Journal of Integrated Social Sciences
www.JISS.org, 2023 - 13(1): 1-23

Original Article:

EMOTION IDENTIFICATION AND FACIAL RECOGNITION IN INDIVIDUALS WITH AUTISTIC TENDENCIES DURING THE COVID-19 PANDEMIC

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Abstract

Facial expressions guide social interactions and help people remember other's faces. Studies show that, in general, people are poor at recognizing emotions when a covering obscures the face. The autistic population has been known to struggle with emotion identification and facial recognition. However, there is little research on the impact of covering facial features on these abilities in the autistic population. This study aimed to investigate the effects of facial masks on the ability to recognize faces and identify emotions in people with varying levels of autistic tendencies. In two online experiments, each recruiting participants from different platforms, participants watched videos of people making emotional facial expressions with or without facial masks and identified the person's emotions. After a filler task, they took a recognition test to report if they had seen the face in the previous experimental phase. The study's results confirm that recognizing emotions and remembering faces with masks is challenging, with weak evidence for differential effects for those with autistic tendencies. Additionally, there were mixed results for the Mturk sample. In general, this work shows that facial masks may be impacting the way that people with varying levels of autistic tendencies are remembering faces in the post-COVID-19 world.

Keywords: facial masks, COVID-19, emotion identification, facial recognition, autism

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INTRODUCTION

Facial expressions and facial identity are essential to social interactions. Facial expressions provide clues to a person's mood and intentions and can help with memory for faces (Wang, 2012). During the COVID-19 pandemic, facial masks were widely used to prevent the transmission of the virus, and some predict people will continue to wear them in cold and flu seasons going forward (Victor & Ives, 2021). However, face masks cover critical portions of the face necessary for emotion recognition (Blais et al., 2012; Wegrzyn et al., 2017), which may impact how people can use these cues for social functions.

Identifying or recognizing what someone is feeling based on their facial expression is an essential social skill (Wang, 2012). Certain facial regions provide more information for recognition than others. For instance, the eyes and the mouth give the most information for emotion recognition (Blais et al., 2012; Wegrzyn et al., 2017). The mouth offers more information for happiness and disgust, and the eyes provide better information for sadness, fear, and anger, and both features significantly aid in recognizing surprise (Nusseck et al., 2008; Wegrzyn et al., 2017). When these portions of the face are covered, emotion recognition is impaired (Kret et al., 2021; Marini et al., 2021). It has been shown that people perceive less happiness in the faces of those wearing niqabs compared to those without niqabs (Fischer et al., 2012). Additionally, wearing surgical masks hinders emotion recognition for men and women across four emotions; it is suggested that negative emotions, like sadness and anger, would be most affected by surgical masks in real-world situations (Parada-Fernández et al., 2022). In response to the presence of a facial mask, emotion recognition is less accurate, specifically for disgust (Grahlow et al., 2022), and individuals often confuse similar emotions, such as disgust and anger, when reading a face with a mask (Carbon, 2020). Furthermore, the lower accuracy of emotion recognition indicates that the ability to recognize emotions is impacted by facial masks (Carbon, 2020).

Memory for faces is also a critical cognitive process in social interaction. Remembering whether or not one has seen a face previously facilitates social interactions by helping the individual determine if they know someone; talking to a stranger requires a different set of social actions than talking to a friend. Studies show that facial expressions and the holistic (entire) face are essential to recognizing and remembering faces (Wang, 2012; Bainbridge et al., 2013). People can experience a substantial decrease in the ability to perceive faces when the face they are looking at is covered or masked (Freud et al., 2020). For example, Freud et al. (2020) found that face masks lead to a significant decrease in face processing abilities, suggesting that face processing is less holistic in the presence of masks- in other words, because people cannot see the whole face, they have to rely on small pieces of facial information, such as the eyes or eyebrows, which is less effective than seeing the entire face. Other recent studies also show that masks impair facial recognition for children and adults (Stajduhar et al., 2022), which, in turn, causes adverse effects on social interactions (Carragher & Hancock, 2020). It is necessary to determine the impact of masks on remembering faces because it facilitates social relationships between familiar and unfamiliar people, as well as aiding in police lineups and court testimonies. Covering the face with a mask could create difficulties in how well people can use the face as a memory cue, changing how they interact with peers, friends, coworkers, and more.

One population known to struggle with identifying emotional expression is those diagnosed with autism (Fridenson-Hayo et al., 2016; Rump et al., 2009). Individuals with autism are less accurate than neurotypical individuals in identifying the emotions of disgust, anger, and surprise (Smith et al., 2010). This group tends to confuse emotion categories when the emotion is highly present and experiences significantly more confusion of emotions when it is present at low intensity (Wingenbach et al., 2017). Similar findings have been shown for facial recognition, where autistic populations struggle to remember faces.

Unlike neurotypical individuals, those with autism have a face memory deficiency that does not improve with more time to study the faces (Suri et al., 2021). Similarly, face memory improves in neurotypical individuals but not those with autism, leading to a deficit in adulthood (O'Hearn et al., 2010). Limited research has been done on how obscuring facial cues affects how people identify emotion and recognize if they have seen a face previously for this group. What is available suggests facial masks would negatively impact this ability: autistics can accurately recognize dynamic emotions in people who do not wear masks but are less accurate at facial emotion recognition when shown static stimuli or pictures of faces with masks (Rump et al., 2009; Pazhoohi et al., 2021). It is unclear how facial masks will impact autistic individual's ability to identify emotional expressions and recognize if they have seen a face previously. Understanding these effects is essential for therapists assisting autistic individuals with functioning socially in a world where many people choose to cover their faces.

