The International Journal of
INDIAN PSYCHOLOGY

Research Paper

Investigating The Effect of Face Masks on Subjective Social Judgements from Faces

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ABSTRACT

COVID-19 brought along with it various changes to our daily lives. One such change is the practice of wearing a mask in order to protect from the virus. This has affected the way individuals communicate as masks partially cover one's facial expression making it difficult for the listener to understand and interpret what is being said (Mheidly et al., 2020). Humans rely on holistic processing of faces for social interaction. This paper focuses on examining how masks affect how individuals make subjective social judgements from faces. The hypotheses of this study are: there is a significant difference in the latency of responses in the masked vs. non- masked conditions and that there are significantly lower confidence ratings for social judgments in the masked condition than the non-masked condition. To test these hypotheses, 30 participants were presented with facial stimuli with or without a mask and were asked questions about traits such as attractiveness, trustworthiness and honesty. In addition to this, they were asked to rate their confidence in the judgements made as well. The reaction time of the participants' responses and their confidence ratings were analysed using a t test, and the results were found to be statistically significant. Thus, in the masked condition, participants had greater reaction times and lower confidence ratings indicating interference in facial processing.

Keywords: *COVID-19, Facial Processing, Social Judgements, Holistic Facial Processing*

COVID-19 brought along with it various changes to our daily lives. One such change is the practice of wearing a mask in order to protect from the virus. This has impacted the way individuals communicate with each other as they muffle one's voice and also partially cover one's facial expression making it difficult for the listener to understand and interpret what is being said (Mheidly et al., 2020). As a result, investigating the effects of mask wearing on how we interact with one another is a novel area of research that this study is focused on.

There are two prominent approaches to facial processing. The component approach of facial processing is based on the assumption that humans process the face on the basis of distinct facial features. The component model is based on the way humans perceive objects (Piepers et al., 2012). However, facial recognition is a qualitatively different form of object perception. The second approach to facial processing that highlights this difference is the

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holistic processing of faces. Holism is a central tenet of Gestaltian theory where a major principle is that 'the whole is greater than the sum of its parts.' This theory of face processing suggests that humans perceive and process faces as a whole rather than the component-wise approach we use for object recognition (Piepers et al., 2012; Richler & Gauthier, 2014). The current study is based on the theory of holistic face processing put forth by Farah et al (1998), where they state that the main point of differentiation between facial recognition and object recognition is that facial recognition involves relatively little part decomposition.

Humans demonstrate a tendency to make assumptions about personality traits of an individual such as judgements about warmth, sociability and competence from images of the face (Lin et al., 2021). Multiple studies have also examined how people form opinions about the trustworthiness of an individual on the basis of facial images (Sara et al, 2020; Todorov et al., 2009). However, if holism is the mechanism that underlies facial processing, then hindrance to holistic facial processing could affect the ability to form such social judgements as well. The aim of this study is to determine whether masks that hinder holistic facial processing influence the ability to form social judgements such as inferring trustworthiness, attractiveness, intelligence, etc from facial cues. The information obtained from this study can help understand how mask wearing has influenced how people interact with each other in social settings and provides avenues for future research in understanding holistic face processing as a construct.

Social judgements from faces
Facial processing is a complex process that occurs as a part of social cognition. Research has demonstrated the tendency of humans to make certain social inferences from the faces we perceive. Prior research has shown that people make trait inferences from facial appearances after a mere 100 ms exposure time and there is a high correlation between inferences made after 100 ms of exposure to the facial stimuli and continuous exposure to the stimuli. This suggests that such inferences can be made after only a brief exposure to faces (Willis & Todorov, 2006). A similar study conducted revealed that we could make such trait inferences even after just 39 ms of exposure to the facial stimuli presented. However, in this condition, the inferences about aspects such as intelligence were less consistent as compared to inferences about the threat level or trustworthiness of the faces. This suggests an evolutionary basis for this ability that is rooted in survival related functioning (Bar et al., 2006). From a neuroscientific perspective, such social judgement from faces co-vary with activity in the amygdala and it is posited that the amygdala along with the posterior face selective regions track face typicality where atypical faces have the tendency to draw a greater response from the amygdala regardless of whether the social inferences made were positive or negative in nature. This suggests an emotional component even in social trait inferences (Phelps & LeDoux, 2005; Todorov et al., 2013). Such trait inferences made as first impressions also affect later behaviour made during social interactions. Faces deemed as more trustworthy were more likely to have their offers accepted during ultimatum games. Therefore, these trait inferences made can influence future judgements as well (Kim et al., 2012). Such inferences affect decision-making made in different social spheres and situations such as choosing a company CEO or deciding the prison sentence for a criminal (Gomulya et al., 2017; Wilson & Rule, 2015). This study suggests that the inferences made based on facial exposure are encoded into memory and are used as part of decision making later on. However, the trait inferences that are made after exposure to facial stimuli are encoded not only in relevant situations where there is an aforementioned need to use them for decision making, but they also may be encoded in neutral conditions in which such

