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Physical Aggression and Facial Expression Identification

Alisdair James Gordon Taylor*[a], Maria Jose[b]

[a] Department of Ophthalmology & Visual Sciences, University of British Columbia, Vancouver, Canada. **[b]** Department of Psychology, University of Surrey, Guildford, United Kingdom.

Abstract

Social information processing theories suggest that aggressive individuals may exhibit hostile perceptual biases when interpreting other's behaviour. This hypothesis was tested in the present study which investigated the effects of physical aggression on facial expression identification in a sample of healthy participants. Participants were asked to judge the expressions of faces presented to them and to complete a self-report measure of aggression. Relative to low physically aggressive participants, high physically aggressive participants were more likely to mistake non-angry facial expressions as being angry facial expressions (misattribution errors), supporting the idea of a hostile predisposition. These differences were not explained by gender, or response times. There were no differences in identifying angry expressions in general between aggression groups (misperceived errors). These findings add support to the idea that aggressive individuals exhibit hostile perceptual biases when interpreting facial expressions.

Keywords: facial expressions, aggression, physical, face processing, emotion

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*Corresponding author at: Department of Ophthalmology & Visual Sciences, Vancouver General Hospital Eye Care Centre, University of British Columbia, Vancouver, British Columbia, V5Z 3N9, Canada. E-mail: alisdairt@eyecarecentre.org

Introduction

Behaviour directed toward another individual with intent to cause harm is regarded as aggression (Berkowitz, 1993; Bushman & Anderson, 2001). Aggression is a common trait found in both humans and animals. An individual might exert aggression in order to dominate, maintain his/her position in society, or to compete for resources, thus rendering aggression critical to survival. It is imperative to investigate the underlying mechanisms of aggression and how it impacts on social behaviour given its role in everyday life and because aggression can negatively impact on an individual's social functioning.

The Social information processing model (Crick & Dodge, 1994; Dodge, 1980) suggests biases may drive an aggressive individual's behaviour when interpreting the ambiguous actions of others. This "*hostile attribution bias"* occurs when an individual infers hostile intent to the behaviour of another individual even though the intent of that individual is uncertain. According to Crick and Dodge (1994), the bias occurs because of a distortion in social cue processing over time. This distortion is crucial as it hinders the aggressive individuals' ability to decode the necessary cues from another individual's actions in order to interpret their intent. In the absence or distortion of these cues,

the aggressive individual may attribute hostility to the intentions of the other individual's actions, resulting in the likelihood of an aggressive response. One example where this bias may arise is during the extraction of facial cues.

While invariant facial features such as gender or race may be reasonably identifiable, variant characteristics such as facial expressions can be ambiguous to interpret. An individual produces facial expressions to convey messages to perceivers regarding their feelings or views on a particular incident. This form of non-verbal communication assists us with interpersonal encounters, and contributes to building relationships (Ellis & Young, 1998). If an aggressive individual is unable to accurately decode facial expression cues from others then biases can creep in. The purpose of the current study was to investigate the impact of trait aggression on facial expression processing.

Recent studies have shown aggressive individuals exhibit biases when processing angry facial expressions across different paradigms, (e.g., Bertsch, Böhnke, Kruk, & Naumann, 2009; van Honk, Tuiten, de Haan, van den Hout, & Stam, 2001; Zhang & Liu, 2011). These studies allude to a pre-conscious processing of threatening stimuli in aggressive individuals. Other research has focused on aggressive individuals abilities when making judgments about facial expressions - an arguably more ecologically valid task. When asked to simply identify facial expressions, Larkin, Martin, and McClain (2002) found aggressive participants were more likely to misidentify non-angry expressions to be angry (misattribution errors). Misattribution errors may stem from impairment to social cue interpretation, leading to hostile attribution biases described earlier (Crick & Dodge, 1994). It should be noted that Larkin and colleagues measured the *'hostility'* aspect of aggression. Trait aggression is considered to be multi-dimensional consisting of several sub traits (Buss & Perry, 1992).

In a more recent study, Hall (2006) also presented participants with images of faces and asked her participants to make judgments about the expression the face exhibited. Participants then completed the aggression scale of the Personality Assessment Inventory (PAI) (Morey, 1991). Results showed that the higher the level of self-reported aggressive attitude, the more likely the individual was to perceive non-existent aggression. This misattributed anger was possibly due to the pre-existence of a hostile bias found in aggressive individuals. Consistent with Larkin et al. (2002), Hall (2006) observed that high-aggressive individuals made more misattribution errors for angry faces compared to low-aggressive individuals. Hall suggested that individuals saw aggression in their environment and were reinforced to see the world as they thought it was by attributing a hostile intent to others. This explanation fits into the hostile attribution account (Crick & Dodge, 1994). However, in Hall's study, high and low aggression groups were determined by dividing total aggression scores from the PAI. This method may only give us a general insight into the relationship of trait aggression and facial expression processing, whereas investigation into sub-traits of aggression will highlight specific relationships between certain facets of aggression and human behaviour. For instance it is not yet reported whether trait physical aggression specifically impacts on healthy individuals' ability to identify facial expressions.