This study examined the impact of facial masks on the capacity to remember faces and identify dynamic expressions of basic emotions such as anger, disgust, and happiness (as defined by Ekman in 1992) among individuals with different levels of autistic tendencies. Participants were not directly asked if they had a formal diagnosis for autism spectrum disorder. Instead, they completed a measure assessing their tendencies, thoughts, and behaviors frequently associated with autism. It was predicted that participants with higher levels of autistic traits would perform worse on emotion identification and facial recognition tasks, regardless of stimuli type, such as unmasked conditions. However, this effect may be attenuated for the masked condition. It was also expected that those with low levels of autistic tendencies would have higher scores for emotion identification and facial recognition when presented with stimuli wearing no masks and lower scores for these abilities when presented with faces with masks.

EXPERIMENT 1

In the first experiment, undergraduate university students were recruited to test the effect of facial masks on the ability to identify emotions and recognize faces in short videos.

METHOD

Participants

One hundred and two individuals started an online experiment hosted on Qualtrics and posted to the University's Undergraduate Psychology Department Subject Pool. Seven did not complete the experiment, and one individual's data was excluded due to self-reported drug use during the experiment. The remaining data from 94 participants, aged 18 to 36 (M= 20.47; SD= 2.421), was analyzed. The participants were not asked if they had a formal diagnosis of autism spectrum disorder. Of the participants, 43 (45.7%) were white, and 76 (80.9%) were women. Please refer to Table 1 for a summary of all demographic information. Participants received two research credits for their participation, and the California Lutheran University Institutional Review Board approved the study.

Table 1. Descriptive Statistics for the Demographics Measures by Sample

	University Sample (*n*=94)	Mturk Sample (*n*=118)
Demographic Statistics		
Age		
Average (*SD*)	20.47 (2.42)	36.31 (10.62)
Gender *n* (%)		
Men	17 (18.1%)	88 (74.6%)
Women	76 (80.9%)	30 (25.4%)
Education Level *n* (%)		
High School Diploma/GED	13 (13.8%)	12 (10.2%)
Some college	57 (60.6%)	23 (19.5%)
Bachelor's Degree	16 (17%)	67 (56.8%)
Master's Degree	0 (0%)	13 (11%)
Other	7 (7.4%)	3 (2.5%)

Materials

Face Video Stimuli. Twelve videos of men and women displaying anger, disgust, and happiness while wearing and not wearing a mask were created. The video stimuli were created using photographs of human faces from the CK and CK+ face databases (Kanade et al., 2000; Lucey et al., 2010). For this experiment, the researchers photoshopped a surgical face mask on half of the photographs using Adobe Photoshop. The mask was photoshopped to cover the lower portion of the face (i.e., over the nose and mouth). A video was then created by transitioning the set of images, progressing from a neutral expression to one of three basic emotions (Ekman, 1992) and back to a neutral expression. The completed 12-video set included a masked version and an unmasked version of each emotion (anger, disgust, and happiness) from each gender (man and woman). See Appendix for an example of still images from the videos. Methodologically, researchers debate whether static or dynamic stimuli are better for assessing emotion recognition. Dynamic stimuli are believed to provide a more realistic interaction, leading to greater accuracy in identifying emotions (Ambadar et al., 2005). This experiment used dynamic videos instead of static images of facial expressions to replicate real-life social situations (Ambadar et al., 2005; Enticott et al., 2014).

Emotion Identification Task. For each video, participants were asked to identify the emotion displayed by the person in each video using a multiple-choice question.

Filler Video. A 2-minute and 8-second video of wild animals (Search, 2012) was used as a distractor task.

Face Recognition Test. After the filler video, participants were shown thirty images of faces. Six were from the image sets used to create the Emotion Identification Task Videos (target items), along with twenty-four additional similar images from the CK and CK+ databases that were not used in the first part of the experiment (Kanade et al., 2000; Lucey et al., 2010). In the test phase of the experiment, all images were presented without masks (See Appendix for example images). With the image of the face still on the screen, participants were asked to indicate if they had seen the face previously (yes/no).

Autism Measure. The Autism Spectrum Quotient Short-28 item was used to evaluate the degree of autistic tendencies among participants. The AQ-Short, developed by Hoekstra et al. in 2011, provides insight into an individual's autistic traits. Low scores on the AQ-Short indicate low levels of autistic tendencies, while high scores indicate a more significant presence of these traits. The AQ-Short is highly correlated with the full-scale AQ-50 item measure, with a coefficient of 0.93 and 0.95 (Hoekstra et al., 2011). Hoekstra et al. (2011) note that a score of greater than 65 on the AQ-Short can be used as a primary screening for autism-related traits in a clinical setting where complete assessments are not possible or in research settings where filling out the full 50-item scale is too time-consuming.

Demographic Questions. Lastly, demographic questions of age, race and ethnicity, gender, and sex were included.

Procedure

The experiment was conducted online using Qualtrics, allowing participants to complete it at their preferred time and location. They were first asked to consent to participate in the study, after which they were shown videos of faces wearing masks or not (depending on the group they were assigned to) and asked to identify the emotions displayed in the videos from a multiple-choice list. After this recognition task, participants watched the filler video. They then completed the Face Recognition Test, which included images of faces seen and unseen before, without facial masks. Participants had to determine whether they had seen the person before in the experiment. Finally, participants were given the Autism-Spectrum Quotient Short-28 item (Hoekstra et al., 2011) and brief demographic questions.

Design

For this experiment, a two-by-two factorial design was utilized. The participants were randomly assigned into one of two between-subjects groups; one group watched videos with masks, while the other group watched videos without masks. Additionally, in the data-analysis stage of the project, participants were separated into two quasi-experimental groups, "Autism-Indicated" or "Autism-not-Indicated," based on the AQ-28 measure with a cut-off score of 65, in line with screening recommendations from Hoekstra et al., 2011, and statistical recommendations from Barron and Kenny (1986). See Table 2 for summary statistics of the Autism Scale measures by sample. The dependent variables included the accuracy of identifying emotions in the Emotion Identification Task (Proportion Correct- Emotion Identification Task), the accuracy of recognizing previously seen faces (Proportion Correct- Face Recognition Test), as well as sensitivity and discriminability measures (d-prime and criterion) for the recognition task. These additional measures aimed to consider the possibility of response bias or carelessness from participants, such as reporting every image as "seen," regardless of their experiences in the first half of the experiment.

