

Reading Emotions Through a Surgical Mask

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ABSTRACT: Our faces provide information about our emotions, personal identity, trustworthiness, attractiveness, age, and sex. However, because of the COVID-19 pandemic, mask-wearing, which occludes 60% of the face, has become pervasive. Consequently, some clinicians and educators have expressed concern about the effect of masks on social, emotional, and cognitive health in adults and during child and adolescent development. This paper investigates the impact of mask-wearing on the ability of children, adolescents, and adults to identify emotions. In particular, this paper explores the typical development of emotion-reading abilities, emotion reading through masks, and emotion reading in specific populations such as those with disabilities and those from various cultural backgrounds. The paper ends with a framework for improving communication through masks.

KEYWORDS: Behavioral and Social Science; Cognitive Psychology; Emotion reading; Facial Processing; Mask-wearing.

■ Methods

This paper explores the effects of mask-wearing on emotional face processing. Google Scholar was used to search for relevant literature published in the last seven years. The following search terms were used: "emotional face processing," "development of emotional face processing," and "emotional face processing and masks." To include a section on cultural differences, the timeframe was subsequently extended to the past 20 years with the additional search term "emotional face processing and culture."

■ Introduction

Typical emotional processing from faces:

Our faces have 43 muscles that change our facial expressions.³ These muscles can move in many ways to help us express emotions and as cues to help others interpret these emotions. The Facial Action Coding System (FACS) describes the muscle actions that create emotional expressions. In this system, happiness is coded when the lip corner is lifted, and the cheek is raised. Disgust is coded when the nose wrinkles, the lip corner depresses, and the lower lip depresses. This suggests that both happiness and disgust rely on the lower parts of the face. Anger and surprise, however, are coded based on the three muscles on the upper parts of the face.

There are three main theories of how people perceive emotions in facial expressions.³ The first is that visual information from the face can be matched with the mental representation encountered in the past. According to this theory, most people would label faces with downturned lips as "sad" because they have repeatedly labeled sadness that way in the past. The second is that emotion recognition relies on proprioceptive feedback from the receiver's face. That is, mimicking the expression on someone's face can provide information for interpreting emotional expressions. The third is that contextual information is used to interpret emotional expressions. When the expression

is ambiguous, people use pre-existing stereotypes and expectations about emotions that fit the context.

Some studies show that the mouth is most relied on to understand basic emotions, pain, and neutral expressions.³ However, in some cases, people can categorize facial expressions accurately just by viewing the eyes. Adults tend to look at the eyes more frequently than other facial features when asked to infer emotions.⁴ Humans are sensitive to the eyes, so eye musculature often conveys enough information for adults to understand emotions. However, when emotions are ambiguous or subtle, both adults and children tend to shift their attention between the eyes and other facial features.

Development of Facial Emotion Processing:

In the first year of life, infants shift from configural to holistic facial processing.² Configural facial processing only focuses on specific parts of the face. On the other hand, scanning facial expressions in a holistic manner allows people to receive information from the mouth, nose, and other parts of the face. By three years of age, children show higher accuracy at inferring emotions from the eyes alone, implying that they are able to identify some emotions only by looking at the eyes though they can increase accuracy and pick up small details by scanning facial expressions in a holistic manner as adults do.

Additionally, people use the information other than the static view of a face to interpret facial configurations and compensate for a lack of signal for face processing.³ In an extreme instance, people with prosopagnosia compensate for their inability to read facial identification cues by using different sources of information such as a characteristic gesture or voice pattern. However, all people use context rather than purely relying on facial information.

Processing Emotions with a Mask:

Typical emotional processing from the face is prevented because of mask-wearing. For instance, because masks obscure visual information, people are unable to mimic facial expres-

sions of someone's face and interpret that facial expressions.¹ Similarly, people cannot match the face to the mental representation, since masks hide information used in this matching process. Moreover, people may use pre-existing stereotypes and expectations about emotions because of masks. Multiple studies also show that wearing a mask can be a clear disadvantage for nonverbal communication. Some of the problems include having more trouble identifying others and struggling to understand what is being said.⁴⁻⁵ Additionally, people have difficulty knowing whether to trust someone and feel less confident about their emotional reading capabilities.⁶

One study assigned college students to wear a mask, a hat, and glasses, or to wear nothing.⁷ Participants were told to find a same-sex, same-mask-condition person whom they had never before talked to. They talked about three topics of their choice for 2 minutes. After the conversation, they were separated from their partners and evaluated the partner's appeal as a potential friend, both qualitatively, such as "I had a good feeling about this person before we interacted" and quantitatively, rated on a 7-point scale. In addition, they were asked to rate each of their partners on a variety of factors, such as the appearance of the face, clothing, and posture. Students with visible faces were described as demonstrating openness and expansion, whereas students with masks were described as demonstrating solitary. Despite this small difference, this study suggests that connecting and communicating may not be substantially affected by mask-wearing.