judgements may not even be salient. The pervasive nature of such judgments reveals how exposure to a face can form the basis for impression formation that is independent of actual social interaction with the person. This also demonstrates the stable nature of impression formation from facial appearance (Klapper et al., 2016). The kinds of trait inferences made from emotionally neutral faces can be classified into fourteen trait dimensions, two important evaluations made from faces are valence and dominance evaluation. As mentioned earlier, the prominence of these two traits in facial evaluation is related to the survival value that it holds for humans. Both traits are important to evaluate the threat level of the individual. There is also a correlation observed between the judgements seen in other trait dimensions such as a correlation between attractiveness and trustworthiness. Finally, the reason for forming the judgement may also influence the type of inferences made. For example, in order to assess a politician, competence judgement may be more salient than attractiveness and may influence decision making (Oosterhof & Todorov, 2008; Todorov et at., 2008; Jaeger et al., 2022). Facial expressions as well may influence trait judgements about an individual where smiling faces are rated higher on traits of sociability (Knutson, 1996). All these factors together can influence the first impression of an individual as derived from facial appearance. However, for this holistic facial processing is essential.

The role of holistic face processing in trait impression formation
Holism is an important feature of face processing. When making inferences about an individual from facial appearance, holistic processing is an important feature that underlies such decisions. Even when making gender judgements about the faces presented, holistic processing of faces is essential. Not only that, the underlying physiognomic facial characteristics that make up a gender of a face are not race specific but are global in nature. This points to the fact that there are underlying uniform rules in place when making certain inferences such as the gender of an individual from the face presented (Zhao & Hayward, 2010). For social judgments to take place, facial processing requires a holistic processing of the face. The initial process through which facial processing takes place in the composite face task is holistic and only after exposure to faces for longer than 100 ms do judgements only the instructed half take place. This reinforces the role of holism in facial processing and in social inferences formation after a brief exposure to the facial appearance is presented. It also compares social judgments made after a brief exposure to facial appearance where bottom-up processing takes place and those made after a prolonged exposure. The social inferences that are made are not only on factors such as emotion or race that have fixed patterns of facial features to look for, but also can be made for more subjective characteristics such as judgements of trustworthiness, attractiveness, etc. (Abbas & Duchaine, 2008; Todorov et al., 2010). Attractiveness is a subjective judgement made that to an extent is influenced by culture and society. Even judgements in this domain can be influenced by the facial processing that takes place. Individuals that are shown photographs of incomplete faces tend to rate those faces as more attractive as compared to photographs with complete faces suggesting that there are differences in the inferences made when an individual is presented with a complete facial appearance and a partial facial appearance (Orghian & Hidalgo, 2020). Facial appearance from different angles that occludes the entire face can have an influence of the inference made on the basis of facial processing as well. For example, faces appear to be more trustworthy and open when facing the person perceiving the face as opposed to when it is facing elsewhere (Sutherland et al., 2016). When making social inferences, the internal features of the face such as the eyes, nose and mouth proved more salient for forming social inferences as compared to the external features such as the hair, ears or chin. In addition to this, different patterns of results are obtained regarding social inferences when different internal features are occluded which

further points to the necessity of holistic face processing in forming social inferences (Santos &Young, 2011).