***Table 2*. Descriptive Statistics for the Autism Quotient Measures by Sample**

	University Sample (*n*=94)	Mturk Sample (*n*=118)
AQ Measure Statistics		
Scale Used	AQ-Short	AQ-10 Adult
Number of Questions	25	10
Average (*M*) for Sample	61.66	21.99
Sample Minimum	42.00	12.00
Sample Maximum	84.00	31.00
Standard Deviation (*SD*) for Sample	8.44	3.55
"Autism-Indicated" Scale Cut-Point	65	6
"Autism-Indicated" Participants *n* (%)	30 (31.9%)	13 (11%)

Note. See Hoekstra et al. (2011) for information about the AQ-Short, and Allison et al. (2012) for information about the AQ-10.

RESULTS

Emotion Identification Task

A two-way ANOVA was conducted to examine the effect of mask presence and autism traits on correctly identifying a person's emotions in a video. Results show that there was a main effect for mask condition, such that overall, people were much better at identifying emotion in the video when the person in the video was not wearing a mask (*M*=88% correct) as compared to when the person in the video was wearing a mask (*M*=61.9% correct), $F(1,90)=40.509$, $p<0.001$, partial-eta-squared= 0.310. Additionally, there was no main effect for the Autism Screener, such that people who were Autism-Indicated identified emotions at roughly the same levels (*M*=75.8% Correct) as people who were Autism-Not-Indicated on the screener (*M*=74.9% Correct), $p=0.832$. However, there was a significant interaction between the presence of a mask in the video and levels of autism, $F(1,90)=4.096$, $p=0.046$, partial-eta-squared= 0.044. While overall, people had a more challenging time identifying the emotions of the masked videos, people who were Autism-Indicated on the screener had slightly higher scores (*M*=66.7% correct) for masked faces than people who were Autism-Not-Indicated (*M*=57.2% correct) on the screener, $p=0.077$. Whereas for unmasked videos, both Autism-Indicated and Autism-Not-indicated groups scored relatively high (*M*=85%, *M*=92.6%, resp.) and did not differ statistically, $p=0.249$.

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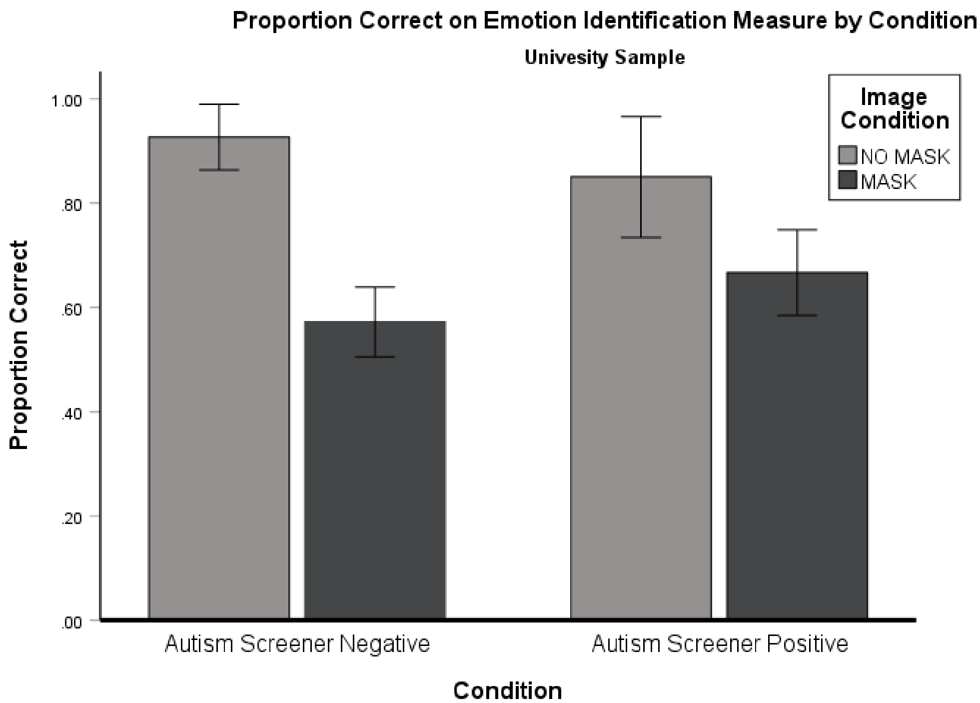

Figure 1. Proportion correct on the emotion identification measure by condition in the university sample. Error bars represent +/- 2 SE

Face Recognition Test

A two-way ANOVA was conducted to examine the effect of mask presence and autism traits on correctly recognizing a photo of a face, as seen before in the previous portion of the experiment. Results show a main effect for mask condition, such that overall, participants who viewed the videos of people wearing masks had a more challenging time correctly identifying the faces that they had seen previously (*M*=67.6% Correct) as compared to participants who viewed the faces without masks in the videos (*M*=81.9% correct), $F(1,90)=10.801$, $p=0.001$, partial-eta-squared= 0.107. There was no main effect for Autism-Indicated or Autism-not-Indicated groups, $F(1,90)=0.051$, $p=0.821$, partial eta squared = 0.001; both groups correctly identified "seen" faces roughly the same, (M_{pos}=75.2% correct; M_{neg}=74.2% correct). Additionally, there was no interaction between conditions, $F(1,90)=0.202$, $p=0.654$, partial-eta-squared=0.002.