Physical aggression is regarded as behaviour causing or threatening physical harm towards others. It is an undesirable trait of a destructive nature, associated with poor communication and interpersonal interaction (Hazaleus & Deffenbacher, 1986; Parrott & Zeichner, 2002). Given these deficits in interpersonal communication, it is reasonable to presume that individuals with high levels of trait physical aggression will find the task of determining another's emotional state very difficult and will exhibit misperceptions when interpreting facial expressions, similar to those with high levels of overall aggression or hostility (Hall, 2006; Larkin et al., 2002). In addition, hostile biases may be strong in individuals with high trait physical aggression because they are more readily willing to engage

in situations involving conflict. Lastly, increased exposure to angry faces may contribute to hostile biases in aggressive individuals as well, as it is likely that physically aggressive individuals have been involved in many threatening situations. Overall, misattribution of anger should be expected from physically aggressive individuals.

The main aim of the present study was to establish the relationship between trait physical aggression and facial expression processing in a sample of healthy participants. We wanted to know whether individuals with high levels of physical aggression make biased judgments of facial expressions - would these individuals see anger when it is not there and consequently misattribute anger to non-angry expressions? The nature of such errors might be critical, as an inappropriate behaviour could follow from a misidentified facial expression. For instance, a perceiver may attempt to help an individual who appears to be upset and hurt. However, if the face of the apparent 'hurt' individual is only briefly visible, or difficult to see, then it is possible that the perceiver has misinterpreted their expression. In this situation the misinterpretation could be dangerous, as the perceiver may approach to offer assistance, whereas the apparent hurt individual may respond with verbal or even physical aggression towards the perceiver. Consequently, it is important to understand the errors that perceivers make when processing other's facial expressions. To investigate, we adopted the Aggression Questionnaire (BPAQ (Buss & Perry, 1992)) - a widely used indicative measure of trait aggression and a facial expression identification task, whereby participants were required to identify the correct emotion from a series of faces of varying facial expressions (happy, neutral, angry, disgusted, and fearful). This task has been widely used (see Palermo & Rhodes, 2007) and making judgments about facial expressions is something we do every day, thus this paradigm is ideal for exploring social information processing in aggressive individuals.

One criticism of previous aggression studies that have used facial expression identification tasks concerns the amount of time participants were given to respond. Hall (2006) fails to report information about how participants responded and how long they were given to respond. In Larkin et al.'s (2002) study, images of faces were presented for 10 seconds followed by a 5 second response interval. A more valid method would be for participants to respond as soon as they think they have interpreted the emotional expression, in order to represent real-life quick judgments. In many situations, evaluation of a person's emotion is conducted in a short amount of time for adaptive reasons. For example processing a threatening facial expression quickly may avoid potential conflict. Therefore we asked participants to respond as soon as they thought they knew the facial expression to increase ecological validity and to assess whether response times would account for any effects of physical aggression on misattribution errors. An additional criticism of Larkin et al.'s procedure was the order the questionnaire and task were carried out. To avoid unfair saliency being placed on trait aggression, participants should complete the questionnaire after the face expression identification task. We expected high levels of physical aggression would correlate with an increased number of misattribution errors - those individuals with high scores on the physical aggression scale of the BPAQ will incorrectly misidentify non-angry facial expressions as angry expressions significantly more than those individuals with low physical aggression scores. A supplementary aim of the present study was to examine whether high and low aggressive individuals differ with their ability to correctly identify angry faces in general. Findings from previous studies are somewhat inconsistent. Whilst some studies have not seen any differences in angry expression identification between groups (Hall, 2006; Larkin et al., 2002) others have (Barth & Bastiani, 1997). Therefore we recorded participants' under-reported judgments of angry expressions (misperceived errors) in an attempt to clear up the inconsistencies of past studies findings and establish whether these types of errors varied according to physical aggression.