Furthermore, several studies have tested children by showing them photographs of faces with and without masks and asking them to choose from a list of corresponding emotions. In general, children have more difficulty identifying emotions by faces that are obscured by masks, although the effects of recognizing each emotion differ across experimental paradigms. For example, Ruba and Pollak (2020) used the Japanese and Caucasian Facial Expressions of Emotions face database to show seven-to-thirteen-year-olds pictures depicting sadness, anger, and fear via a Random Image Structure Evolution (RISE) paradigm.² The facial configurations used in the experiment were initially presented in a highly degraded format in which children only had access to partial facial information. The images became less degraded at regular intervals. Children were asked to select from many emotion labels to indicate their belief of how the person displaying the facial configuration was feeling. They found that children became more accurate with each emotion as the images became less obscured. Across all emotions, children were less accurate with faces that wore a mask compared to faces that were not covered. In particular, children tended to interpret facial configurations associated with fear as "surprised" when faces were covered with masks.

However, some studies have shown that mask-wearing is not a hindrance when interpreting emotions by stating that the eyes are more important cues than the mouth for expressing emotion. For example, Bombari *et al.* (2013) found that people use their eyes more than their mouths to infer anger, sadness, and fear.⁸ Therefore, it is possible that mask-wearing is not always a hindrance. In fact, Carbon and Serrano (2021) found that in some cases, children are better at detecting emotion

with a mask, and they theorize that this is because children can then focus on the eyes without being misled by the mouth.⁹ The reason this might be important is that a smile can indicate different intentions including reward, reassurance, superiority, and positive feelings.¹ Obscuring a smile can allow a person to focus on the eyes, which are less ambiguous. However, it is unclear why some studies find the eyes to be most relevant only for negative emotions and others for positive emotions as well.

Effects on confidence:

Some studies investigated not only the effect on accuracy but also the effect on confidence when interpreting facial expressions. Carbon (2020) asked people to look at facial stimuli with a mask photoshopped over the mouth of each photograph and evaluate it from a list of six emotions.³ Without masks, kids were about 90% accurate, which is equivalent to adult performance. With masks, kids were about 78% accurate, which is also equivalent to adult performance. The study found that people had difficulties with analyzing anger, disgust, sadness, and happy faces with a mask on. However, a difference from the Ruba and Pollack study is that fearful and neutral faces were not worse with a mask on. Interestingly, wearing masks had a median influence on identifying facial emotions, but a large influence on people's confidence.³ This suggests that mask-wearing impacted children's confidence more than their accuracy.

In a follow-up study, Carbon & Serrano (2021) tested nine-to-eleven-year-olds in the same paradigm.⁹ There were no significant differences between children's and adults' accuracy in interpreting emotional expressions with and without masks. The children were nearly perfect at identifying happiness, neutrality, and anger but had more difficulty with fear and sadness, and the most difficulty with disgust.

Effects on people with disabilities:

One important question is whether mask-wearing could differentially affect people with disabilities, particularly intellectual disability. The reason this seems plausible is that studies have found impaired emotion recognition in people with intellectual disabilities. In particular, one study examined facial emotion recognition in adolescents with intellectual disability, hearing impairment, and those without disabilities.¹⁰ The study employed the Emotion Recognition Test (ER40) and asked participants to determine which emotion was represented. The adolescents with intellectual disabilities achieved lower scores on the Emotion Recognition Test than the participants from other groups. There were no differences between adolescents with hearing impairment and adolescents without disabilities. All groups were able to recognize happiness as the best and anger as the worst. This suggests that mask-wearing could be especially problematic for individuals with intellectual disabilities. To test these extrapolations, future research should specifically test the effect of mask-wearing on facial expression perception in individuals with disabilities. Given the dearth of studies on this topic in those with a variety of disabilities, future studies are needed.