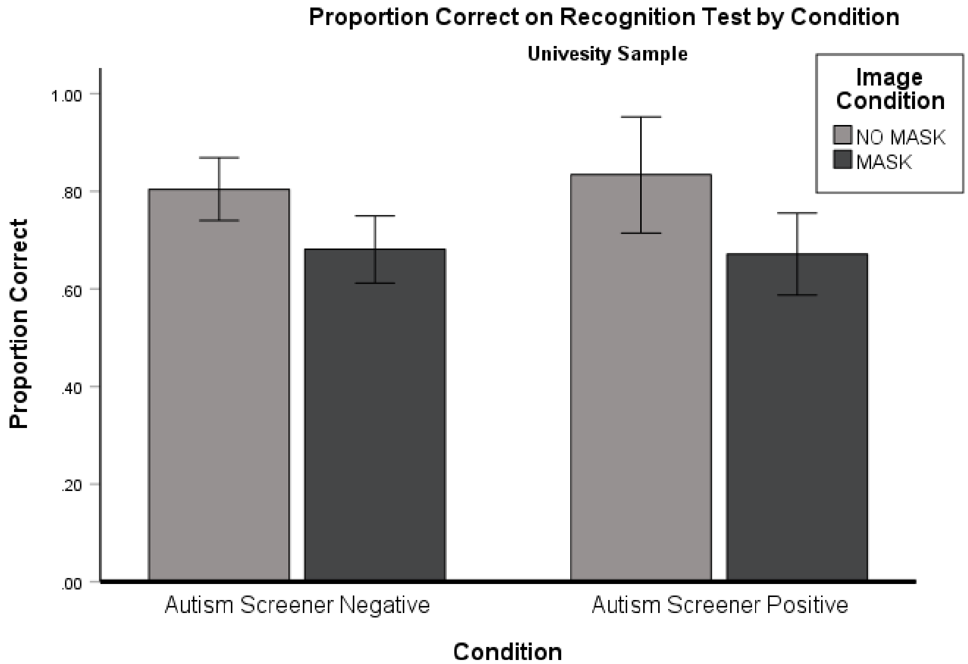

Figure 2. Proportion correct on the face recognition test by condition in the university sample. Error bars represent +/- 2 SE.

Face Recognition Test Sensitivity Analysis

However, the Face Recognition Test analysis reported above does not consider response bias. For example, in this experiment, it is possible that a careless participant could respond "seen" for every item in the recognition test, saving themselves cognitive effort and time while still yielding a high (100%) proportion of targets correct and yet not reflecting their actual memory for the items. Therefore, in addition to the primary analyses noted above, a "hit rate analysis" was conducted using signal detection theory (Stanislaw and Todorov, 1999). Signal detection theory (SDT) analyses can be used when two stimuli must be discriminated, for instance, yes/no tasks, rating tasks, and signals/noise tasks. SDT allows researchers to examine response bias and sensitivity (Stanislaw & Todorov, 1999). Higher sensitivity (d-prime) indicates more correct rejections and identifications, and low criterion indicates an over-perception of the stimulus. In this experimental context, the sensitivity analysis examined whether people correctly identified when they saw a face and when they genuinely had not seen a face in the emotion identification portion of the experiment by condition (mask vs. no mask). D-prime and criterion were calculated with formulas presented by Stanislaw and Todorov, 1999. A d-prime score closer to 3 indicates accurate performance, while a d-prime closer to 0 reflects guessing (American Psychological Association, 2023).

Similar to the previously reported analyses, two-way ANOVAs were conducted to examine the effect of mask presence and autism traits on both d-prime and criterion in the Face Recognition Test. Results show a main effect for mask condition, such that overall, people who viewed the masked-face videos had lower sensitivity (*M*=1.478) than people who viewed the unmasked face videos (*M*=2.206), *F*(1,90)=19.740 *p*<0.001, partial-eta-squared= 0.180. In other words, people who viewed the masked videos had a more challenging time determining whether or not they had seen the face previously. There was no main effect for the Autism-Screener condition *F*(1,90)=0.002, *p*=0.962, partial-eta-squared=0.00, and no interaction between the Autism condition and mask condition *F*(1,90)=0.090, *p*=0.764, partial-eta-squared=0.001. A similar analysis with criterion as the outcome variable showed no statistically significant effects. All *F*'s<2.2, all *p*'s>0.136.

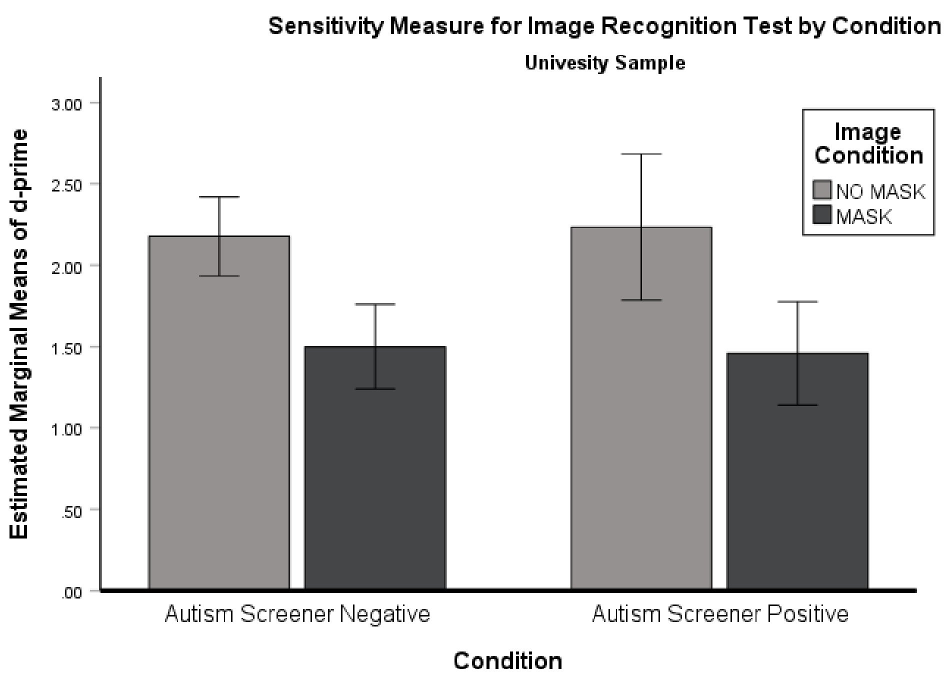

Figure 3. D-prime scores of the face recognition test by condition in the university sample. Error bars represent +/- 2 SE

