happy faces.

Race was another critical factor interacting with emotions. The participants preferred to establish a wider social distance from Asian faces than Caucasian faces. The preferred social distance from Asian faces was greater for happy and neutral expressions than the distance from Caucasian faces having the same expressions; however, it was wider for fearful Caucasian faces than for Asian fearful faces. They might have preferred a larger social distance from Asian neutral and happy faces in safe situations as a result of not being familiar with them or for reasons connected to the origins of the current pandemic. However, fear-related cues seemed to be better recognized on Caucasian faces and resulted in the participants' electing a larger social distance from Caucasian masked faces that exhibited fear.

Two reasons may underlie the participants' preference for larger social distance in the case of Asian faces. First, they might want to maintain more distance from unfamiliar-looking people about whom they did not have any information. The second reason might relate to the origins of the COVID-19 pandemic, which was first described in Wuhan, China. Although the COVID-19 virus has since that time spread worldwide, it was more prevalent in Eastern countries at the early stages of the pandemic. Therefore, Asian faces could be perceived as posing a higher risk of virus transmission during the data collection period.

The participants also indicated a preference for a wider distance from female neutral Caucasian faces than male neutral Caucasian faces. The social distance for happy faces, from closer to farther, was Caucasian female, Caucasian male, Asian female, and Asian male. That said, the difference between the participants' responses to female and male Asian faces was not statistically significant. Social distance for fearful faces was greater for male than female faces for both races. However, the difference between Caucasian and Asian fearful male faces was not statistically significant. Possibly, the subjects might have thought that anything that could frighten a man, whether Caucasian or Asian, might pose a critical threat to the viewer. In terms of disgust, the participants' responses exhibited a sex difference in social distance for stimuli from both races. The distance was wider for male Caucasian faces than male Asian faces; however, it was wider for female Asian faces than for female Caucasian faces. Thus, familiarity and emotional expression seem to be critical factors in the participants' decision to adjust social distance.

Conclusion

In summary, face perception and social distancing have significantly changed over the course of the COVID-19 pandemic. Seeing and recognizing masked faces as well as trying to understand emotional expressions while adjusting social distance have become common challenges of daily life. Although humans process faces holistically, masked face perception may improve partial face processing ability in the near future. Moreover, although the other-race effect was evident for unmasked faces, this phenomenon has become more obvious since people from different races started wearing facial masks. Mask wearing decreased both face recognition and recognition of emotional expressions, negatively impacting communication among people from different ethnicities. One possible solution to future encounters with COVID-19–like viruses where humans must protect themselves with facial masks might be the production and use of transparent facial masks to improve face perception and communication skills with other people.

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Figures

Figure 1

Unmasked and Masked Caucasian and Asian Facial Stimuli

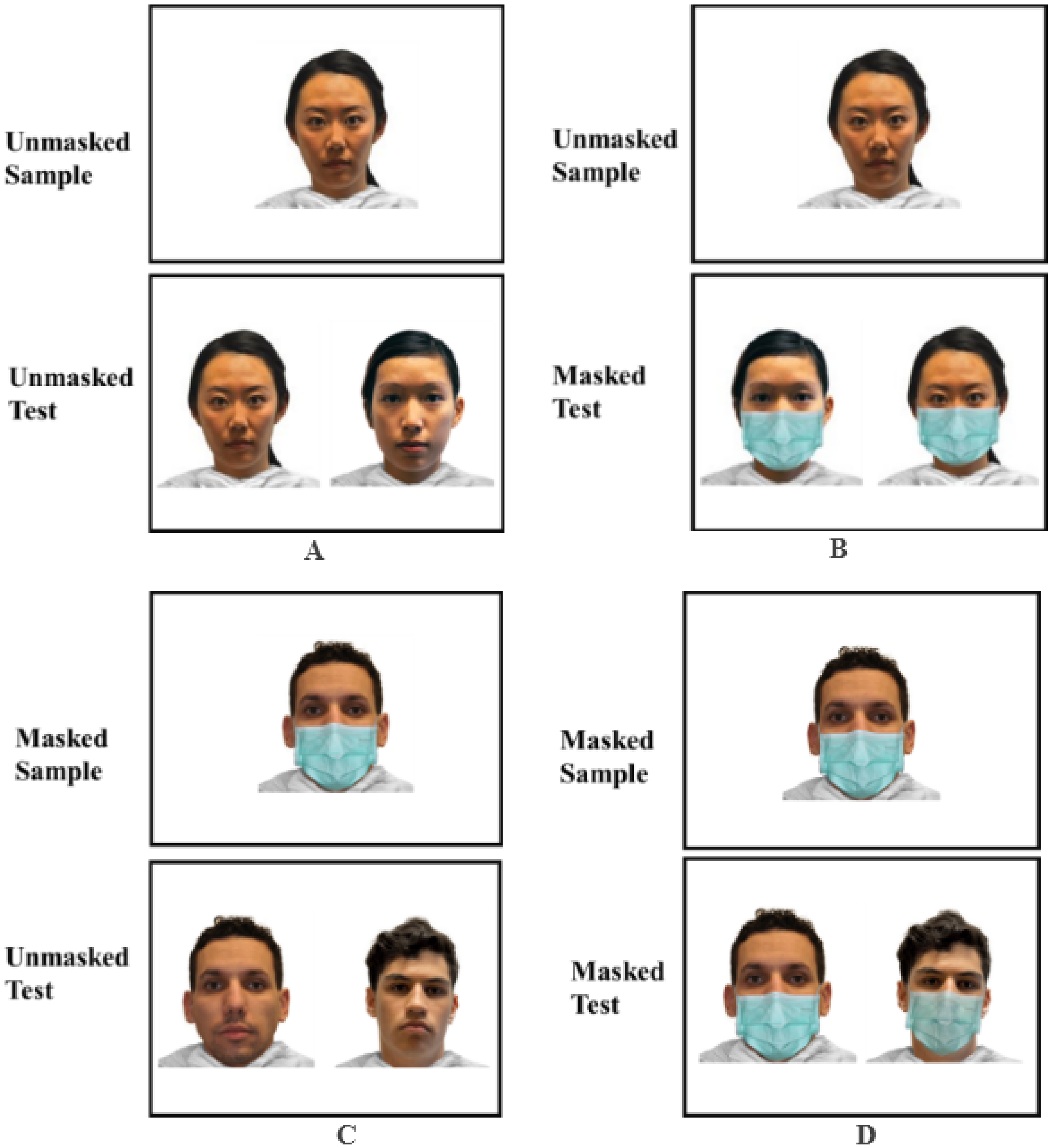


Figure 2

Experimental Conditions. Note. (A) An unmasked sample was presented, then unmasked faces were presented in the test phase. (B) An unmasked sample was presented, then masked faces were presented in the test phase. (C) A masked sample was presented, then unmasked faces were presented in the test phase. (D) A masked sample was presented, then masked faces were presented in the test phase.