Method

Participants

Participants comprised 80 (26 male) Undergraduates (Mean age 21.45) from Bournemouth University. Course credit was awarded as compensation for participation. All participants provided written consent and the research was approved by the departments Psychology ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Materials and Apparatus

Aggression Questionnaire — Trait Aggression was measured with the Buss-Perry Aggression Questionnaire (BPAQ) (Buss & Perry, 1992). The questionnaire consists of 29 items divided into four sub scales; (i) anger, (ii) hostility, (iii) verbal aggression, (iv) physical aggression. The BPAQ has shown high internal consistency (α = .89) and high retest reliability (α = .80) (Buss & Perry, 1992; Harris, 1997). Items consisted of single statements, for example "I often find myself disagreeing with people", or "If somebody hits me I hit back". Participants had to indicate how accurately each statement described them using a 1 (very inaccurate) to 5 (very accurate) Likert scale.

Facial Expression Identification Task — Images of faces were selected from the "*The Radboud Faces Database"* (RaFD) (Langner et al., 2010). The RaFD is a high quality face database, which contains pictures of various emotional expressions in accordance with the Facial Action Coding System (Ekman & Friesen, 1978). We selected 12 images (6 male, 6 female) for each of the five facial expressions (happy, neutral, angry, disgust and fearful) totalling 60 images. Images were edited using Adobe Photoshop Elements 6.0, cropped and resized to a resolution of 800 x 600 pixels, on white background. Participants completed the facial expression perception task on a Windows based computer using a 21 inch CRT monitor, with a screen resolution of 1,280 x 1,024 pixels. Experiment Builder (S-R Research Ltd.) was used to programme and display the experimental stimuli. During data collection, a Dell host computer recorded participants' responses and response times.

Procedure

After the experimental instructions were explained, participants were then asked to complete the facial expression perception task. This task was divided into two blocks – practice and experimental. In the practice block, participants viewed twenty faces in one continuous block. To begin, participants were asked to look at a black cross in the centre of the screen. Shortly afterwards a face was presented and participants had to indicate which expression they thought the face showed, by pressing the corresponding response key (1=angry, 2=disgust, 3=fearful, 4=happy, 5=neutral). Participants were instructed to do this as quickly and as accurately as possible. Images were randomised, with an exposure time of 5s per face. Participants were encouraged to ask any questions during the practice block. The procedure for the experimental block was identical to the practice block, although now a new set of 60 faces were used for the experimental block. Upon completion, participants completed the BPAQ (Buss & Perry, 1992). The questionnaire was completed second so as to avoid unfair saliency being placed on trait aggression. Testing lasted roughly thirty minutes.

Results

Gender and Facial Expression Identification

As previous studies have found gender differences in facial expression processing (Rotter & Rotter, 1988), we assessed whether a gender difference in the number of errors made existed in the present study. Independent samples t-tests showed no gender differences in the number of misattribution errors and misperceived errors made (*ps* > .57) therefore gender was collapsed over. However, the disproportionate ratio of female to male participants in our study necessitated the use of gender as a covariate.

Relationship Between Trait Aggression and Facial Expression Identification

Partial correlations (when controlling for gender) were analyzed to establish the relationship among total trait aggression scores, sub trait aggression scores, anger misattribution errors (mistaking a non-angry expression as angry) and anger misperceived errors (misidentifying angry expressions, see Table 1). Physical aggression scores correlated significantly with misattribution errors, (r = .270, p = .016), providing support for our hypothesis. None of the other aggression scales correlated with misattribution errors (all r < .207, all p > .067). Similarly, there were no observed relationships between aggression scores and misperceived errors (all r < .050, all p > .660), therefore misperceived errors were not analyzed further.

Table 1

Partial Correlations Among Scores of Verbal Aggression, Anger, Hostility, Physical Aggression, Total Aggression, Misattribution Errors and Misperceived Errors When Controlling for Gender (N = 80)

Variable	Phys agg	Anger	Hostility	Verb agg	Tot agg	Misattribution	Misperceived
Phys agg		.647 (p < .001)	.136 (p = .023)	.388 (p < .001)	.781 (p < .001)	.270 (p = .016)[a]	.050 (p = .660)
Anger			.299 (p = .008)	.596 (p < .001)	.872 (p < .001)	.127 (p = .263)	-.045 (p = .695)
Hostility				.105 (p = .305)	.566 (p < .001)	.039 (p = .735)	-.034 (p = .766)
Verb agg					.672 (p < .001)	.146 (p = .198)	.035 (p = .757)
Tot agg						.207 (p = .067)	.003 (p = .981)
Misattribution							.273 (p = .015)
Misperceived							

Note. Phys agg – Physical aggression, Verb agg – Verbal aggression, Tot agg – Total aggression.

[a]Significant correlation between Physical aggression and Misattribution errors.

