Relationship Between Masks and Perceived Emotions

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Abstract

The Covid-19 pandemic introduced mask wearing on a global scale. As a consequence, people noticed a barrier in face-to-face communication. Previous studies found just seeing the eyes of a face, like wearing a mask, impaired participant's ability to read the intensity of an emotion (Beaudry et al., 2014). We decided to look further into how face masks impact a person's ability to perceive emotions. We replicated the study conducted by Teddi et al.(2023) The goal of the study was to understand the relationship between facial coverings and emotional recognition. We gathered data using a repeated-measures Qualtrics survey with 55 subjects. We presented pictures of faces portraying an emotion with and without masks. We hypothesized that participants would rate the faces with masks as more negative and less positive regardless of which emotion was presented. The findings supported our hypothesis. The participants rated the faces with masks expressing negative and neutral emotions more negatively, and positive emotions less positively. This was consistent with the study replicated. Masks seem to present emotions as more negative than the emotion the person wearing the mask is trying to convey.

Keywords: facial mask, emotion, emotion intensity, perceived emotions

Relationship Between Masks and Perceived Emotions

The COVID-19 pandemic had a global impact. Many individuals experienced lockdowns, encountered travel restrictions, and navigated a new way of living and working. The first goal was to stop the spread of the virus. After lockdown, face coverings only revealing the eyes along with social distancing were the most commonly used practices in the United States. About 75% of schools in the United States had mask mandates in the fall of 2021 (Blake, 2022). That same year, many businesses also had mask mandates depending on state requirements. The addition of social distancing and quarantine procedures resulted in many people reporting feelings of loneliness. In a preliminary study, "43% of young adults reported increases in loneliness since the outbreak of the pandemic" (Cashin, 2021). These measures left many researchers questioning the psychological and social effects of face coverings. While the feelings of isolation reported by many during the pandemic have decreased, because of the integration of masks in social interactions there still are barriers in communication. This continues after an event like the pandemic, because many cultures use various forms of face coverings, i.e. hijabs, scarves, sunglasses. We decided to look further into how face masks impacted social interaction, especially the ability to perceive the emotions of someone who is wearing a mask.

Theory of Mind

A theory attached to how people can understand others' emotions is the Theory of Mind. The term "Theory of Mind" was defined by Premack and Woodruff (1978). Theory of Mind is about the "mind reading" abilities humans seem to have over animal counterparts. The "mind reading" is how humans can put themselves into the shoes of another and understand why others would think or act the way they do. People who have healthy theory of mind abilities are able to attach emotional states to facial expressions accurately. Leos et al. (2023), hypothesized that

masks hinder the population's ability to see the full face; therefore, inhibits an individual's ability to attach emotion to a face in theory of mind. While participants were able to correctly attach an emotion to the facial expression, the mask hindered the ability to label the intensity of the emotion accurately. The same study found positive emotions were seen as less positively in the models wearing masks. Participants viewed the negative emotions (such as anger or sadness) as being even more negative than the pictures of the expression without a mask. Problems in communication arise especially when everyone is in masks and everyone is viewing their interactions with people as more negative.

Emotional Recognition

There are people who also have poor skills when it comes to emotional recognition and the ability to label an emotional state to a person. An experiment conducted by Ribeiro & Fearon (2010), found a correlation between the theory of mind and its effects on facial reading with the eyes and those with an anxiety disorder or social reading disorder. They used the Dot Probe Test. This test assesses attentional biases and measures the speed at which the participant places an image into either human or object categories. Previous research has found non-neurotypical people to have different patterns of attention and results vary from a neurotypical person. This was the test they used to assess the skill of emotional recognition defined in the Theory of Mind. They then used their "Reading the Mind of the Eyes Test " which was cropped pictures of facial expressions only showing the eyes. In comparing people with "good theory of mind" versus "poor theory of mind", Ribeiro and Fearon found people with poorer skills were better at finding negative emotions through the eyes and rated them with more intensity. They theorized this could be a biological adaptive measure for survival. Those who have better skill at recognizing

emotion through reading the eyes alone would be better equipped when people are wearing masks, such as in a situation like the pandemic.