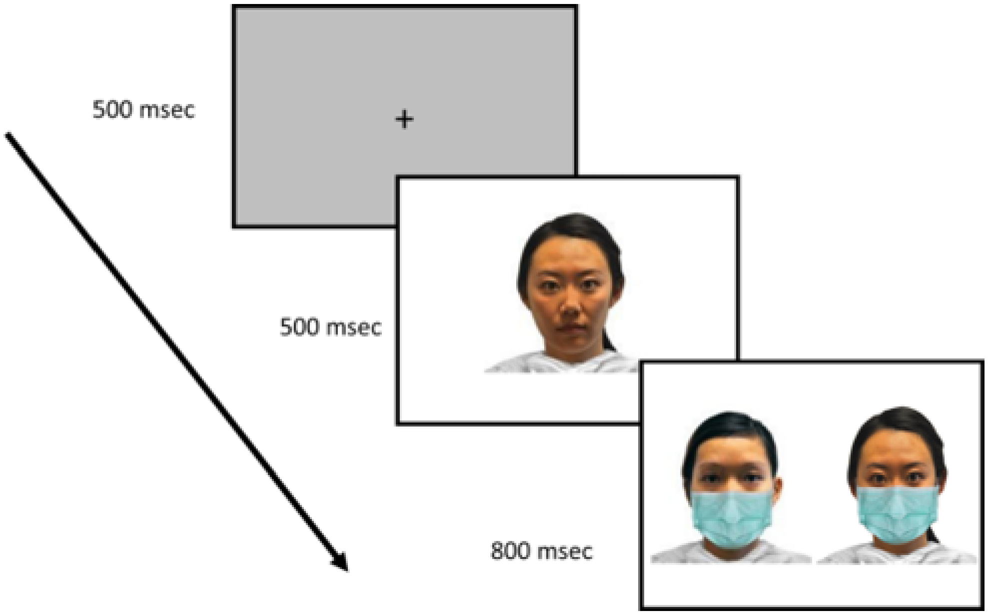
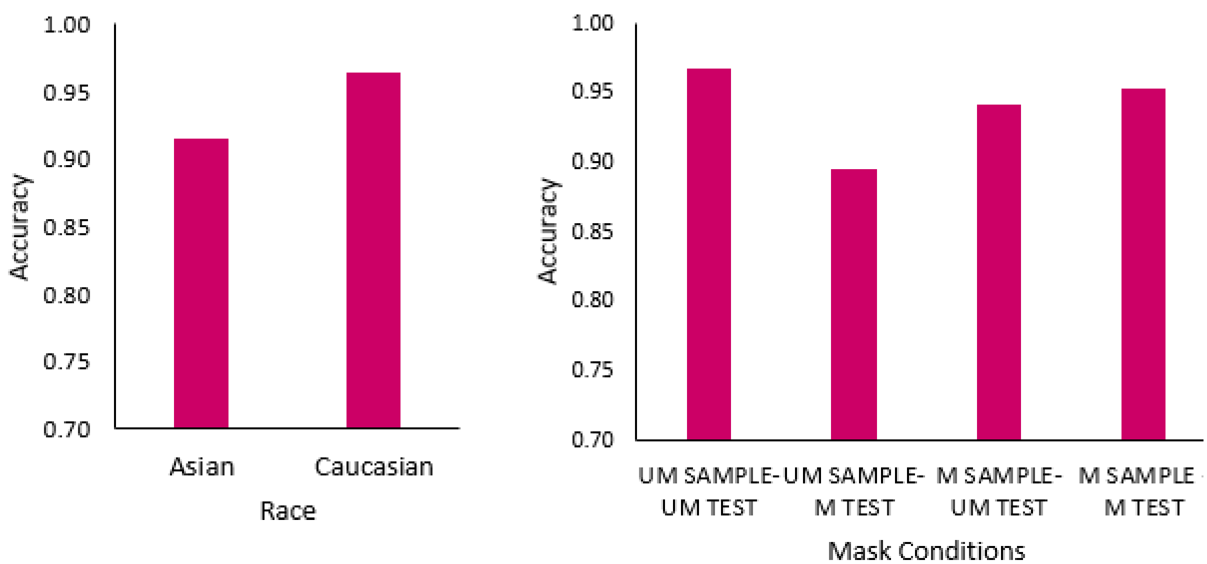


Figure 3

Experimental Procedure



a b

Figure 4

Accuracy for Race and Mask Conditions. Note. (a) mean accuracy for Asian and Caucasian faces; (b) mean accuracy for unmasked sample–unmasked test, unmasked sample–masked test, masked sample–unmasked test, and masked sample–masked test conditions (M = masked, UM = unmasked).