Physical Aggression and Misattribution Errors

We next conducted an analysis in order to establish whether misattribution errors varied as a function of physical aggression. To do this, we first divided the physical aggression scores into quartiles, thus creating four groups of participants. Participants with scores falling in the upper quartile and lower quartile were then entered into an analysis of covariance (ANCOVA) with physical aggression group (high-aggression vs. low-aggression) as the independent variable, misattribution errors as the dependent variable and gender as the covariate. Participants with scores falling in the middle range were excluded from this analysis, resulting in a new N of 38, (12 males). The ANCOVA revealed a significant main effect of physical aggression group on the number of misattribution errors made by participants, after controlling for the effect of gender (F(1, 35) = 5.586, p = .024, η^2 = .138). High-aggressive participants were significantly more likely to mistake non-angry facial expressions as angry expressions compared to low-aggressive participants, (M = 3.50 vs. 1.77, see Table 2) providing further support for our hypothesis.

Response Time Analysis

A response time analysis was conducted in order to assess whether physical aggression modulated response times for misattribution errors. An independent t-test showed that there was no difference in misattribution errors response times between high and low aggression groups ($t(36) = .220$, $p = .827$), ruling out the possibility of a speed/accuracy trade off.

Table 2

Averaged Facial Expression Misattributed and Misperceived Identification Errors as a Function of Facial Expression Type and Physically Aggressive Groups

	Expression					
Errors	**Angry**	**Disgust**	**Fear**	**Happy**	**Neutral**	**Total**
Misattribution						
High (n = 22)	3.50	3.25	2.06	0.38	1.00	2.04
Low (n = 16)	1.77	3.73	1.82	0.27	0.68	1.65
Total (N = 38)	2.50	3.53	1.92	0.32	0.82	1.85
Misperceived						
High (n = 22)	3.06	3.56	2.25	1.00	0.31	2.04
Low (n = 16)	3.18	2.64	1.95	0.32	0.18	1.65
Total (N = 38)	3.13	3.03	2.08	0.61	0.24	1.85

Discussion

The purpose of this study was to investigate the relationship between trait physical aggression and facial expression identification in healthy individuals. As expected, when making facial expression judgments, participants with high levels of physical aggression made significantly more misattribution errors compared to participants with low levels of physical aggression. This meant that aggressive individuals commonly believed the facial expressions they saw were angry expressions, even when they were non-angry. This difference was not attributable to gender or response time differences. Participants' ability to correctly identify angry expressions overall did not vary as a function of physical aggression.

We tested the hypothesis that high-aggressive individuals would be more likely than low-aggressive individuals to misidentify varying non-angry facial expressions as angry expressions. Our findings supported this hypothesis, as participants in the high-aggressive group made significantly more misattribution errors compared to participants in the low-aggressive group. This finding is consistent with previous studies who have found effects of hostility and general aggression on misattribution errors in facial expression identification (Hall, 2006; Larkin et al., 2002). However, to our knowledge, this is the first reported study to show that misattribution errors vary according to the level of physical aggression in the general population. These findings are in line with the "hostile attribution bias" (Crick & Dodge, 1994). The hostile attribution bias suggests that biases may drive an aggressive individual's behaviour when attempting to interpret the ambiguous actions of others. Breakdown in social cue encoding leads to a distortion in social cue processing - thus hindering the aggressive individuals' ability to decode the necessary cues from another individual's actions in order to interpret their intent. Hostile predispositions are likely to creep in when there is cue distortion, which can lead to inaccurate facial expression identification, as observed in the

present study. It is therefore possible that high-aggressive individuals in the current study were unable to appropriately extract cue information from the faces they saw, leading them to rely on perceptual biases when trying to identify the expressions. Impaired interpersonal skills may be another potential source of the misattribution of anger shown by high-aggressive individuals. Deficits with interpersonal interaction and communication have been previously observed in individuals with physical aggression (Hazaleus & Deffenbacher, 1986; Parrott & Zeichner, 2002), which may account for the expression interpretation difficulties these participants had in our study.