The influence of masks on facial perception and recognition

The COVID-19 pandemic resulted in widespread mask usage to protect from the virus, and as a result, mask wearing became an important influence in interpersonal communication in society. Masks- wearing results in a decrease in face processing abilities as measured by the Cambridge Face Memory Test. In addition to this, there was also a reduced inversion effect noted for the masked faces. Presenting the perceiver with an inverted face makes it difficult for the perceiver to note configural relationships between face parts and therefore, provides evidence for interference of masks to holistic processing of faces (Freud et al., 2020). Emotion recognition is another process that relies on holistic face processing. The impact of covering the face, especially with a face mask on emotion recognition results in confusing individuals as it affects the readability of emotional expression (Carbon, 2020; Kim et al., 2022). Not only is recognition of emotions hindered by face masks but also wearing face masks reduces the perceived intensity of the emotional expression on faces. This occurs independent of exposure time and attitude towards masked faces suggesting a hindrance by face masks in emotion intensity recognition (Tsantani et al., 2022). Research on face masks and social judgements such as trait inferences has shown that masked faces appear younger and more trustworthy as compared to unmasked faces (Lau, 2021). However, this research has been conducted using a white Caucasian stimulus set and there was no fixed stimulus exposure time set. Besides this, there were no confidence ratings regarding the judgements made in order to establish the participants confidence in their decisions. This provides a research gap for new research. The questions that this study is aiming to address are: do masks affect how people make social judgments from faces? and are social judgments from faces that depend on holistic face processing hampered due to facial masks?

Hypothesis

1. There is a significant difference in the latency of responses (reaction time) in the masked vs. non- masked conditions.
2. There are significantly lower confidence ratings for social judgments in the masked condition than the non-masked condition.

METHODOLOGY

Sample

This sample includes 30 subjects aged 18-25 (young adults) and includes 25 females and 5 male participants. The exclusion criteria is individuals who report visual perception disturbances along with individuals with conditions affecting facial perception such as people with schizophrenia or autism spectrum disorder.

Variables

- Independent Variable: Mask wearing on the face which is manipulated at 2 levels- the no mask condition (control group) and the masked condition (experimental group.)
- Dependent Variable 1: The latency of response to the facial stimuli presented measured in milliseconds.
- Dependent Variable 2: The self reported confidence in judgements made regarding the facial stimuli presented as measured by a validated Likert scale with choices from 1 to 7.

Operational Definitions

- Latency- time taken to respond to stimuli presented.
- Social Judgements- subjective decisions made about traits of the faces presented Sociability- the tendency and accompanying skills to seek companionship, engage in interpersonal relations, and participate in social activities.
- Attractiveness- subjective appeal or aesthetic beauty regarding task faces.
- Trustworthiness- the subject's willingness to entrust the face presented with personal property in a financial or physical capacity regarding task faces.
- Intelligence- ability to understand complex concepts and to have the potential to solve problems with respect to task faces.

Research design

The research design is an experimental within group subjects design with the same participants being the control condition where they were presented with facial stimuli with no mask and the experimental condition where they were presented with masked facial stimuli.

IV- presence or absence of mask manipulated at 2 levels control- no mask, exp- masked DVs- latency of response to stimuli, confidence in the stimuli.

Traits- Dimension 1- Sociability (attractiveness and friendliness)
        Dimension 2- Trustworthiness (honest and competent)
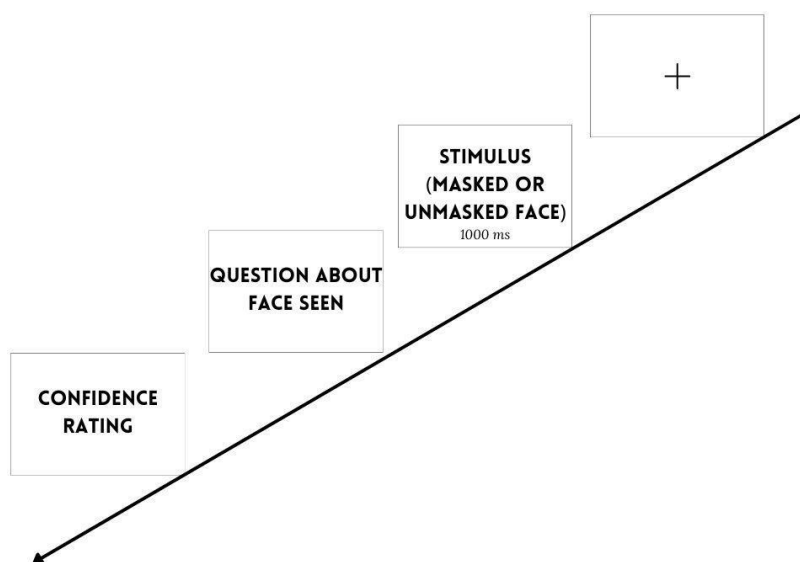   Dimension 3- Intelligence

Fig. 1: Image of Research Design Procedure

Tools used

The Indian Face set is a collection of Indian face stimuli that has been collated for use in psychological research. This study uses this collection of images as the facial stimuli in the experiment. For the masked condition, masks have been superimposed on these facial stimuli using Photoshop.