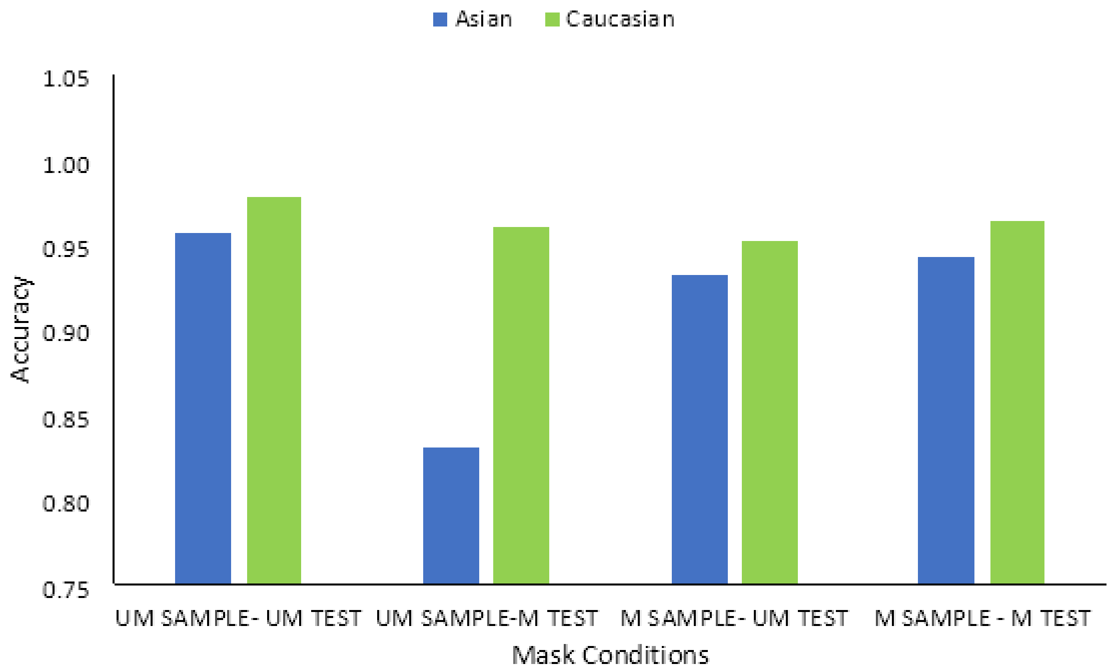


Figure 5

Mean Accuracy with Related to Race and Mask Conditions. Note. The figure shows mean accuracy for Asian and Caucasian unmasked sample–unmasked test, masked sample–masked test, unmasked sample–masked test, and masked sample–unmasked test conditions (M = masked, UM = unmasked).

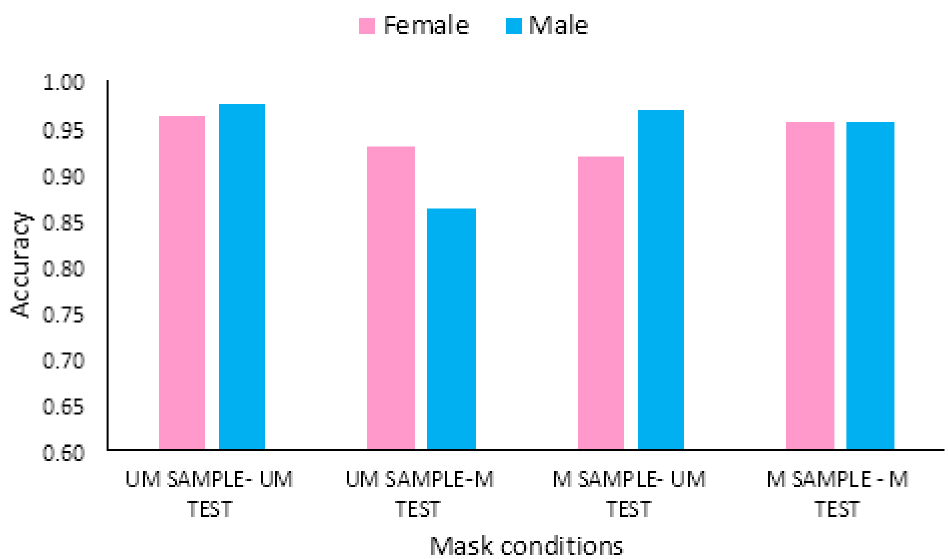


Figure 6

Mean Accuracy for Sex and Mask Conditions. Note. The figure shows mean accuracy for female and male unmasked sample–unmasked test, masked sample–masked test, unmasked sample–masked test, and masked sample–unmasked test conditions (M = masked, UM = unmasked).

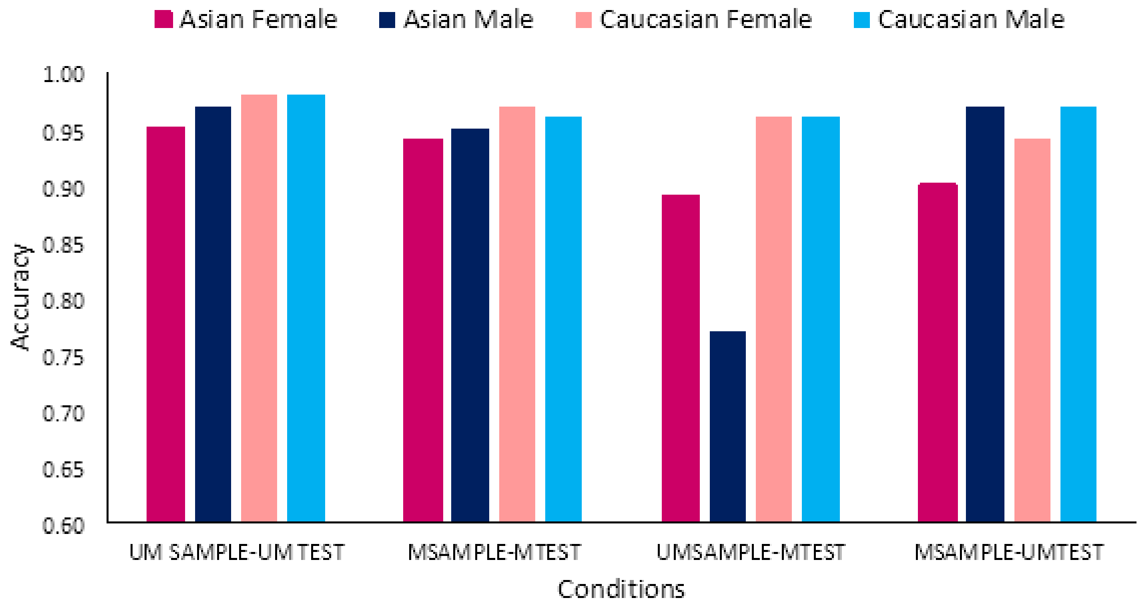


Figure 7

Mean Accuracy for Race, Sex, and Mask Conditions. Note. Figure shows mean accuracy for unmasked sample–unmasked test, masked sample–masked test, unmasked sample–masked test, and masked sample–unmasked test conditions (M = masked, UM = unmasked).