Facial Features

Different sections of the face provide context for emotional recognition. Previous research has found that happiness has the highest recognition rate while sadness has the lowest. (Levitan et al., 2022) Facial features are not equally important in the recognition of all emotions. The recognition process may focus on one facial feature more than another depending on the emotion. Wegryzyn et al. (2017) found negative emotions are identified easier with the upper portion of the face, eyes, and eyebrows, while the lower portion was better at identifying positive emotions. They also found the nose was not useful in recognition. This study did not use face masks, but rather pixelated portions of the face in an attempt to isolate emotion perception to a region of the face. Tsantani et al. (2022) focused on how only seeing the eyes impacted people's ability to accurately perceive emotions. They found that only seeing the eyes of a face impaired the participant's ability to read the intensity of the emotion, especially in positive emotions. They found eyebrows allude to emotions such as anger or sadness while the mouth and lower portion of the nose alludes to emotions such as happiness or surprise. Beaudry et al. (2014) aimed to find which region of the face was most useful when recognizing emotions. Although the eyebrows were focused on more than the mouth when perceiving emotion, it was concluded that the emotional recognition process is too complex to be simplified to a single facial feature. Many other resources we found have similar findings. Levitan et al. (2022) found masks impair specifically the perception of the intensity of emotions. They also agreed that positive emotion perception comes from mouth positioning and found their participants had trouble identifying positive emotions when covering the lower region of the face. Face masks and cropped images

both gave the same result. Face masks affect real-world situations and people use more than just faces to interact with others.

Another study recognized the outside effect of gestures in communication (Carbon, 2020). This study had similar conclusions on how there is more confusion in emotional perceptions with the presence of masks. The participants were shown six types of emotions. Each of the emotions was shown with a mask and without a mask. Participants more accurately identified facial emotions in faces without masks than in faces with masks. The presence of a mask dramatically dropped the accuracy of emotional recognition. Carbon also acknowledged the use of gestures in real-world situations and external validity needed to be studied.

Facial covering such as sunglasses, scarves, or face masks were used by Roberson et al. (2012). The reduction of available facial features can disrupt configural processing, the ability to connect the relationship between multiple facial features such as the mouth, nose, and eyebrows. Overall accuracy increased when the full face was visible. Their study provides ecological validity to the impact of facial features in emotional perception.

Age

In the same study by Roberson et al. (2012) children, participants under the age of nine, often preferred to focus on the eye region while adult participants struggled when the mouth was covered. This difference displays the switch of processing strategies during maturation. The study found around nine years old there is a switch from feature-based emotion perception to a configural processing strategy that relies on the whole face.

Carbon & Serrano (2021) focused solely on the age difference in participants. They wanted to study the impact of wearing masks on children's face processing performance. Carbon and Serrano found children were not accurately identifying the emotions disgust, fear, and

sadness. Children were able to recognize angry and neutral faces more accurately than the adult participants. Children differ from adults in facial recognition. Educators during the pandemic may not have realized the impact their mask had on their communication with their students. There can still be developmental differences for children during the pandemic who were not switched to a configural processing strategy, using the whole face to recognize emotion, when the majority of social interactions were in masks.

Ethnicity Bias

As humans, we make judgments on people based on appearance and face masks play a role in how we perceive people. Ethnicity bias is the concept of how the faces of individuals of the same race, or ethnicity, are often identified more accurately and recognized faster than those of another race (*APA Dictionary of Psychology*, 2018). Cooper and et al. (2022) tried to find a correlation between this concept and emotional recognition with masks. This experiment had many layers to it, but ultimately they found no statistically strong correlation with ethnicity bias in the emotion recognition with masks. However, they did find a correlation between attitudes on mask-wearing and the accuracy of the emotional perception test with masks. Ethnicity bias may not be as prominent as in the past because of the popularity of social media and instant access to media from all cultures in the world; most people have been exposed to enough facial patterns of other ethnicities that emotional recognition is not a strong factor.

Physical Attributes

The term "mask fishing" became widely used during the years of Covid 19 and referred to someone appearing much more attractive with a mask hiding most of their face. Part of the aim of a study conducted by Fernandes et al. (2021) was to determine if people perceived others to be more attractive displaying certain emotions with and without masks being worn. Women

perceived a greater attractiveness to the models with the expression of anger when they were masked. Regardless of the sex of the participant, happiness was perceived as equally attractive with and without a mask. Emotions such as sadness and surprise are seen as more attractive while a mask is on. The researchers theorized wearing a mask covers some defining features of the emotions as found through the other studies the lower region contributes to the intensity of emotions and recognition of positive emotions. Eyebrows, lashes, and eyes themselves are often found to be one of the focal points of facial beauty. With these being much more pronounced with a mask, covering the lower portion of the face, people will perceive individuals as more attractive regardless of the emotions they are displaying.

