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Outgroup threat and opportunity to derogate: A social neuroscience approach

Intergroup communication is at the core of intergroup relations. Studies demonstrate that intergroup threat and having an opportunity to derogate the outgroup result in heightened cortisol levels. However, biomarkers associated with different stress systems may show distinct patterns under the same conditions. We investigated whether perceptions of threat and the opportunity to derogate would result in an increase in alpha-amylase levels. White Canadian university students (N = 77) read discriminatory or favorable comments that Chinese individuals made towards Canadians. Subsequently, they were given the opportunity to derogate the outgroup. Salivary alpha-amylase was collected at baseline, following the threat, and after the opportunity to derogate. Participants showed an alpha-amylase response to threat, albeit delayed, but no further increase in concentration values due to derogation. The findings illustrate the impact of intergroup communication on physiological stress as well as the importance of using multiple biomarkers to elucidate that relationship.

Key words: outgroup derogation, threat, stress response, alpha-amylase, social neuroscience

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For many researchers, communication is at the core of intergroup relations (e.g., Clément, 1996; Dubé-Simard, 1983; Giles & Gardikiotis, 2018; Holtgraves, 2011; Taylor, 2014). The prolegomena to this special issue as well as Giles' principles of intergroup communication (Giles, 2012) illustrate the vast impact it has on a plethora of intergroup phenomena, among which are the conditions promoting or hindering conflict (e.g., Dovidio & Gaertner, 2010). In turn, these involve the usage of language and communication strategies to differentiate from and denigrate outgroup members by linking them symbolically to traits and behaviors that would be perceived negatively (Haas, 2012). Specifically, derogation of an outgroup as a communication strategy has been studied in relation to its impact on both the relations between groups and individual reactions (e.g., Cervone et al., 2021; Maass et al., 2014). However, it seems uncertain if derogation acts to attenuate the impact of denigration or, on the contrary, to enhance it. Furthermore, it seems that the results of traditional self-reports on the matter would be unreliable, inviting indirect approaches to assessing reactions, including social neuroscience (Taylor et al., 2010). In fact, this approach offers a number of benefits. Intergroup research often involves sensitive topics (e.g., prejudice), resulting in reactions that are influenced by social desirability and self-presentation motives. Social neuroscience assessment methods would better tap into beliefs that individuals may be unwilling to report or be unaware of (Gardner et al., 2000) by directly measuring the variables of interest (Amodio, 2013; Cacioppo et al., 2010). The current study was an application of the social neuroscience approach to outgroup derogation and its consequences for physiological stress responses in those who have been subjected to an intergroup threat.

Although there is consensus that identity threats elicit a stress response (Fischer et al., 2017; Lucas et al., 2017; Sawyer et al., 2012), the relative impact on stress of compensatory behaviors aimed to retain esteem, such as derogating the outgroup, remains understudied. There are currently diverging predictions on the outcome of having an opportunity to respond to identity threats, that is, whether this opportunity lowers stress levels, based on social identity theory (SIT, Tajfel & Turner, 1979), or increases stress levels, based on the model of intergroup anxiety (MIA, Stephan & Stephan, 1985).

Social Identity Theory

An important part of our self-concept is our social identity, which is derived from our perceived membership in social groups (e.g., ethnicity, gender, sexuality, geographical location, e.g., Hogg, 2016). According to SIT (Tajfel & Turner, 1979; Turner, 2000), humans are motivated to (a) categorize others and themselves into groups to gain information about the world and themselves; (b) identify with others who share similar qualities to gain a sense of belongingness, pride, esteem (Sani, 2012), and reduce feelings of uncertainty (Hogg et al., 2017); and (c) compare members belonging to their group (i.e., the ingroup) to members belonging to

other groups (i.e., the outgroup) to derive a sense of superiority, and in turn, fulfill their desire to have a positive self-concept. A perceived threat to the ingroup, typically resulting from unfavorable intergroup comparisons that undermine the status of a given group or create competition, can result in strengthened ingroup identification, favoritism (Branscombe et al., 1999), and discrimination against outgroups, such as derogation (Branscombe & Wann, 1994). The mere experience of identifying with a group promotes ingroup bias, which facilitates favoritism toward, and preferential treatment of, members of the ingroup that are not extended to others (Myers et al., 2021). Situations that make one's group identity more salient, such as formulating groups or threatening a group's status or abilities (i.e., social identity threat) can increase ingroup favoritism, which can result in tactics to restore ingroup superiority, such as discrimination in the form of outgroup derogation (Balliet et al., 2014; Greenwald & Pettigrew, 2014).