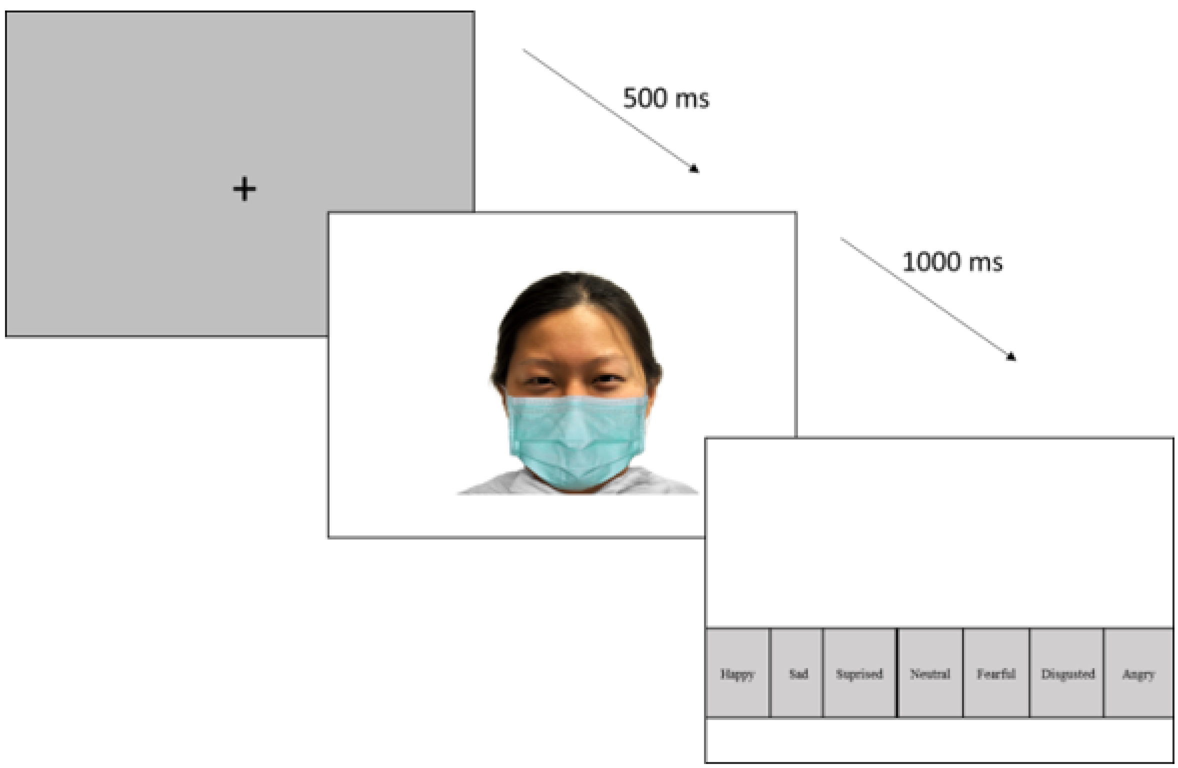


Figure 8

Experimental Procedure

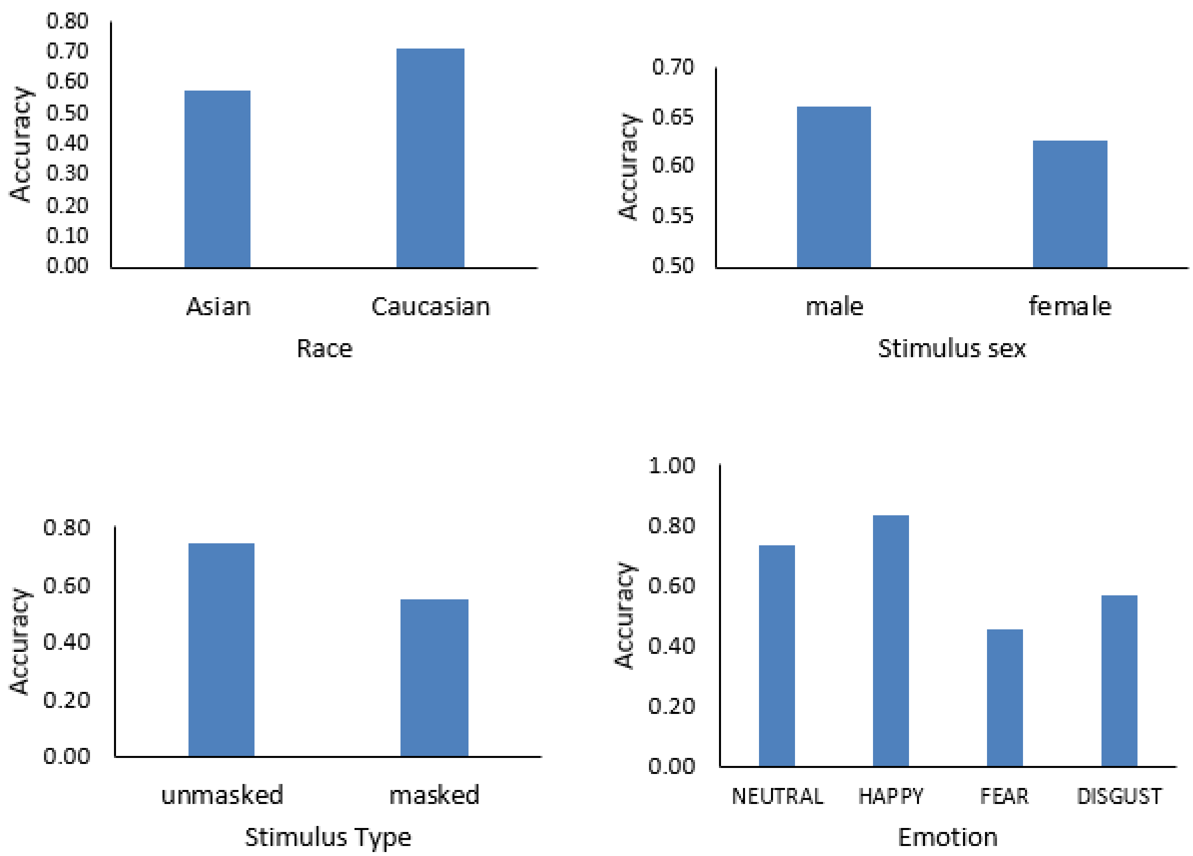


Figure 9

Mean Accuracy for Race, Stimulus Sex, Mask Conditions, and Emotions

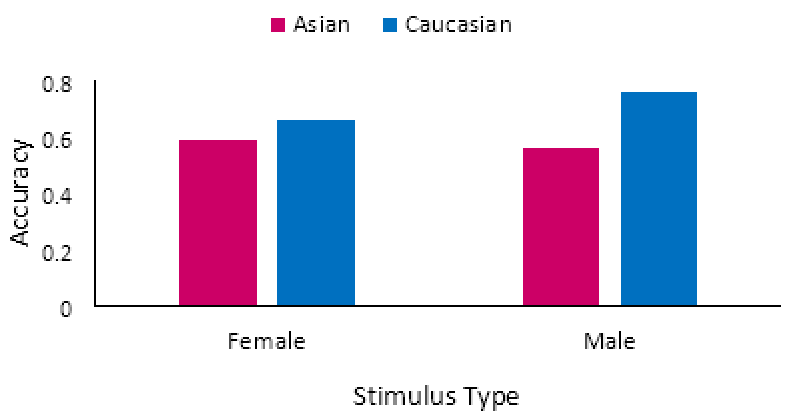


Figure 10

Mean Accuracy for Race and Sex of Stimulus

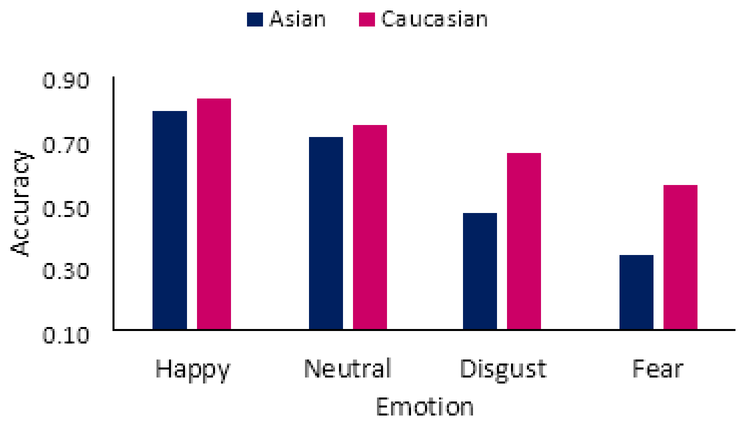


Figure 11

Accuracy for Race and Emotional Expressions