Current Study

The following study is a replication of the study conducted by Teddi et al. (2023). The goal of the present study is to understand the relationship between facial coverings and emotional recognition. While the original study also explores masks' effect on social interaction based on judgments of approachability we will be focusing specifically on emotional perception. The study used faces from a database that show moderate to clear emotions. They photoshopped masks on the pictures with chosen emotions. The study used a likert scale to measure opinions, on a google doc survey and sent out the survey. The study focused on the strength of the rating between two emotions rather than focusing on the accuracy of choosing one emotion. Participants were expected to rate masked faces in between or middle of anchors thus indicating lesser perceived emotion. Similarly, participants were expected to rate unmasked faces closer to an anchor to indicate stronger perceived emotion. For example, participants seeing an emotion without a mask would choose an option closer to anchors angry or neutral. As expected, unmasked happy faces were rated significantly less happy than masked happy faces and

unmasked sad faces were rated significantly sadder than masked sad faces. Angry faces showed no significant difference between masked or unmasked, while neutral faces showed a significant difference. Masked neutral faces were rated as calmer compared to unmasked neutral faces which were rated closer to the angry anchor. Happy and sad recognition is dependent on the lower region of the face thus scoring lower intensity ratings when a mask was present. It is important to note the limitations of the study including the use of a convenient sample, lack of racial and cultural diversity, and reduced generalizability due to lack of a diverse sample as the survey was sent out to college students. The present study will include some of the same limitations due to convenience sampling on a college campus. Unlike the original study, we hypothesize that participants will identify higher emotion intensity when the presented faces are not covered by a mask regardless of which emotion is presented. We decided to take a less directional hypothesis to look for an effect on all different emotions and implemented different scales that would help us test this.

Method

Participants

Initial participants totaled 65, but due to incomplete responses, the final number was totaled at 55. Most participants were gathered from a small, predominantly white, Christian liberal arts university in Southeast USA. Participation was voluntary, and procedures followed the university's Institutional Review Board (IRB) procedures for obtaining informed consent and conducting research.

Demographics

Of these participants, there were 39 females, 14 males, and 2 nonbinary individuals. The age range was 18-60 (21.81). The majority of participants were White (85.5%), followed by

Black or African American (9.1%), Native American/Alaska Native (1.8%), and 3.6% preferred

not to say. The sample was reflective of the racial/ethnic makeup of the university where most of

our participants came from.

Measures

Measuring the accuracy of the participants' recognition of the emotions expressed by the

images was the goal of this study and this was accomplished with 9-point Likert scales. One

scale's anchors were calm and angry, (This person is… 1 calm – 9 angry) while the other was

sad and happy. The FACES database (Ebner et al. 2010) is a collection of 72 facial expressions

performed by 6 participants that have been validated by a method-acting protocol for emotional

realism. We chose 8 unmasked faces from this database and added a face mask to each of them,

totaling up to 16 images in all. (see appendix) The images are of white adults who expressed

happy, sad, angry, or calm emotions. We obtained permission from the conductors of the original

study, (Teddi et al. 2023), and all organizations included so that we could replicate the study as

closely as possible.

Procedure

Participants started the survey with demographic questions on race, age, ethnicity, and

gender. Participants were then randomly assigned to see masked or unmasked individuals first.

Then participants rated the emotions depicted on the image via a 9-point Likert scale. In between

the ratings of masked and unmasked faces, the participants were asked some questions to serve

as a distraction so those who'd been shown unmasked faces first would find it hard to rate the

masked faces from memory. (Would you ever wear a mask on an airplane?) Altogether

participants rated 16 facial images reflected from four individuals (young adult woman, young

adult man, middle-aged woman, and a middle-aged man) and these faces were portraying four emotions (happy, sad, calm, and angry). Each presentation consisted of one face and one rating scale and two mask conditions (no mask, mask) and two ratings (happy-sad and calm-angry).

Results

A t-test and correlation were used to analyze the data. For each of the four emotion expressions, a paired sample t-test compared participants' ratings on the repeated variable, which was unmasked faces versus masked faces. The paired samples t-$test$ results shown in Table 1 indicate the presence of a mask produced a significant difference for sad and happy faces but not for angry faces. Neutral faces indicated significant differences regarding the middle-aged female (Karen p = .001**), but not the middle-aged male (Paul p = 1.00). Participants found it harder to recognize calmness for the masked middle-aged female, but they did not for the masked middle-aged male. The rating of happy and sad faces supported expectations while neutral faces partially supported expectations, and angry faces did not support expectations. Participants found it harder to recognize happiness and sadness for masked faces but not for angry masked faces. As shown in Table1 there was no significant emotion recognition difference between angry masked or unmasked faces for the young female (Sarah p = .2470 or young male (Jacob p = .390).