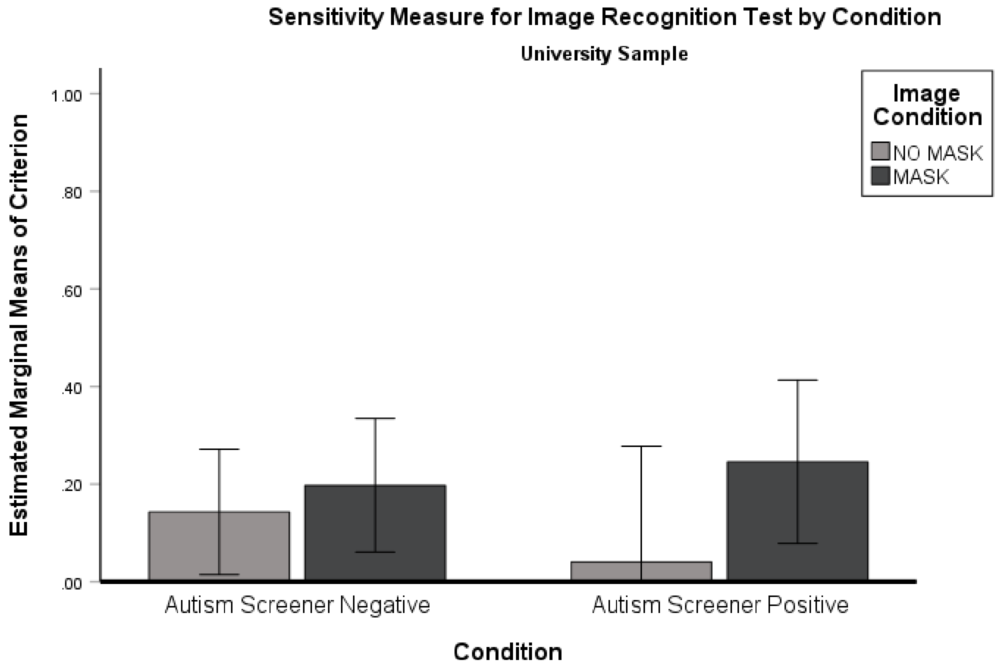

Figure 4. Criterion scores of the face recognition test by condition in the university sample. Error bars represent +/- 2 SE.

DISCUSSION

Experiment 1 showed that facial masks made it more difficult for the participants to recognize emotions and determine if they had seen a face previously. This result replicates findings such as Grahlow et al., 2022, who focused on the neurotypical population and found that emotion recognition is less accurate for images with facial masks. The experiment expands on these previous findings by demonstrating the effects of wearing masks on video facial recognition. Interestingly, this experiment adds nuance to findings on autistic populations from Rump et al. (2009) and Pazhoohi et al. (2021), showing differences in emotion recognition in dynamic stimuli vs. static stimuli with and without masks. In the current study, people in the Autism-Indicated group scored slightly better on emotion identification in the mask condition than those in the Autism-not-Indicated group. Speculatively, it is possible that dynamic video stimuli gave participants the additional cues they needed to perform better on the task as if they had seen static images. Another possibility is that people with higher Autistic traits are more accustomed to challenges in emotion identification. Therefore, the task overall was not as effortful for them as it would be for someone unpracticed with emotion identification obstacles. It is also possible that this finding is a type-1 error, given the weak *p*-value and small effect size. Additionally, this experiment tested university-aged students in one region of the

United States and was mainly composed of younger female participants, limiting the generalizability of these results.

EXPERIMENT 2

In the second experiment, participants were recruited from a new sample through Amazon MTurk to increase the diversity of the sample. This allowed for data to be gathered from a more comprehensive age range and more varied gender representation. The methodology was identical to Experiment 1, except it used a shorter Autism Spectrum Quotient scale to fit the short nature of studies on the platform.

METHOD

Participants

A total of 157 individuals started the online experiment hosted on Qualtrics and posted to the Amazon MTurk Subject Pool. Six participants did not finish, six were removed for answering the attention check questions incorrectly, twenty-three were removed for reporting drinking alcohol or taking drugs during the study, and four were removed for not answering questions on the Autism Scale. The remaining data from 118 participants was analyzed and included in the results below. Please refer to Table 1 for a summary of sample demographic information. Participants were not asked to report a formal diagnosis of autism or any other neurological condition. Participants received $1.50 for their participation, and the California Lutheran University Institutional Review Board approved the study.

Materials, Procedure, and Design

The materials, procedure, and design for Experiment 2 were identical to Experiment 1, with two main exceptions. First, the experiment recruited participants via Amazon's Mturk rather than the University subject pool. Second, the autism measure, the AQ-28, was replaced with the AQ-10 (Allison et al., 2012). The AQ-10 correlates significantly with the original Autism Spectrum Quotient-50 item. While it is not used to diagnose autism, it can be a reliable screening tool in research and clinical settings. Using the AQ-10 scores in the data analysis stage of the project, participants were separated into two quasi-experimental groups, "Autism-Indicated" or "Autism-not-Indicated," using a cut-off score of 6, in line with screening recommendations from Allison et al., 2012. See Table 2 for summary statistics of the Autism Scale measures by sample.

RESULTS

Emotion Identification Task

A two-way ANOVA was conducted to examine the effect of mask presence and autism traits on correctly identifying a person's emotions in a video. Results show that there was a main effect for mask condition, such that overall, people were much better at identifying emotion in the video when the person in the video was not wearing a mask (*M*=84.4% correct) as compared to when the person in the video was wearing a mask (*M*=51.3% correct), *F*(1,114)=22.996, *p*<0.001, partial-eta-squared= 0.168. Additionally, there was no main effect for Autism Screener, *F*(1,114)=0.210, *p*=0.647, partial eta squared = 0.002, such that people who were Autism-Indicated identified emotions roughly at the same levels (*M*=69.4% correct) as people who were Autism-not-Indicated on the screener (*M*=66.3% correct), *p*=0.647. Additionally, there was no interaction between the Autism screener scores and mask condition, *F*(1,114)=0.701, *p*=0.404, partial eta squared= 0.006, such that higher and lower levels of autism did not change the effect of masks on emotion identification.