While ingroup favoritism often occurs more frequently and independently from outgroup derogation (e.g., viewing one's group positively without equally viewing outgroups negatively; Brewer, 2001; Gaertner et al., 2006), the latter has been found to occur more often in contexts involving threat. Past research suggests that group members who are subjected to a self-esteem lowering threat are more likely to derogate as a way of defending themselves (e.g., Finchilescu, 1986; Meindl & Lerner, 1984). These results have been corroborated in studies in which ingroup members feel better after derogating outgroup members in various contexts relating to ethnic (Branscombe & Wann, 1994), age (Knobloch-Westerwick & Hastall, 2010), and gender groups (Maass et al., 2003). Thus, research based on SIT suggests that a perceived threat to identity leads to feelings of stress and that derogation is, therefore, a means to relieve this stress and reaffirm a positive identity.

These findings are further supported by experimental studies measuring physiological stress. Experiencing acute threats to group identity, such as exposure to prejudicial or integrity threatening cues, is associated with physiological responses that are suggestive of high levels of stress. Some examples of threat-related responses include cardiovascular patterns (stereotype threat, Vick et al., 2008; discrimination, Sawyer et al., 2012), increased heart rate (ethnic discrimination, Fischer et al., 2017), and arterial pressure (stereotype threat, Blascovich et al., 2001; group esteem threat, Scheepers, 2009), increased salivary cortisol secretion (sexism, Townsend et al., 2011; ethnic discrimination, Fischer et al., 2017; identity threat, Matheson & Cole, 2004; Sampasivam et al., 2016, 2018), and increased salivary alpha-amylase secretion (ethnic discrimination, Fischer et al., 2017; Lucas et al., 2017). Furthermore, a meta-analysis on perceived discrimination and health also found that perceived discrimination produces a significant stress response and is associated with poor mental and physical health (Pascoe & Richman, 2009).

However, to our knowledge, no study has reported a reduction of physiological stress following derogation. On the contrary, the theoretical model of identity threat process and responses (Petriglieri, 2011) suggests that derogation is an identity-protection response. Accordingly, this coping strategy does not change

an individual's threatened identity nor does it change the views of the threat source, thereby maintaining the appraisal of threat. This notion is supported by the model of intergroup anxiety.

Model of Intergroup Anxiety

Anxiety as a result of anticipating or engaging in intergroup interaction is referred to as intergroup anxiety, which may be aroused by specific outgroups or by outgroups in general (Stephan, 2014). Intergroup anxiety has both trait and state components (e.g., chronic vs. episodic, Paolini et al., 2016), with state intergroup anxiety being aroused by features of the situation rather than features of the outgroup (Stephan, 2014). State intergroup anxiety emerges and has effects on arousal during actual intergroup interactions (Stephan, 2014). There are three interacting components of intergroup anxiety: affective, cognitive, and physiological.

Physiological stress responses have been shown to accompany intergroup contact due to the expectation of an aversive experience coupled with the anxiety-related affect it tends to elicit. For instance, during intergroup contacts, greater cortisol secretion was found among those who were concerned about appearing prejudiced (Trawalter et al., 2012) and among women who were evaluated by men and subjected to sexism (Townsend et al., 2011). In Latinx participants, greater concern, more threat emotions, and higher blood pressure and sympathetic nervous system responses were found during anticipation of delivering a speech to a prejudiced White confederate (Sawyer et al., 2012).

Causality between the components of intergroup anxiety is yet to be established, such that both affective and cognitive components of intergroup anxiety can activate arousal (Stephan, 2014). Unlike SIT, this suggests that behavioral manifestations of negative attitudes toward outgroups, such as derogation, may contribute and perhaps amplify physiological arousal caused by intergroup interaction. For instance, individuals who were subjected to a symbolic threat or threat to group values and belief systems demonstrated higher salivary cortisol secretion following derogation compared to a nonderogation threat control group (Sampasivam et al., 2018). These findings are aligned with the intergroup anxiety model, suggesting that derogating an outgroup following intergroup interaction or a group threat can augment, rather than attenuate, physiological stress responses.