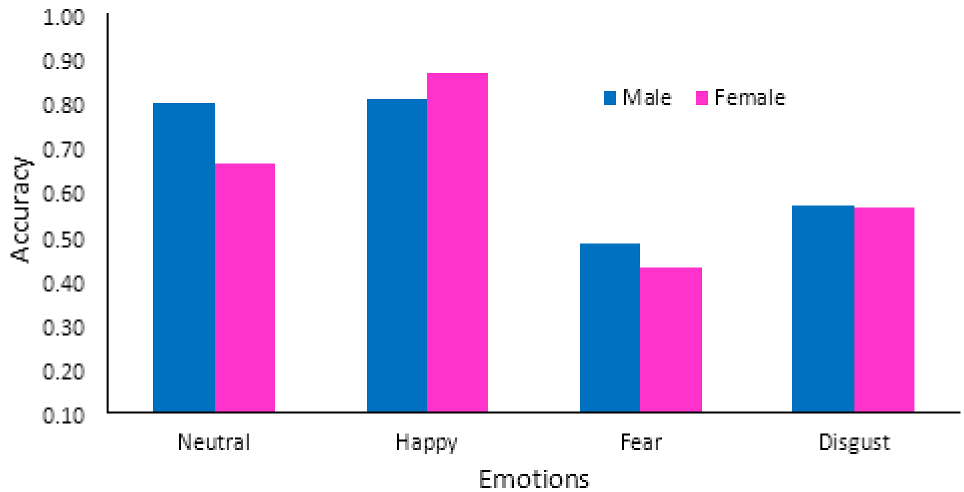


Figure 12

Accuracy for Sex of Stimulus and Emotional Expressions

Figure 13

Accuracy for Emotion and Mask Conditions

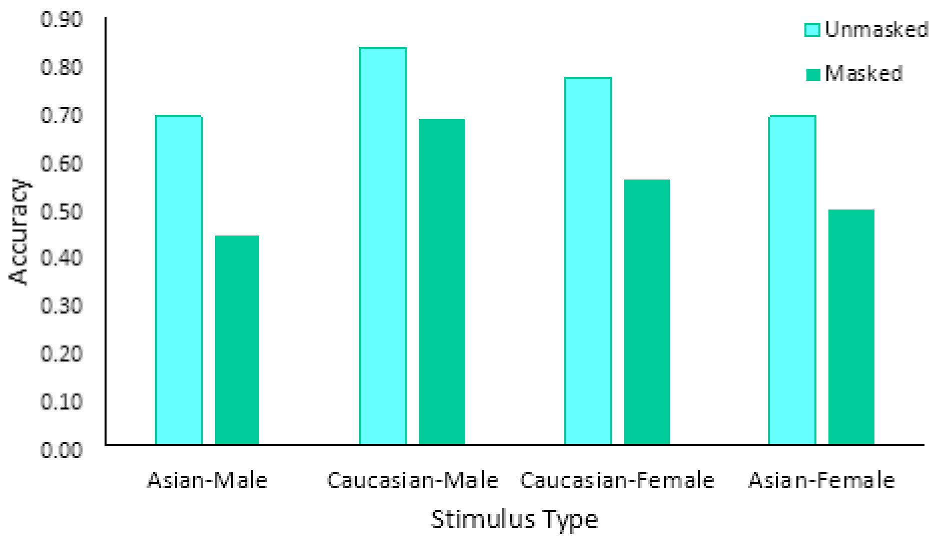


Figure 14

Mean Accuracy for Mask Conditions, Race, Sex of Stimulus

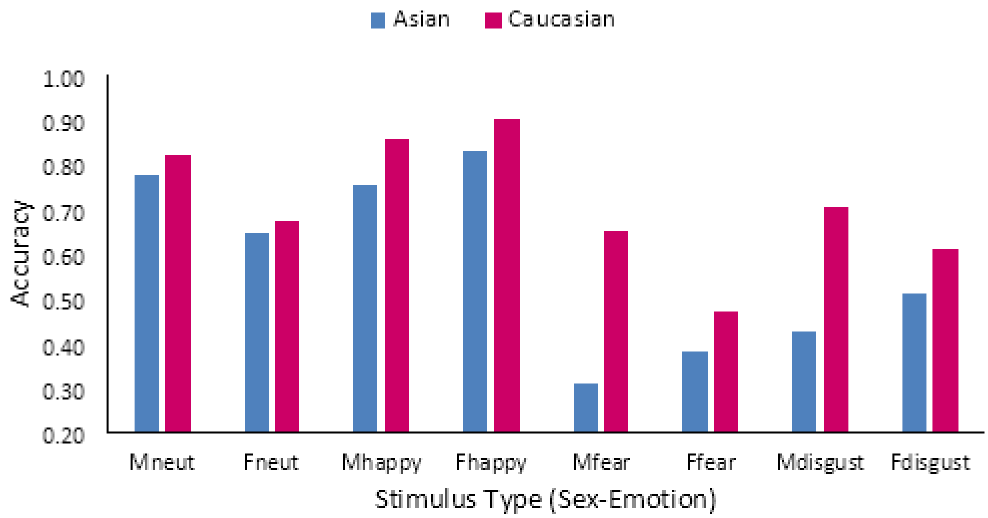


Figure 15

Accuracy Scores With Respect to Race, Sex, and Emotion Conditions. Note. M = male, F = female.