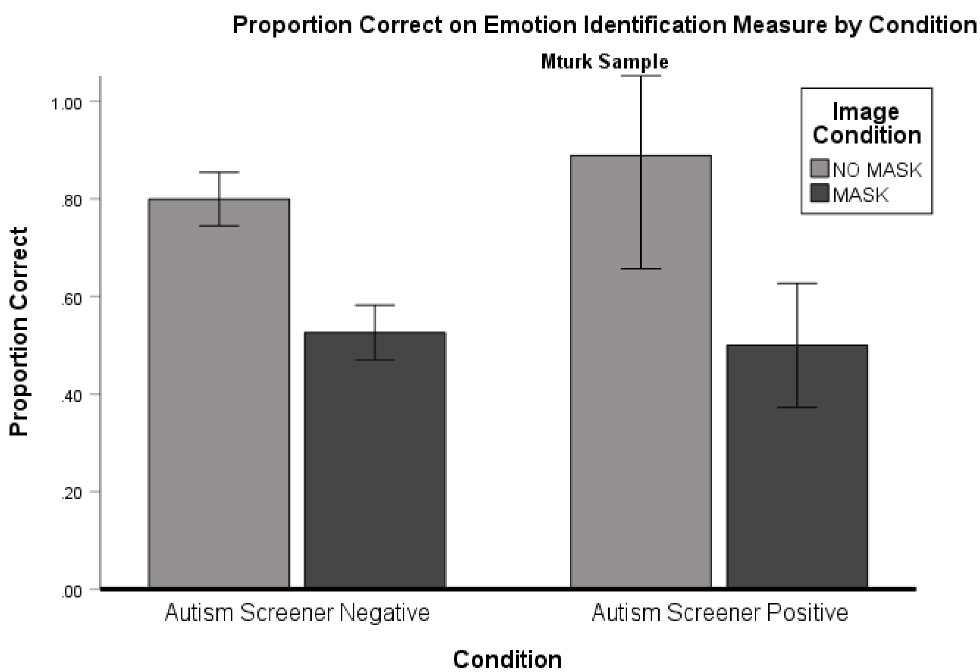

Figure 5. Proportion correct on the emotion identification measure by condition in the Mturk sample. Error bars represent +/- 2 SE.

Face Recognition Test

A two-way ANOVA was conducted to examine the effect of mask presence and autism traits on correctly recognizing a photo of a face, as seen before in the previous portion of the experiment. Results showed no main effect for mask condition $F(1,114)=0.010$, $p=0.921$, partial eta squared=0.00, such that participants who viewed the videos of people wearing masks had just as challenging of a time correctly identifying the faces that they had seen previously (M=52.6% correct) as compared to participants who viewed the maskless faces in the videos (M=53.5% correct). Additionally, there was no main effect for Autism levels, $F(1,114)=2.302$, $p=0.132$, partial eta squared = 0.020; both groups correctly identified "seen" faces roughly the same, (M_{pos}=46.4% correct; M_{neg}=59.7% correct). Additionally, there was no interaction between mask and autism conditions, $F(1,114)=0.296$, $p=0.588$, partial-eta-squared=0.003, such that people scoring high on autism traits performed similarly in mask and no mask conditions as people scoring lower on autism traits.

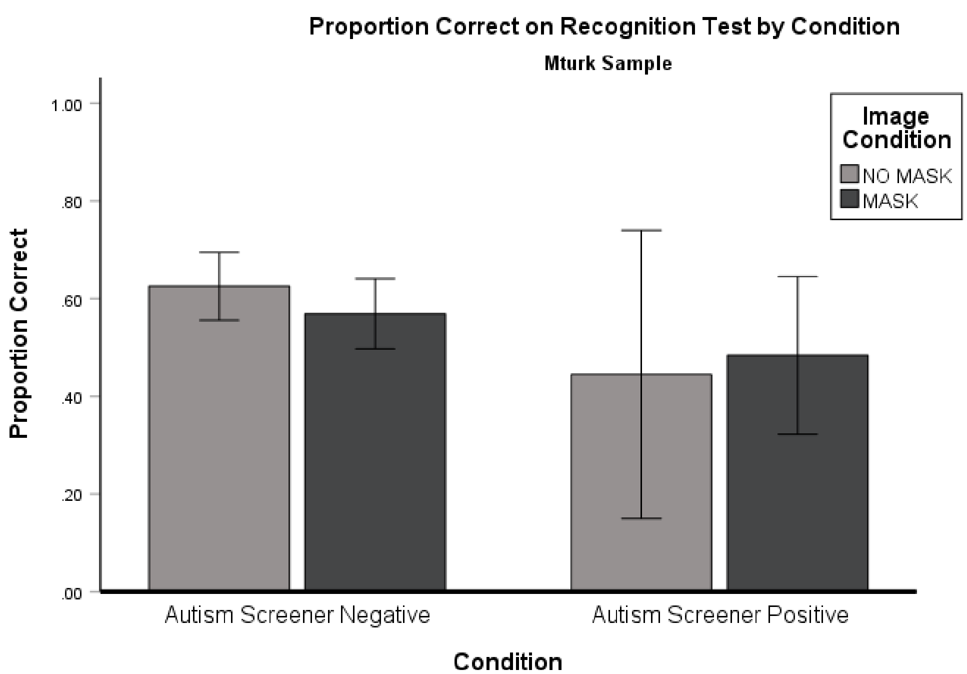

Figure 6. Proportion correct on the facial recognition test by condition in the Mturk sample. Error bars represent +/- 2 SE.