Our previous study (Sampasivam et al., 2016) examined cortisol secretion following a threat to group values, belief systems, and worldviews in White Canadians, and following an opportunity to derogate the outgroup. Participants allocated to the threat condition exhibited higher cortisol secretion following the threat compared to those in the non-threat condition. Additionally, those in the threat condition who had an opportunity to derogate the outgroup had higher levels of cortisol secretion compared to the threat control group who did not engage in derogation. Despite these findings, it is difficult to conclude if these acute stress

responses based on cortisol concentrations would be replicated in other stress biomarkers, given the complexity of the interaction among the stress systems.

Stress System and Biomarkers

A social neuroscience approach has been frequently used to understand the social cognitive mechanisms underlying intergroup relations and biases, such as prejudice and stereotyping, and the consequences of perceiving various forms of group identity threats on individuals' psychological and physical health (Amodio, 2008; Derks et al., 2013). Despite their breadth, in many of those studies, there are no attempts to examine the communication behaviors of the participants, including that of the researchers. What is said and how it is received is usually integrated in the backdrop of a protocol ensuring experimental stability and control. Thus, intergroup communication usually remains out of reach of current observation paradigms (Clément et al., 2016). This shortcoming potentially expends social neuroscience to the field of intergroup communication and specifically, to the assessment of the rival hypotheses described above using physiological measures of stress.

Stress can be defined as a threat to homeostasis by a real or perceived challenge (McEwen, 2000; McEwen & Stellar, 1993; Goldstein, 2010; Goldstein & McEwen, 2002). A stressor, whether physiological or psychological, and whether positive or negative, is a stimulus that leads to a physiological imbalance. When an event is perceived as stressful, a physiological reaction occurs that involves the activation and coordination of the central and peripheral nervous system, which interacts with the immune system downstream, implicating several homeostasis mechanisms (Ali & Nater, 2020).

The two major neuroendocrine systems that are activated in response to a stressor are the hypothalamic-pituitary-adrenal (HPA) axis, which is modulated by the central nervous system, and the sympathetic-adrenal-medullary (SAM) axis (Chrousos & Gold, 1992), which is modulated by the autonomic nervous system. In stress research, the HPA axis is the most studied neuroendocrine stress system (Hellhammer et al., 2009). Cortisol, a hormone secreted by the HPA, has been established as the principal biomarker of stress-induced HPA axis activation (Ali & Nater, 2020; Kirschbaum & Hellhammer, 1989). Cortisol is produced by the adrenal gland, one of a class of endocrine glands, and circulates in blood before passively diffusing into saliva (Sterling & Eyer, 1988), resulting in a roughly 15- to 20-minute lag between, for example, stress-induced HPA axis activation and a change in the salivary concentration of cortisol.

More recently, stress researchers have been examining the role of the autonomic nervous system in the stress response, measuring different biomarkers that are indicative of specific autonomic mechanisms underlying the stress response and their interactions with other stress systems (Ali & Nater, 2020). Salivary alpha-amylase (sAA) has more recently been recognized as a valid and

reliable marker of SAM activity (Nater & Rohleder, 2009). Alpha-amylase is a salivary enzyme involved in the digestion of carbohydrates and starches, which makes it an ideal, non-invasive proxy measure of SAM activity in acute stress paradigms (Ali & Nater, 2020). Research has shown that sAA levels increase in response to psychosocial stress (Maruyama et al., 2012; Nater et al., 2005, 2006; Rohleder et al., 2004; van Stegeren et al., 2008). Furthermore, sAA activity has been shown to be elevated in acute stress paradigms involving negative intergroup contact. For example, Turkish immigrants subjected to ethnic discrimination demonstrated elevated sAA levels (Fischer et al., 2017).