Table 1

Emotion Recognition of Masked and Unmasked Faces

Measure	Unmasked	Unmasked	Masked	Masked	Cohen's D	*p*
	M	SD	M	SD		
Sarah Sad	8.52	.885	7.78	1.369	-5.44	.001**
Karen Happy	1.78	1.040	2.26	1.417	.355	.012**
Sarah Angry	7.83	1.450	7.54	1.701	-.159	.247
Karen Neutral	5.35	2.002	3.33	1.816	-.907	.001**
Jacob Angry	8.65	.985	8.53	.920	-.117	.390
Paul Neutral	3.76	2.036	3.76	1.905	0	1.00
Jacob Sad	7.76	1.170	6.67	1.402	-.712	.001**
Paul Happy	1.15	.488	2.25	1.766	.609	.001**

**p* < .05

Discussion

The present study examined whether face masks interfered with the perception of emotional expressions, using anchored rating scales. We predicted that the presence of a mask would interfere with all emotional recognition, which was supported by happy and sad faces but not angry and neutral faces. While the female neutral face was significantly different between masked and unmasked faces, the male neutral face was not. The present study focused on the recognition of emotions, while the original study conducted by Teddi et al. (2023) focused on emotion recognition, intensity, and approachability. Like the original study, angry faces

indicated no significant difference between masked and unmasked faces. Happy and sad faces did indicate a significant difference between masked and unmasked faces. Unlike the original study, neutral faces indicated a significant difference between female masked and unmasked faces but not for male masked and unmasked faces. Both studies found similar results that indicate emotions requiring the lower face for recognition will display significant differences.

The angry and neutral faces could have shown insignificant differences because the lower face contributes little additional information to determine angry and calm faces (Wegryzyn et al., 2017). The presence of a mask did not interfere with the recognition of calmness and anger. Happy and sadness both rely on the lower face for identification of the emotion. The lower region contributes to the intensity of emotions and recognition of positive emotions (Fernandes et al., 2021). Therefore, masks did interfere with the recognition of happiness and sadness.

Implications

Due to the interference of emotional recognition of masked happy and sad faces, it is important to recognize that these emotions could be misinterpreted. The presence of a mask may hinder the communication and approachability of individuals. Eyebrows, lashes, and eyes are often found to be one of the focal points of facial beauty. With these features being much more pronounced with a mask, covering the lower portion of the face, people will perceive individuals as more attractive regardless of the emotions they are displaying (Fernandes et al., 2021). If a person is perceived as attractive it could increase the likelihood that they would be approached. A mask also covers the mouth which is vital to the ability to read lips. Therefore, other indicators of emotions should be utilized. Other indicators include body language, gestures, and verbal communication. There is more confusion in emotional perceptions with the presence of masks due to the disruption of configural processing (Carbon, 2020). While facial features are

important for emotion recognition, they are not the only indicators that should be used for identifying an individual's emotion. A combination of indicators should be utilized to determine emotion.

Limitations

Limitations of the study include sample acquisition and characteristics and the face targets. For sample acquisition, we used a convenience sample of mostly college students. Broadening the sample to the surrounding community could have allowed more opportunity to explore age as an independent variable. Regarding sample characteristics, our sample lacked racial, cultural, educational, and gender diversity, which reduced generalizability. The face targets were all white men and women, as were all the images from the database. Using target images that diversified race, gender, and age could contribute to understanding facial expression consistency and universality. Only using the publicly available faces could have limited our selections. Although due to the prominent use of social media from cultures around the world, most people have been exposed to enough facial patterns of other ethnicities that emotional recognition is not strongly statistically correlated with ethnicity bias in the emotion recognition process of masked faces (Cooper et al., 2022).

Further Research

Future studies could explore age as an independent variable. Studies can focus on the effect of age on emotional recognition with or without a face mask. Older adults focus more on the lower face than other age groups (Roberson et al., 2012). Thus, the presence of a face mask may affect emotion recognition more among older adults than younger adults. Although without the use of eye tracking equipment it is uncertain what directly causes the inability to recognize the emotion of a masked face regardless of age. Older adults may struggle with hearing,

requiring them to lipread. A mask can interfere with lip reading which can be vital for older adults to understand verbal communication. By encompassing more indicators of emotions, such as body language, gestures, and verbal communication, researchers could increase the ecological validity of future studies (Carbon, 2020).

Conclusion

Research on face mask-wearing has just begun to grow beyond the ability to recognize emotion. Understanding the effects of face masks plays an important role in social interaction. Relying on multiple factors apart from facial features to determine emotion can mitigate the effects of face masks. Utilizing other emotional indicators while studying emotional intensity, approachability, trustworthiness, attractiveness, and safety may offer insight to better the social interaction between cultural groups, generations, and the deaf community.

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Appendix