Face Recognition Test Sensitivity Analysis

In addition to the primary analyses noted above, a "hit rate analysis" was conducted similarly to the Experiment 1 analysis. This analysis is critical in interpreting the data because it accounts for careless responses and sensitivity bias. D-prime and Criterion were calculated as prescribed in Stanislaw & Todorov, 1999, where a d-prime score closer to 3 indicates accurate performance, while a d-prime closer to 0 reflects guessing (American Psychological Association, 2023).

Results of the two-way ANOVA on d-prime scores showed no main effect for mask condition, such that people who viewed the masked-face videos had similar recognition sensitivity (M=0.80) than people who viewed the unmasked face videos (M=1.193), $F(1,114)=1.845$, $p=.177$, partial-eta-squared= 0.016. In other words, people who viewed the masked videos had similar difficulties in determining whether or not they had seen the face previously compared to those who viewed the unmasked videos. Additionally, there was no main effect for the Autism-Screener condition $F(1,114)=2.737$, $p=0.101$, partial-eta-squared=0.023; participants in the Autism-Indicated group had similar d prime scores (M=0.757) as participants in the Autism-not-Indicated group (M=1.236). Additionally, there was no interaction between the Autism groups and mask conditions $F(1,114)=0.689$, $p=0.408$, partial-eta-squared=0.006. A similar analysis with criterion as the outcome variable showed no statistically significant effects. All F's<0.004, all p's>0.376.

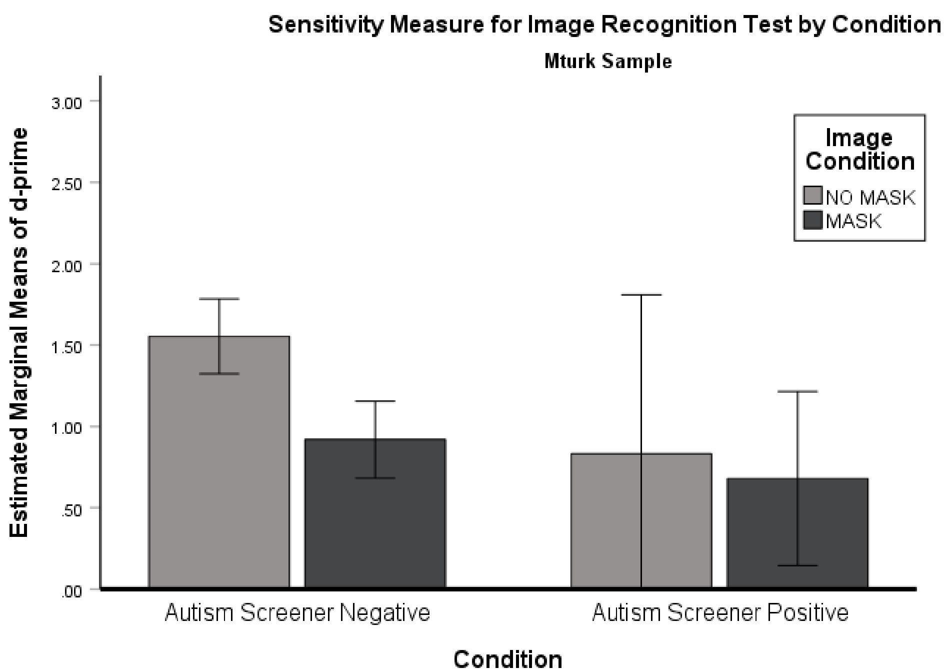

Figure 7. D-prime scores for the facial recognition test by condition in the Mturk sample. Error bars represent +/- 2 SE.

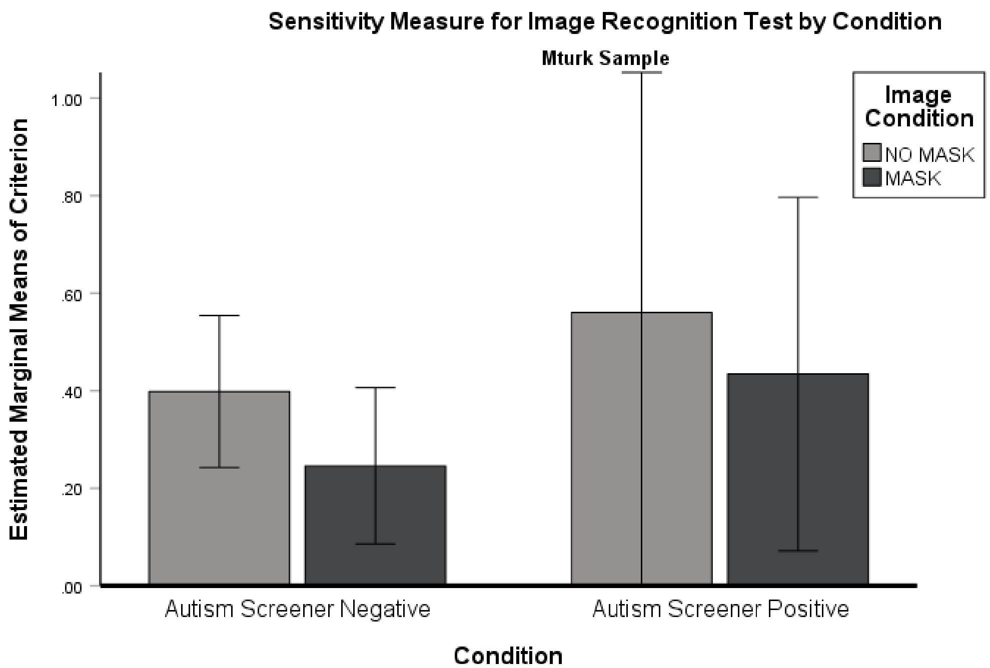

Figure 8. Criterion scores for the facial recognition test by condition in the Mturk sample. Error bars represent +/- 2 SE.