A secondary aim of the current study was to establish whether participants' ability to identify angry expressions in general would vary according to their level of physical aggression. In line with past studies, (Hall, 2006; Larkin et al., 2002) there were no differences in misperceived errors for angry facial expressions between high and low aggressive participants. However one study had reported that high-aggressive individuals were more accurate to identify angry expressions compared with low-aggressive individuals, although this was found in a child population (Barth & Bastiani, 1997). It may be surprising that high-aggressive individuals did not perform differently to their low-aggressive counterparts when identifying angry expressions in the present paper. Previous studies have observed processing advantages for high-aggressive participants when attending to angry expressions (e.g. Bertsch et al., 2009; Zhang & Liu, 2011) and when attending to non-facial threatening stimuli as well (Parrott, Zeichner, & Evces, 2005). Again, a hostile attribution bias is suggested to play a role in this biased processing. Some have argued in favour of pre-conscious processing of threatening stimuli in aggressive individuals due to an evolutionary-evolved, content-specific response to the facial expression of anger (van Honk, Putman, Hermans, & Tuiten, 2000). Differences in paradigms or aggression inventories may explain why previous studies have observed this processing advantage in aggressive individuals. Choice of aggression measurement may also account for the lack of relationship found between hostility and misattribution errors and overall aggression with misattribution errors in the present study.

One interesting finding from this study was that relative to low-aggressive individuals, high-aggressive individuals were more likely to misattribute anger to disgust facial expressions more so than the other non-angry expressions. This has also been reported in another study (Larkin et al., 2002). However, unlike Larkin's study, gender did not alleviate this relationship. Interestingly, Pond et al. (2012) found a negative relationship between physical aggression and disgust sensitivity, that is those with high levels of physical aggression were those with low sensitivity to disgust. Expressions of disgust may be misleading to aggressive individuals due to impaired signals for social avoidance (Rosenberg, Ekman, & Blumenthal, 1998). Similarly, individuals with hostile predispositions – such as aggressive individuals may also misinterpret signals for social approach (Larkin et al., 2002; Rosenberg et al., 1998). In the present study, high-aggressive individuals mistook happy expressions as neutral expressions, highlighting the potential impairment of social approach signals. Indeed, it is not uncommon for other populations who demonstrate social approach signal deficits to mistake happy expressions as neutral (Eack, Mazefsky, & Minshew, 2014). One possibility for this breakdown in interpreting social approach signals is that physically aggressive individuals fail to appropriately engage in cognitive processing that is necessary here, leading to poor emotional interpretation (Epps & Kendall, 1995). Another possibility is that a general social-cognitive impairment exists. It would be interesting to examine whether aggressive individuals show impairments when dealing with additional emotional related tasks, such as applying emotional information to guide behaviour (Mayer, Salovey, & Caruso, 2004). If impairments exist in other facets of emotional processing, then this may point towards a more general deficit of emotional intelligence in physically aggressive individuals.

Some limitations of the present study should be noted. The ratio of male to female participants was heavily in favour of females. Although we controlled for gender in our study, it would be fruitful to include a more representative sample of men and women in future research. If this is done, then it would be interesting to explore whether gender differences exist in terms of misattribution errors, as they have been reported previously regarding expression processing (e.g., Rotter & Rotter, 1988). Another potentially interesting avenue would be to see if the gender of the faces presented influences facial expression processing in aggressive individuals. Previous research has suggested that people look for particular cues on faces that they expect to see in men and women and consequently associate certain emotions to each gender (Hess, Adams, & Kleck, 2004). For example, thicker eyebrows indicate perceptions of dominance, a characteristic that can be expressed with anger (Zebrowitz, 1997) and is typical for a male face (Brown & Perrett, 1993). As a result, angry expressions are typically identified faster and more accurately when portrayed by a male, as opposed to a female face (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007). Moreover, one sex may portray certain expressions to a clearer, more interpretable level than the other. This raises questions about whether aggressive individuals' will show these same male anger superiority effects and establish if anger is equally misattributed across male and female faces. One potential outcome is that aggressive individuals will misattribute anger to non-angry expressions more so in male faces.

The present data suggests that an individual's ability to identify the emotional state of others from facial expressions is influenced in part by their level of trait physical aggression – although high-aggressive participants' judgments of angry expressions were intact, those with high levels of this trait commonly mistake non-angry expressions to be angry expressions. This finding supports the notion of a hostile predisposition that influences behaviour when social cue signals have insufficiently been encoded. These findings suggest that our expectations regarding another's emotionality is partly based on our own personality, which has implications for elucidating how social behaviour and interpersonal interaction are influenced by undesirable traits which are prevalent in everyday life.

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Competing Interests

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About the Authors

Alisdair Taylor is a Post-Doctoral Research Fellow in Neuroscience at the University of British Columbia, Canada. He received his doctorate in Psychology from the University of Sussex, U.K. His current research interests include the decision making processes in Parkinson's disease and individual differences in emotion processing.

Maria Jose is a Post-Graduate student at the University of Surrey, U.K. She obtained her Bachelor's degree from Bournemouth University, U.K. Her current research interests involve the relationship between trait aggression and face processing.