Effects of culture:

Several studies have invested in emotion recognition cross-culturally. One study showed that people who live in

countries with ancestrally diverse populations express their facial expressions more than people who live in countries with less ancestrally diverse populations.¹¹ This may be because there is a relatively low consensus about which emotion is experienced in which context in countries with ancestrally diverse populations. Furthermore, it was revealed that people in East Asia focus on the eyes when looking at facial expressions, and people from Western cultures focus on the mouth.¹² This shows that the importance of the mouth when interpreting facial expressions may not be universal.

One explanation for differences aligns with a general finding that Westerners (including Europeans and North Americans) have an “analytic” pattern of attention, whereas East Asians have a “holistic” pattern of attention.¹³ That is, Westerners are more inclined to separate objects from their context. For example, American and Japanese participants were asked to observe the underwater world and describe it. Americans included information about the central objects, whereas Japanese participants described not only the objects but also their relationship to the context. This difference may be attributable to the Western traditions of Platonism, Aristotelianism, and monotheism, which reflect the individual perspective, in contrast with the Eastern philosophical traditions of Confucianism, Buddhism, and Taoism, which reflect this holistic perspective.¹⁴

These differences extend to the recognition of facial expressions. For example, in one study, Americans described facial expressions as spontaneous manifestations of inner feelings and expressed disapproval of the suppression of facial expressions.¹³ On the other hand, Japanese participants described facial expressions as a reflection of relationships with others in addition to inner feelings and discouraged expressions of strong emotion.

One study provided a cartoon picture of an individual in the center surrounded by four other people.¹³ Participants were asked to describe the emotion of the person in the center. Both the Japanese group and the American group recognized that the background figures’ facial expressions varied. However, significantly more Japanese people than Americans were influenced by the background figures when judging the emotion of the person in the center. This study supports that Japanese people include people around when judging the emotion of the central figure, but Americans do not.

There are several possible psychological processes that might have caused this difference.¹³ The first hypothesis is that both Japanese participants and Americans attend to all people in the group, but Japanese participants focus on this initial perception for the final judgment and Americans exclude it from the final judgment. The second hypothesis is that Japanese participants look at other people after they see somebody expressing emotions, whereas Americans exclusively focus on the individual because they believe that facial expression is authentic.

The last hypothesis is that both Japanese participants and Americans focus on the individual face first, but the Japanese participants broaden their vision to have more relevant clues.¹³ In this study, they observed eye movement to see how Japanese participants and Americans interpret and analyze the car-

toons. They also measured the ratio of participants’ attentional allocation to the central figure and background figures. The Japanese participants were less likely to allocate their gaze to the central figure than the Westerners for angry, sad, and happy targets. These results support the third hypothesis. Unlike the Westerners, the Japanese participants incorporated feelings of background figures when evaluating the central person’s facial expression. The effect of the group on Japanese judgments of angry people was relatively weaker than for sad and happy people.

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■ Conclusions

This narrative review has discussed typical processing of facial emotions as well as the effects of mask wearing, including on communication. Given the negative impact of masking wearing on communication, Mheidly (2020) developed a procedure to help people better communicate when wearing masks.¹⁵ They suggest that people can use the following actions to support others in reading their emotions: have an increased awareness of the existence of communication challenges; amplify the utilization of the upper face parts; emphasize body language; and face communication partners more directly and with more attention. It is apparent that people struggle more with detecting emotions through masked faces. Moreover, there are other factors such as cultural backgrounds and disabilities that prevent people from understanding facial configurations easily. Additionally, even if mask-wearing does not significantly affect emotion recognition in some cases, people may lose confidence in their abilities to recognize emotions, which might interrupt bonding and trust. Nevertheless, people are capable of utilizing other information and context to facilitate emotional reading, and social interaction was affected in the smallest way. Studies of mask-wearing can provide insight not only into how people observe emotions but also into how people adapt themselves in these sparse circumstances.

Future Directions:

Further research might investigate how individuals adjust to various alterations in the environment and to communication differences between people. For example, a study might investigate whether communication between people from East Asian and Western countries could be improved if they are each taught about the cultural differences in facial processing. Additionally, studies might investigate whether people spontaneously adapt and/or if they can be trained to adapt their emotion processing styles in the case of a barrier such as a mask. Finally, additional studies on those with a variety of disabilities could be a particularly fruitful avenue for future re-

search. The study could test individuals with different types of intellectual disabilities, such as ADHD and Down syndrome by using Emotion Recognition Test (ER40) to specify which type of intellectual disability can be affected by mask-wearing the most.

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