DISCUSSION

Overall, the results of Experiment 2 confirm the findings of Experiment 1 in that masks make it difficult for people to identify emotions. However, it differed from Experiment 1 in that there were no significant effects from the autism conditions. Experiment 2 had fewer participants in the Autism-Indicated group than Experiment 1, which could account for these results. However, the effect sizes for most analyses in Experiment 2 were relatively small. The d-prime scores were relatively low overall and, taken together with the small effect sizes, could indicate a fair amount of guessing or carelessness by participants in this sample. This result is despite removing participants who failed the attention checks.

GENERAL DISCUSSION

Due to the COVID-19 pandemic, more people regularly wear face masks (Victor & Ives, 2021). While this has helped stem the spread of respiratory pathogens, facial masks cover important facial cues used in emotion recognition. The masks can thus impede essential social functions that rely on understanding another person's emotions (Carragher & Hancock, 2020). Even without masks, some populations, especially, have difficulty identifying emotions. For example, people with autism have deficits in emotion identification and facial recognition (e.g., Rump et al., 2009). However, the full impact of concealing parts of the face on emotion identification for people with autism is still unknown.

The current study aimed to determine how wearing facial masks affects emotion identification and recognition in people with varying autistic tendencies. It was expected that those with higher levels of autistic tendencies would have more difficulty identifying emotions and recognizing faces regardless of whether or not the target face was wearing a mask. However, they may struggle relatively more in the masked condition. Additionally, it was expected that people with lower levels of autistic tendencies would score relatively higher in emotion identification and facial recognition when presented with stimuli wearing no masks but score lower on both tasks when the stimuli included a mask. The results supported some aspects of this hypothesis.

Overall, when participants were presented with videos of faces covered by a mask, their ability to correctly identify the emotions of the face was poor. However, people who were Autism-Indicated on the screener in the university sample still had poor but slightly higher scores for masked faces than people who were Autism-not-Indicated on the screener. This finding is supported by Grahlow et al., 2022, who focused on neurotypicals and found that masks significantly impair emotion recognition. However, this finding somewhat contradicts Rump et al. (2009) that autistic children had poorer ability than their neurotypical counterparts to identify emotional expression via dynamic video stimuli. However, Pazhoohi et al. (2021) found that varying levels of autistic tendencies did not affect emotion identification but that, overall, masks make emotion identification more difficult, which is replicated in the current study. The current findings also contradict a recent study by Ramachandra and Longacre (2022) that showed higher levels of autistic traits were associated with a poorer ability to identify emotion. However, Ramachandra and Longacre's (2022) stimuli differed slightly from the current study, which used dynamic video stimuli that included the entire head.

Similar to findings from Marini et al. (2021), the current study shows that the presence of facial masks decreased participants' abilities to recognize faces as seen before. However, this was only present in the university sample and did not differ by levels of autistic traits. These results somewhat contradict that of Stantić et al. (2021), who found that, in general, people with lower levels of autism were better at facial recognition than those with high levels of autism. However, there are cases where facial recognition abilities may be normal or close to neurotypical ranges due to different ways a face can be presented, for instance, looking at a face straight on or looking at a side profile.

Exploratory hit-rate analyses were conducted on the facial recognition scores for both experiments. These analyses are essential in interpreting the results because they can account for response bias and guessing, indicating when participants could be “over” perceiving faces as seen before- reporting they had seen a face when, in reality, they had not. The results showed that individuals in the university sample who watched the masked videos had difficulty recognizing previously seen faces, regardless of their level of autistic traits. The d prime scores for the Mturk sample did not yield significant effects by condition. They were overall notably lower, indicating the possibility of careless responding or guessing in this experiment. This type of result can be typical for participants on Mturk trying to complete experiments quickly and may explain why the results differed across the two experiments (e.g., Chmielewski & Kucker, 2020).

Another reason the results could have differed across experiments, and a general limitation of this study, is the low number of participants with high levels of autistic tendencies in the Mturk Sample. This limitation could be due to the Mturk platform, as those with higher levels of autistic tendencies may not have the motivation or functional ability to utilize Amazon Mturk. Another general limitation of the study is the lack of formal Autism Spectrum Disorder diagnoses for participants; participants were assessed for varying levels of autistic tendencies through screener tools. However, the screener is not diagnostic; high tendencies do not mean that the individual has autism. Future directions include studying the impact of masks on emotion recognition and facial recognition across the Autism Spectrum, including those with a formal diagnosis.

Emotion identification and facial recognition are essential for building and maintaining social relationships; however, it is clear from this study and previous research that facial masks can impair these abilities. Those with autism often have difficulty navigating social relationships, and adding facial masks to these interactions can make it daunting for these individuals to socialize. Deficits in facial recognition and emotional identification can impair social interactions if the individual cannot recognize peers and can create dangers if the individual cannot determine who they have relationships with (Sucksmith et al., 2013). It is necessary to understand the effect of masks to better aid those with autism in facilitating safe social relationships. Additionally, clinical psychologists and those working with autistics would benefit by understanding how emotion identification and facial recognition processes are being affected by masks in this population, thereby aiding in the development of interventions to help combat these setbacks. For example, new social techniques can be created to teach reliance on different social cues, simulations can be created to help develop skills for interactions with masked individuals, and resources can be explicitly provided to the autistic population to prepare them for interactions with people who choose to wear facial masks.

Understanding how masks affect human communication, cognitive processes, and behaviors has many important applications in the social sciences. For example, this information could be helpful to professionals in the public health field, who need to convince groups to wear protective equipment, such as masks, in medically necessary situations. It may also be helpful to professionals in the political science discipline, for whom mask-wearing has become a political issue. It may also be interesting to look at these effects with a cross-cultural lens, for instance, comparing these types of emotion and communication effects in cultures where wearing masks during cold and flu season is a standard community practice with those cultures that are newer to or more uncomfortable with the practice. Overall, research in this area has the potential to impact not just psychologists working with autistics but any field where the communication of emotion and memory for faces is essential to daily function.

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APPENDIX

Sample Stimuli for Emotion Recognition, Facial Recognition, and the Distractor Task.

Sample Stimuli Without Mask

Sample Stimuli With Mask

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