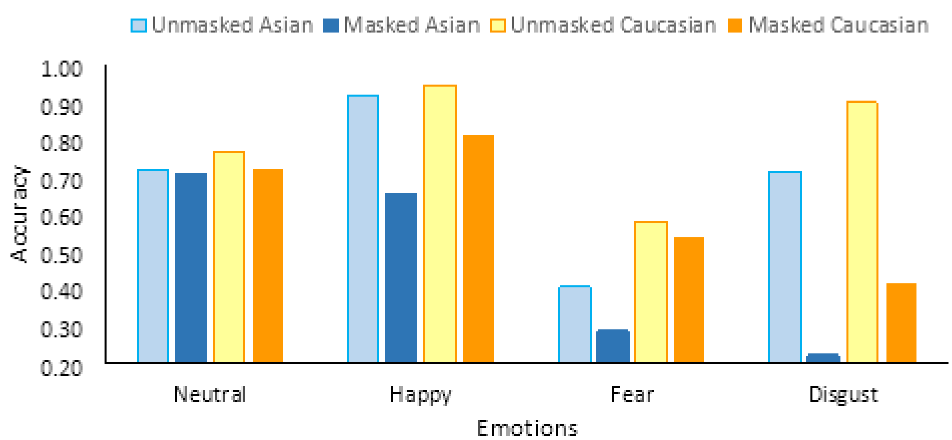


Figure 16

Mean Accuracy Regarding to Mask, Race, and Emotions

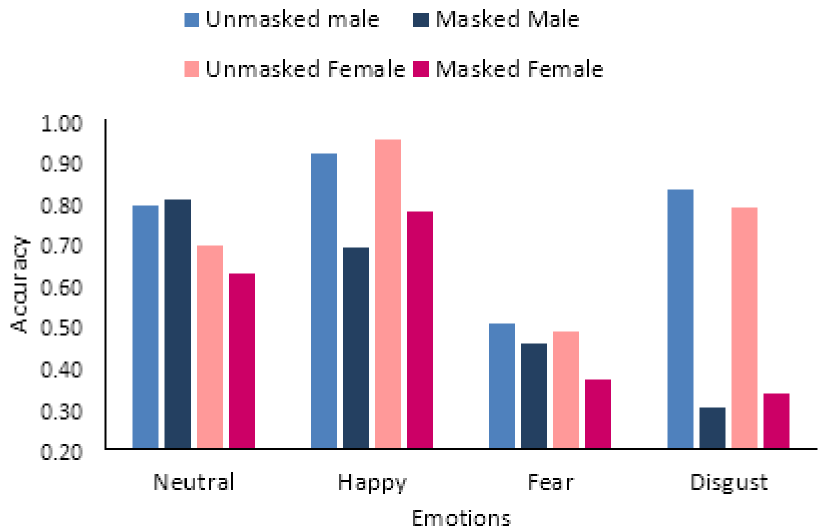


Figure 17

Mean Accuracy for Different Mask, Sex, and Emotion Conditions

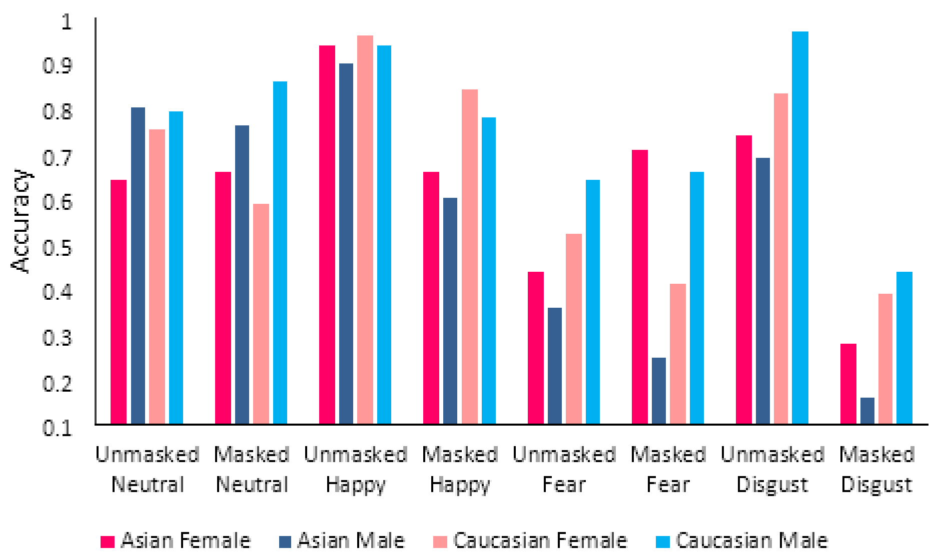


Figure 18

Mean Accuracy for Different Mask, Sex, Race, and Emotional Conditions