It has been suggested that the SAM and HPA systems may be differentially activated by stressors, at times showing distinct response patterns to a given stressor. For instance, when comparing sAA and cortisol secretion of individuals exposed to a physical (electrical stimulation) or psychosocial stressor (the Trier Social Stress Test; TSST), sAA levels peaked rapidly following both stressors and recovered within 20 minutes. However, cortisol secretion demonstrated a delayed response 20 minutes following the psychosocial stress paradigm but not after the physical stressor (Maruyama et al., 2012). Similarly, Balodis et al. (2010) showed an immediate increased response in alpha-amylase following the TSST. However, in their study, cortisol concentrations in the same participants were also elevated in tandem with alpha-amylase values. Typically, cortisol stress-induced reactions are delayed compared to that of alpha-amylase following TSST (Lambert et al., 2018). These findings corroborate other replications using the TSST paradigm in that sAA levels increased after a stressor and recovered within 10 minutes (Fischer et al., 2017; Nater et al., 2005, 2006). These results suggest that sAA responses are more rapid and fleeting, whereas cortisol responses are more delayed and longer lasting. They also suggest that the SAM system may be more sensitive to pain-causing stressors compared to that of the HPA system (Maruyama et al., 2012).

The Current Study

The current study used unpublished sAA data from a previous study (see Sampasivam et al., 2016, cortisol findings) that elicited an intergroup threat in a group of young White Canadian adults and gave them an opportunity to derogate the group who was the source of the threat. Due to the growing interest in the coordination of both the HPA and SAM axes in the context of stress, we collected both salivary cortisol and sAA in our 2016 study in the hopes of shedding light on how they interact during the activation of an acute stress response (Bauer et al., 2002). Therefore, the specific aim of the current study was to investigate if the same intergroup threat used by Sampasivam et al., (2016) activates a stress-induced sympathetic response, as indexed by sAA, and demonstrates a similar pattern of secretion following exposure to an intergroup threat and after the opportunity to derogate the outgroup.

Method

Participants

Seventy-nine female undergraduate students participated in the study (M_{age} = 19.80 years old, *SD* = 4.66). They were recruited through a participation research pool at a Canadian university and were compensated for their time by receiving 2% towards their grade in a course. In this study, it was important for participants allocated to both conditions (threat and non-threat) to belong to the same ingroup to maximize homogeneity of the response to the outgroup. Consequently, only participants who self-identified as White, Canadian, and whose first language was English were deemed eligible for the study. The study was described to participants as an examination of the similarities and differences between cognitive and physiological measures. Informed and written consent was obtained from participants following a description of the procedures and risks. Participants had the opportunity to ask questions. Ethical approval of the study was obtained prior to the recruitment of participants

Experimental Procedure

Salivary Alpha-Amylase Collection and Analysis

The diurnal rhythm of sAA is characterized by a decrease within 30 minutes of awakening followed by a steady slow increase throughout the day (Nater et al., 2007; Rohleder et al., 2008). Consequently, participants were tested between 15:00 and 21:30, when concentrations are most stable. Participants attended a laboratory session in which they completed the tasks online.

Figure 1 displays the phases of the experiment and collection of sAA at each time point. After providing consent, participants were given a glass of water and asked to rinse their mouths to ensure that the saliva samples were not contaminated by food. Participants then watched an instructional video illustrating how to provide saliva samples and filled out a general demographic questionnaire. There were queries on the consumption or use of items that impact stress hormones (i.e., cigarettes, alcohol, birth control and other medications), and about any recent dental work. Those who reported bleeding gums the morning of the study were excluded from further participation due to potential contamination of the saliva samples (Page-Gould & Akinola, 2015). Each participant provided five saliva samples collected from oral swabs placed underneath the tongue for three minutes. The study was completely automated and equipped with timers programmed to ask participants to provide saliva samples at baseline (before allocation to the threat or non-threat condition), 5 min and 20 min after they read the threat or non-threat manipulation, and 5 min and 20 min after having an opportunity to derogate the outgroup or engage in a control task.