Procedure

The subjects selected first filled the consent form. Following this, they were presented with the task. A blank screen with a cross in the centre orients the participant. They were then

presented with the facial stimuli depending on the condition, for a period of 1 second and were asked to judge the face on the dimensions- sociability, trustworthiness, and intelligence. The operational definition of each of these characteristics was provided to the participant to ensure uniformity in their responses. The time taken to respond to the face presented was recorded. Following this, the subject also rated their confidence in the judgements that they have made for each face using a Likert scale of 1 to 7.

RESULTS

The results obtained from the data collection have been analysed using SPSS or Jamovi. There was a t test done for the two conditions in order to determine if there is a difference in the response times and difference in latency of responses between the two conditions. The data from the Likert scale was also analysed using a t test to determine whether a difference in the confidence level in the two conditions were present. Normality testing was first done in order to determine if the data is normally distributed or not. The data for the reaction time was normally distributed with a p value of 0.709. Following this, a paired samples t-test was run on the data.

The results of this as shown below indicate that there was a significant difference in the reaction time in the two conditions with the reaction time of the control (no mask) condition being lesser than the reaction time in the experimental (mask) condition. The p value here was 0.008. As the normality testing showed that the confidence rating data is not normally distributed, a non-parametric alternative to the t-test was run; the Wilcoxon rank test. The results of this test showed that the results are significant at the $p<.001$ level. Thus, this analysis shows that the data is in line with both the hypotheses.

Table 1 Paired Samples T-Test- Reaction Time

			statistic	df	p
RT(C)	RT (E)	Student's t	-2.55	28	0.008*

Note: H_a μ Measure 1 - Measure $2 < 0$
     *p<0.05

Table 2 Paired Samples T-Test (Wilcoxon rank test)- Confidence Rating

			Statistic	df	p
CONFIDENCE(C)	CONFIDENCE(E)	Student's t	3.01	28.0	0.003*
		Wilcoxon W	333 [a]		<.001**

Note. H_a μ Measure 1 - Measure 2 > 0 [a] 2 pair(s) of values were tied
*p<0.01
*p<0.001

DISCUSSION

In the current study, the focus was on whether wearing a face mask, like the one that has been worn during the COVID-19 pandemic could affect subjective social judgements made from faces. The results of this study did indicate that the ability to make social judgements

from faces was hindered when the source of the judgement was wearing a face mask that obscured part of the face. This was evidenced by a significantly longer time latency when making these judgments during the masked condition as compared to the non-masked condition (p=.008). In addition to this, the confidence ratings that the participant was asked to make regarding their social judgements were also significantly higher in the non-masked condition as compared to the masked condition (p=0.003).

As mentioned in the review of literature, facial processing of any kind and for different purposes such as forming social impressions depends on holistic facial processing. This was hindered in the masked condition due to the facial mask. This could explain why there were longer time latencies and lower confidence ratings in this condition compared to the non-masked condition.

However, what remains unanswered in this study is whether the role of holistic face processing is important for all social judgements to be made. For example, the study by Santos and Young (2011) determined that different facial regions are important when making different social judgements. For example, the eyes and the nose are more essential when judging a person's level of trustworthiness or intelligence while the mouth is more important when judging attraction. As a result, using the same paradigm that was used in this study, an eye tracking study can establish what regions the participant looks at when observing a masked face while making social judgements. This is an avenue for future research in this area.

Limitations

This current study uses a primarily South Indian student population as its sample population. Besides this, the effects of age on facial perception were not examined as certain studies do indicate that there might be age-related differences in facial perception (Horning et al., 2012). As a result, the results generated may not be generalizable to other populations. Another limitation of this study is that the images used as facial stimuli in the experimental condition would have a mask photoshopped on them as opposed to having a real image of an individual wearing a mask which would provide more authenticity to the stimuli. The facial stimulus set used is also of Indian faces only and so the effects of race and the other-race bias are not examined in this study.

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