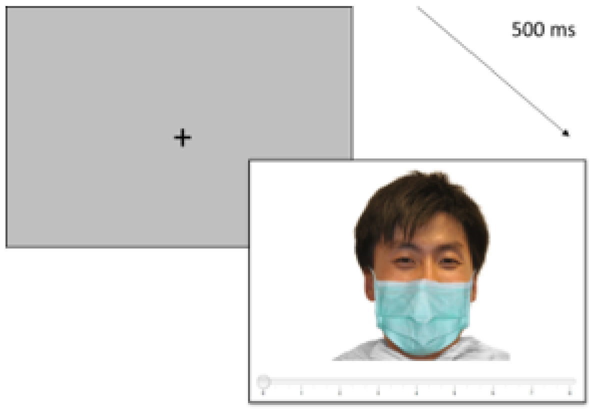


Figure 19

Experimental Procedure

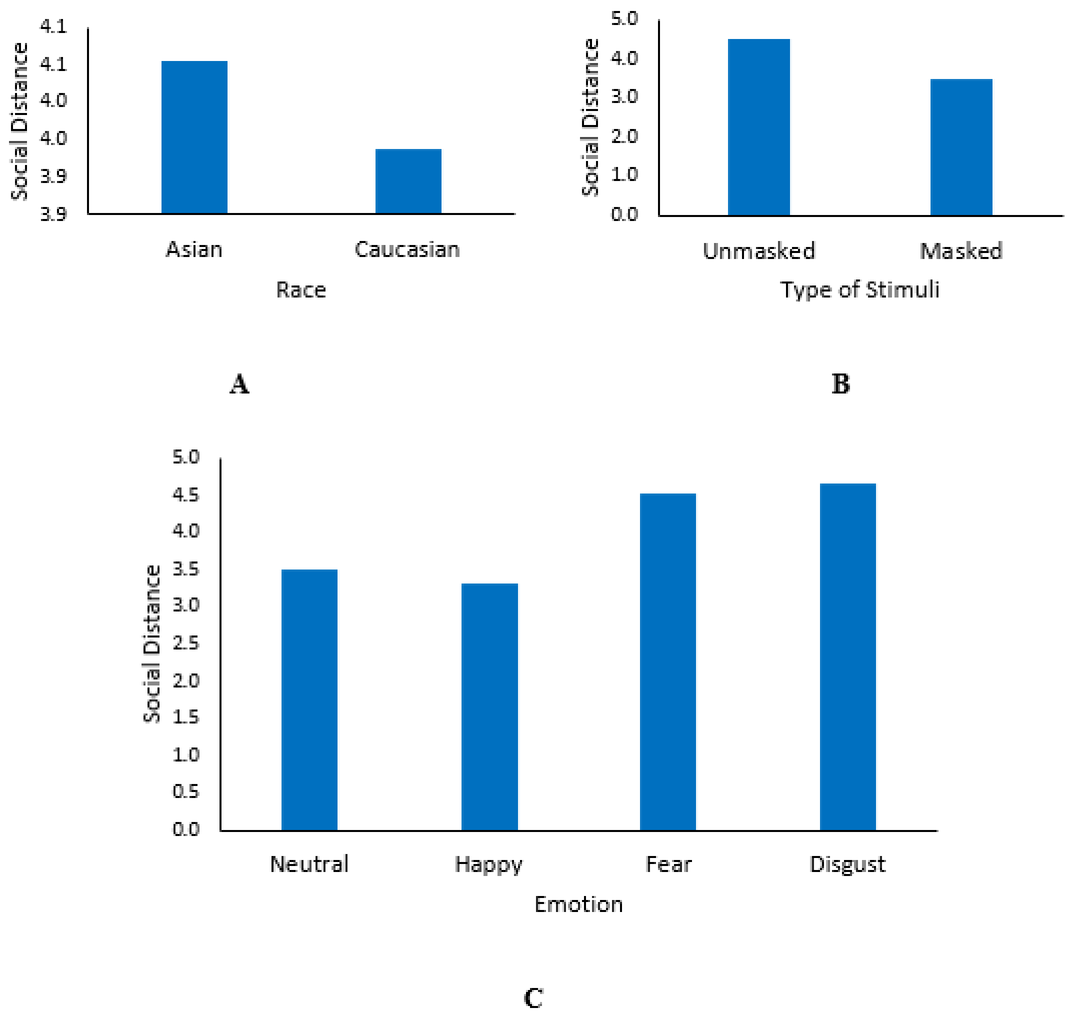


Figure 20

Social Distance with Respect to Race, Mask, and Emotion Conditions

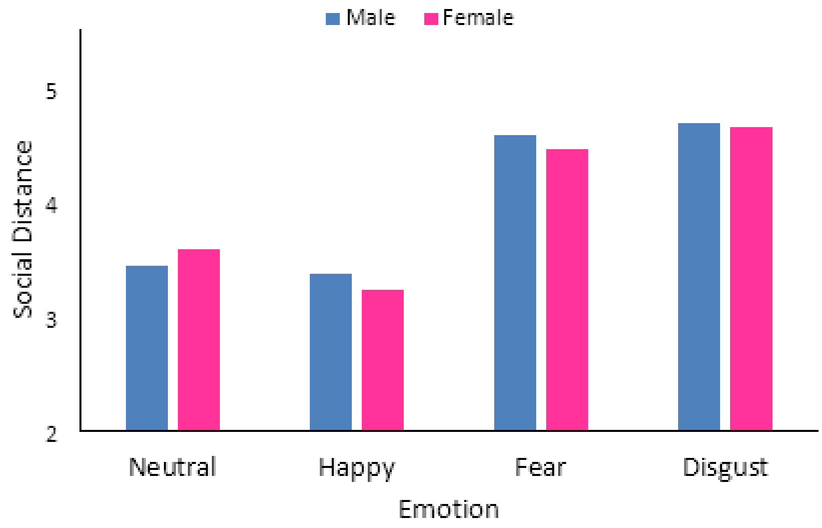


Figure 21

Participants' Preferred Social Distance with Respect to Emotion and Sex of the Stimulus