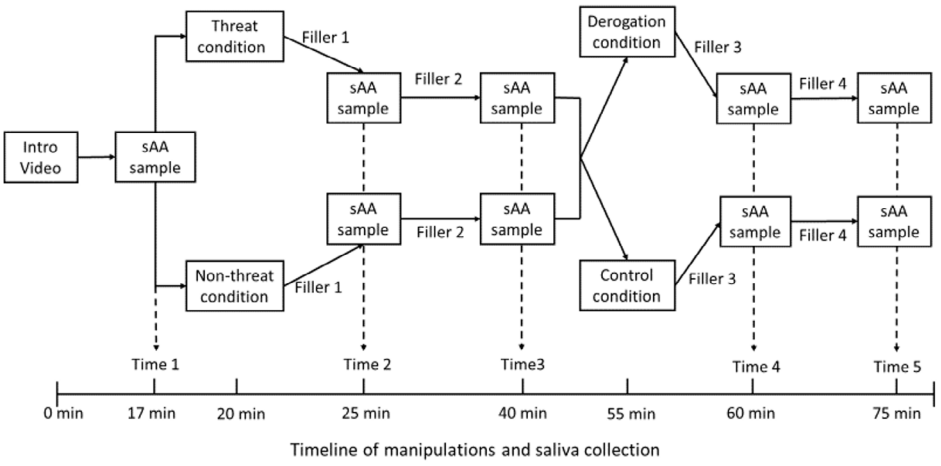
The swabs were deposited in a sterile container and kept in a -80 °C freezer

until assayed for sAA. Commercially available kinetic reaction assay kits and protocols designed by Salimetrics, State College, PA, USA, were used. All samples were assayed in duplicate and the mean of each pair of concentration values was employed in the data analyses.

Threat and Non-threat Conditions

After obtaining the baseline saliva sample, participants were randomly assigned to either the non-threat or the threat condition. In both cases, information on previous psychological studies regarding relations between Canadian and Chinese cultures on the topics of work habits, family structure, hobbies, and values were provided. In the non-threat condition, participants read positive statements about Canadians, highlighting the similarities between the two cultures. For example, it included the following interview insert: "It was easy to make friends with the people I worked with though. I think Canadians are so friendly! Even though my English was bad, we became friends…like really fast, and we work well together." In the threat condition, participants read negative statements about Canadians, which highlighted the differences between the cultures. For example, it stated: "Why do Canadians always think their country is so great? You can always hear them talking about how great Canada is - how they are so multicultural and diverse. But really, China is much more multicultural and diverse - in China, there are, uh, 56 different minority groups and yeah, there are a few problems - but Canada has what? Like, 2 - the French people and native people… [laughing]…That's it! And they can barely hold it together." Thus, the statements in the threatening condition were meant to

Figure 1. *Steps of the Experimental Procedure for the Nonthreat (Top) and Threat (Bottom) Groups*



Note. Both threat and nonthreat groups were further divided into opportunity to derogate or not at T4 and T5 (at the 55 min timepoint on the flowchart).

induce a mild stress response through a perceived threat to the participants' ingroup identity. These conditions underwent a manipulation check using an independent sample of 22 participants. Results confirmed participants in the threatening condition were more threatened than participants in the non-threatening condition, deeming it a successful manipulation (Sampasivam et al., 2016).

A second saliva sample was collected (T2) 5 min following the threat. During the 5 min wait period, participants responded to a filler task that asked them to summarize the information they read. Participants then provided a third saliva sample (T3) 20 min after the threat. Participants responded to additional filler questions about these statements while waiting to provide the third sample.

Opportunity to Derogate Conditions

Following the collection of the third saliva sample, participants from the non-threat and threat conditions were randomly assigned to the opportunity to derogate or control condition. In the opportunity to derogate condition, participants were asked for their opinion about the outgroup. They read 16 short descriptions of specific positive (e.g., giving a member of the ingroup or outgroup a gift) or negative (e.g., fighting a member of the ingroup or outgroup) intergroup behaviors through which they were given the opportunity to derogate by assigning explanations for the behaviors. Participants were asked to read the vignettes and choose the response that, in their opinion, described the behavior most accurately. The response alternatives underneath each vignette varied randomly in their level of derogation. In the control condition, participants were instructed to write a brief paragraph on time management. 5 min after the task, participants provided a fourth saliva sample (T4) and a fifth one (T5) 20 min post-derogation was then collected, and the participants were debriefed.

Between the saliva collection timepoints, participants watched filler videos that aimed to help them keep salient the themes of the study - either the opportunity to derogate or the control task. Both videos were related to challenging intergroup experiences. For example, the first video was derived from the television show *What Would You Do?* in which hidden cameras are used to observe how bystanders react to social dilemmas. Unbeknownst to the bystanders, those involved in the dilemmas are all actors. In the specific episode that the participants viewed, White actors treated visible minorities in a discriminatory fashion in front of bystanders, and some of the bystanders were silent or even joined in on the discrimination, whereas others defended those subjected to the discrimination. In the second video, participants watched a short film called "New Boy," a story depicting the experiences of a boy who moves to Ireland from an unidentified country in Africa.

The statistical analysis first focused on the threat and non-threat groups, regardless of the derogation manipulation. A mixed-design analysis of variance (ANOVA, time repeated, group independent) was conducted, followed by planned comparisons at each time point in order to determine the time course

of the sAA results. Finally, a trend analysis was applied in order to discern whether the results were consistent with a linear or nonlinear pattern. The effect of derogation was assessed at the relevant time points (4 and 5; see also Figure 1) via planned comparisons.

Results

Preliminary Analysis

Two participants had sAA concentrations values undetectable by the assays. Therefore, the analyses were based on the data from 77 participants. Sixteen participants were allocated to the threat condition with the opportunity to derogate, 26 participants were allocated to the threat condition with no opportunity to derogate (control task), 15 participants were allocated to the non-threat condition with the opportunity to derogate, and 20 participants were allocated to the non-threat condition with no opportunity to derogate (control task). The uneven group numbers occurred due to insufficient amounts of saliva to conduct the analysis in some subjects. Of these participants, 76 subjects had usable samples at T1, 77 subjects had usable samples at T2 and T3, and 76 subjects had usable samples at T4 and T5. Furthermore, 75 subjects had usable samples across T1-T5.

The Effect of Threat on sAA

Figure 2 shows the sAA concentrations at each collection time point – T1 at baseline, T2 and T3 after threat, and T4 and T5 after derogation (see the Method section for details). It was expected that those allocated to the threat condition would exhibit higher levels of sAA compared to those allocated to the non-threat condition. Mauchly's test of sphericity was violated ($p < .001$). Therefore, the Greenhouse-Geisser corrected values were used. The omnibus test showed a statistically significant main effect of time, $F(3.241, 191.202) = 4.972$, $p =. 002$, $\eta^2 = .078$, but there was no main effect of threat or interaction. Planned comparisons were conducted on the threat and non-threat group data at each of the five time points. Statistically significant group differences occurred at T5 only, $t(72) = 1.99$, $p = .049$, $\eta^2 = 0.256$. Standard correction strategies for multiple procedures were not applied (each test was set at $\alpha = 0.05$), as this was considered an exploratory study (see Rubin, 2017). Trend analyses were performed on the individual threat and non-threat groups and included all five time points. The results showed a statistically significant linear trend only in the threat condition data, $F(1, 38) = 8.222$, $p = 0.007$. No statistically significant trend was revealed in the non-threat condition data, $F(1, 32) = 3.206$, $p = .083$. No other trends were revealed.

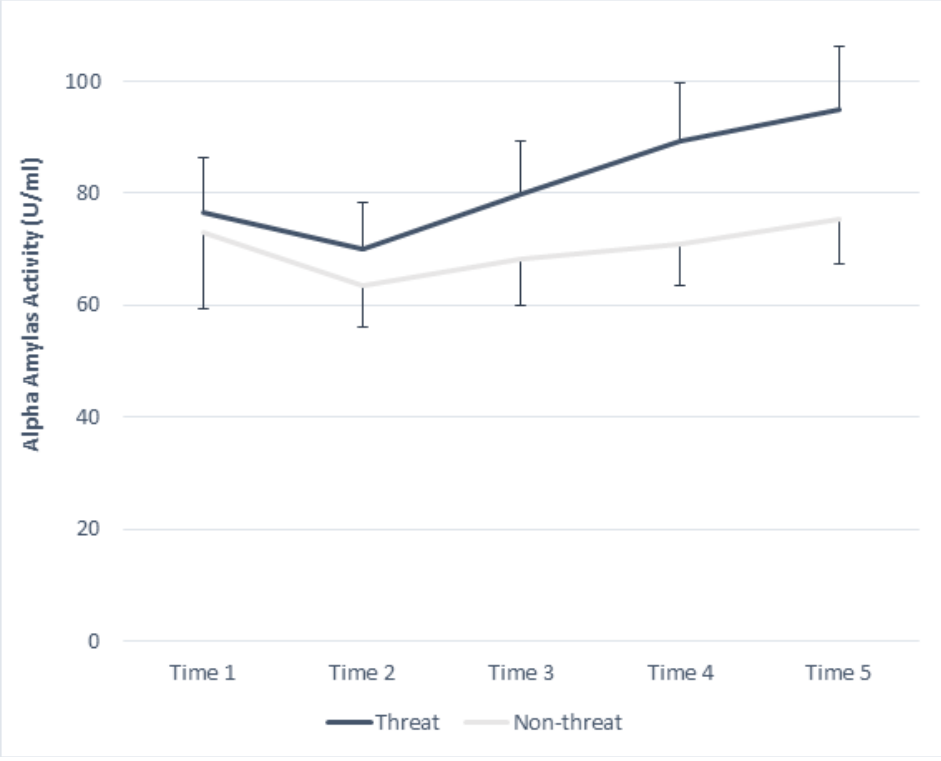
The Effect of Opportunity to Derogate On sAA