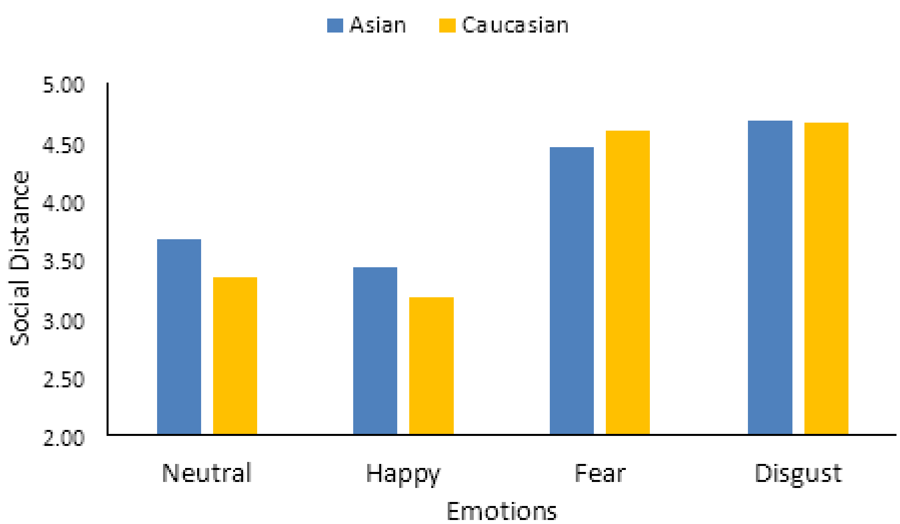


Figure 22

Participants' Preferred Social Distance with Respect to Emotion and Race

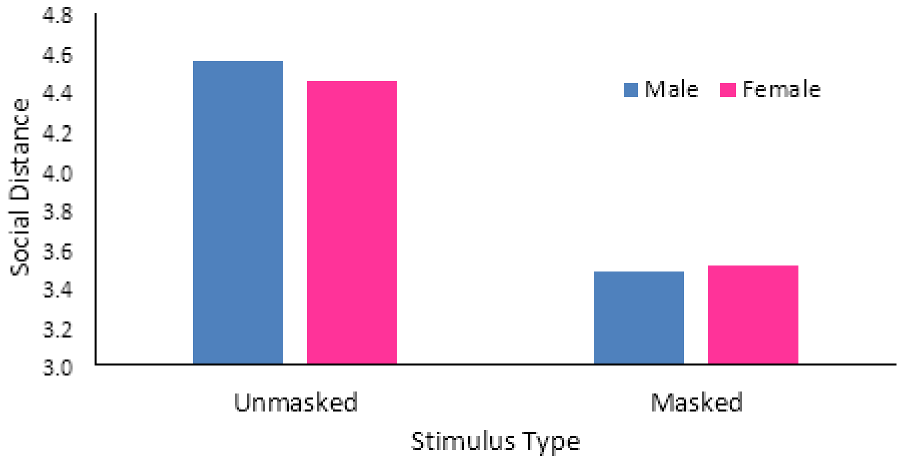


Figure 23

Social Distance with Respect to Masked and Unmasked Male and Female Faces

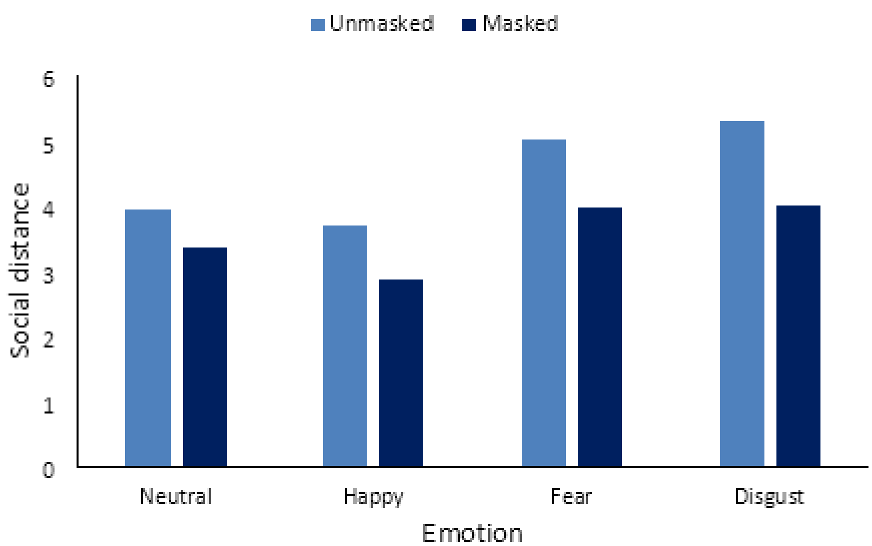


Figure 24

Social Distance With Respect to Masked and Unmasked Faces Having Different Emotional Expressions

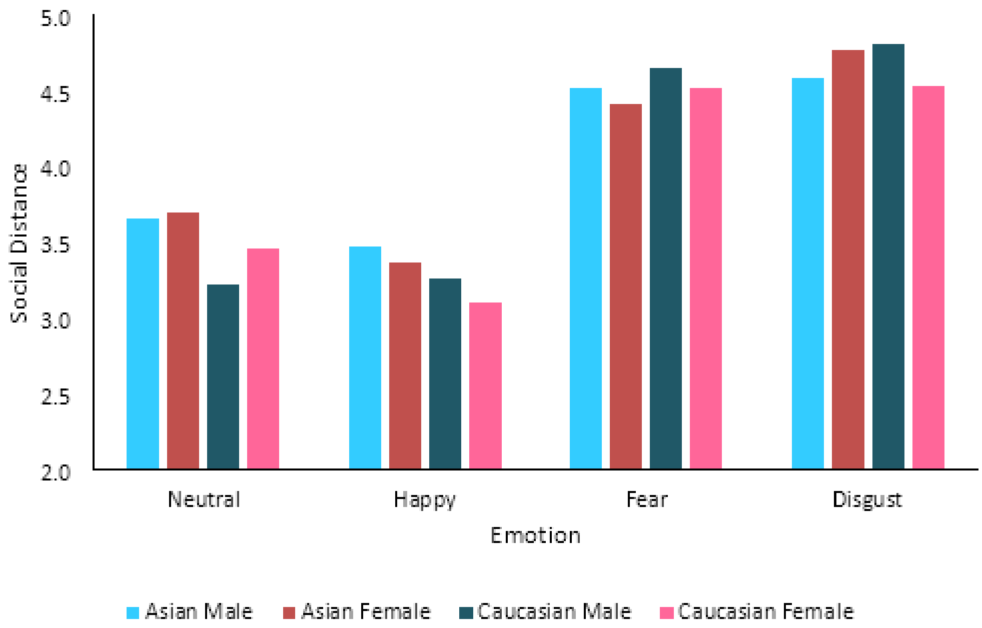


Figure 25

Participants' Preferred Social Distance With Respect to Emotional Expression, Race, and Sex

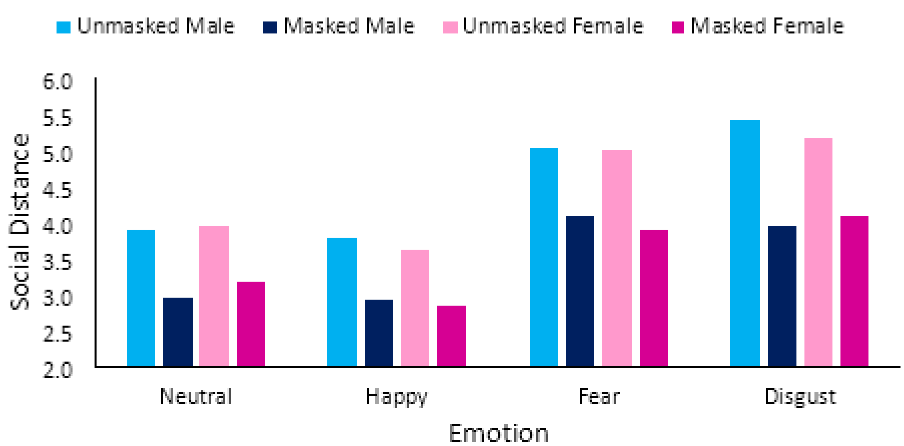


Figure 26

Participants' Preferred Social Distance With Respect to Mask Conditions, Emotional Expression, Race, and Sex