It was expected that those allocated to the threat condition who had the opportunity to derogate would demonstrate higher levels of sAA compared to those in the threat condition who did not have the opportunity to derogate. Planned comparisons applied to groups based on derogation or nonderogation assignment at T4 and T5 revealed no group differences whether under the threat condition (T4: $t[39] = .277$, $p = .783$; T5: $t[39] = .101$, $p = .920$) or the non-threat condition (T4: $t[33] = -.364$, $p = .718$; T5: $t[33] = -1.310$, $p = .199$). sAA concentration means and standard errors of the four groups were as follows: threat derogation = 89.81±10.96; threat no derogation = 94.81±11.50; non-threat derogation = 70.81±7.44; non-threat no derogation = 75.45±11.50.

Discussion

This study evaluated sAA responses as an index of SAM functioning to an intergroup threat with the opportunity to derogate the outgroup. Our objective was

Figure 2. *sAA Concentrations at Each Time Point as a Function of Group (Threat vs. Nonthreat). Error Bars Represent Standard Error of the Mean*



to investigate whether the same participants in Sampasivam et al. (2016) would exhibit a similar stress response pattern as was demonstrated in their cortisol data, following exposure to the intergroup threat and after the opportunity to derogate the outgroup. Because we assessed different stress biomarkers measured at the same time points belonging to the same individuals exposed to the same protocol, we were able to evaluate the coordination of the SAM and HPA axes in response to this intergroup stressor.

Overall, the pattern of our sAA results with peak activity occurring more than 20 min following threat and derogation were incongruent with several previous studies demonstrating a rapid increase in sAA following an identity stressor (Fischer et al., 2017; Lucas et al., 2017; Maruyama et al., 2012). Although the participants in our study who were threatened exhibited a typical HPA axis (cortisol) response roughly 20 minutes after the threat, corresponding to T3 (Sampasivam et al., 2016), we expected to observe an earlier sAA secretion, shortly following the threat manipulation. This was not the case. Nonetheless, a trend analysis revealed that those who were exposed to a threat were more likely to show an increase in sAA over time compared to the control group.

Although sAA secretion is typically rapid (i.e., within 5 minutes) following a threat (Maruyama et al., 2012; Nater, 2005, 2006; Rohleder et al., 2008; van Stegeren et al., 2008), it is plausible that the initial threat was insufficient to trigger an immediate stress response via the SAM pathway despite participants feeling more threatened in the threat condition, as indexed by their cortisol secretion (Sampasivam et al., 2016). Given the time point at which sAA increases were observed, it may be that the videos intended to keep the participants reflecting about intergroup conflicts led to stress above and beyond any stress resulting from the threat. As the information carried by the videos depicted symbolic threats to identity, this interpretation further buttresses the impact of intergroup communication, albeit at the same time confounding the effects of the initial verbal stress and the video on the SAM response.

From the point of view of intergroup issues, our results support the conclusions of both Sampasivam et al. (2016, 2018) cortisol studies regarding the impact of threat but not derogation. Verbal threat increases stress but, in the absence of an effect of derogation, no conclusion is warranted about the relative validity of the social identity and the intergroup anxiety approaches.

Our results, taken in the context of the cortisol studies quoted above, point to discrepancies in the reactivity to stressful intergroup communication. Previous attempts at defining multisystem coordination of the stress response by examining the patterns of various biomarkers of these systems have proven difficult (Lucas et al., 2017). For example, a recent study comparing HPA and SAM reactivity to indirect ethnic discrimination revealed that it elicited cortisol reactivity but no cardiovascular responses (Huynh et al., 2017). Rohleder et al., (2008) also compared SAM and HPA reactivity to experiencing a psychosocial threat and having chronic feelings of shame: there was a statistically significant association

between experiencing shame and SAM activity, but not HPA activity.

Paradigms used in this type of research usually involve an active and present threat such as tasks conducted in the TSST. The very few studies that have examined both biomarkers, cortisol and sAA, in the same subjects (Balodis et al., 2010; Lambert et al., 2018; Lucas et al., 2017) have used the TSST, the gold standard for producing a reliable physiological stress response. In each of these studies, elevations in both cortisol and sAA were observed.

Our approach staged comparatively innocuous threat conditions, involving remote situations of a largely verbal, symbolic nature. They nevertheless succeeded in provoking a SAM response, thus documenting the reactivity of the autonomic system to symbolic threat. This suggests an actual impact of even remote threat on the deregulation of functions pertaining to that system. For example, heightened sAA reactivity is linked to poor health outcomes, particularly in adults who have experienced childhood trauma (Kuras et al., 2017). Isolated exposure to threat and derogation may have inconsequential long-term effects but for individuals who experience regular adversity, the impact may have wide ranging health sequalae and epigenetic influences. Given the significant consequences of being exposed to intergroup threats, further research delineating how different types of stressors activate stress response systems and the accumulative impact of stress on these systems is key.

Limitations and Future Directions

Our study is limited by factors related to the complexity of running these protocols and, for that reason, opens the path to further investigations. First, our inclusion of only women as participants was motivated by control and availability issues. Introducing participant gender as a factor requires an additional layer of considerations regarding the hormonal characteristics of the participants as well as the logistics of including both groups in the design and protocols. Nevertheless, this opens the question as to the reactivity of male participants and how they would compare. Second, whereas our results support the importance of threat as having an impact, no effect was obtained with respect to the opportunity to derogate. More specific attention should be paid to what was actually said by the derogating participants. It may be the case that some formulations are more impactful than others. To some extent, this was examined in a subsequent study using the linguistic intergroup bias paradigm (Sampasivam et al., 2018). A fuller investigation of the communicative behavior of victims would be in order. Third, whereas this study is inconclusive about the effects of derogation, it is so only to the extent that this physiological reaction, at that point in time, is concerned. Derogating participants may still feel elated or angered as longer-term physiological responses may show. Fourth, this research was conducted within the very specific, relatively peaceful context of Sino-Canadian relations. The materials devised for this study were meant to elicit a response from a very

specific group of participants. Clearly, this calls for further inquiries in other contexts in which the relations between groups may be less cordial.

Conclusion

Following the call for the application of social neuroscience to intergroup communication, our study has examined the impact of intergroup threat on autonomic physiological activity, the SAM response. Further buttressing the value of this approach, our results support the strong association between what is said during intergroup contact and physical health and wellbeing while calling to attention differences in the way physiological systems react. Knowledge of these mechanisms is essential to our understanding of the community transmission of prejudice and discrimination and their impact on poor social climate as well as public health. Therefore, it is an essential avenue for the advancement of intergroup communication.

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Conflict of Interest Disclosure

The Authors have no conflicts of interest to declare.

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Research Ethics Statement

This work was conducted in accordance with ethical guidelines by receiving approval from the IRB at the University of Ottawa.

Authorship Details

Katherine Collins: research concept and design, collection and/or assembly of data, data analysis and interpretation, writing the article, critical revision of the article, final approval of the article.

Kheana Barbeau: data analysis and interpretation, writing the article, critical revision of the article, final approval of the article.

Simnthujaa Sampasivam: research concept and design, collection and/or assembly of data, writing the article.

Catherine Bielajew: data analysis and interpretation, critical revision of the article, final approval of the article.

Richard Clément: research concept and design, data analysis and interpretation, writing the article, critical revision of the article, final approval of the article.

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