An Investigation into the Acquisition, Generalization, Facilitation and Immunization of Intergroup Anxiety

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Declaration

1. The data of Study 1 in Chapters 2 and 3 were collected prior to the commencement of Nicholas Harris' PhD and contributed to Nicholas' psychology honours thesis, which was submitted to the School of Psychology at the University of Newcastle in 2009. The breadth of the data, analytical approach, and scope of the analyses employed as part of this PhD submission differ significantly from those reported in his honours thesis. Towards inclusion in this PhD thesis, the psychophysiological data of this initial study were re-coded after consultation with expert research colleagues to perfectly adhere to standardized methodologies from established psychophysiology laboratories. The data from this initial study were re-analyzed in greater depth and larger scope: This included extending the initial focus on anxiety acquisition to incorporate an investigation of generalization, the moderating impact of individuals' prior contact, and mediational tests. As a result, this PhD thesis sheds a light on processes that have broader implications for theory and interventions. As such, this study's rationale, hypotheses, results, and implications, as discussed in this PhD thesis, are significantly different to those originally presented in Nicholas' honours thesis.

2. The rest of this PhD thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made. I give consent to this copy of my thesis, when deposited in the

University library, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.

3. I hereby certify that the work embodied in this thesis contains a published paper of which I am a joint author. I have included as part of the thesis a written statement, endorsed by my supervisors, attesting to my contribution to the joint publication.

4. As second author of the review paper accepted for publication in Group Processes and Intergroup Relations, Nicholas Harris provided a significant contribution at all stages of the joint publication. Nicholas Harris contributed to the extensive literature review: He located the majority of the articles, coded them under guidance, adapted table structure from past publications, and populated the tables for the manuscript. He wrote selected parts of the manuscript, provided feedback on drafts and carried out extensive editorial changes of the manuscript under guidance; he also designed a first draft of figures and wrote a first complete draft of response to editors and reviewers during the revision process. As first author, Stefania Paolini contributed to the extensive literature review by designing the coding protocol, training Nicholas to the protocol, and carrying out quality checks on sample articles, and table entries. Stefania wrote the bulk of the first complete draft of the manuscript, and finalized the material for the revision process. As third author, Andrea Griffin gave feedback to the coding protocol, manuscript drafts, and letter of response to editor. She was instrumental in translating the conceptual model into the

graphical form depicted in the figures. All authors read and approved the final version of the manuscript. The full reference for this manuscript is:

Paolini, S., Harris, N., & Griffin (2015). Learning anxiety in interactions with the outgroup: Towards a learning model of anxiety and stress in intergroup contact. *Group Processes & Intergroup Relations*. Doi: 10.1177/1368430215572265. Appendix A includes the published version of this paper; Chapter 1 presents a revised version of the manuscript for this thesis.

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Abstract

The anxiety, tension or uneasiness that individuals experience when in contact, or when anticipating contact, with members of a different social group is commonly referred to as intergroup anxiety (Stephan & Stephan, 2000). Past investigations of intergroup anxiety have focused on the anxiety attenuating effects of positive intergroup contact experiences, used self-report anxiety measures, and assessed either anxiety towards specific outgroup members (or 'episodic anxiety'), or towards the outgroup in general (or 'chronic anxiety'). The research reported in this thesis investigates the mechanisms underpinning the acquisition and generalization of anxiety towards outgroup members by using an adaptation of direct or first-hand (Olsson, Ebert, Banaji & Phelps, 2005) and vicarious or second hand (Olsson, Nearing & Phelps, 2007) aversive learning paradigms employed in previous research. The empirical work within this thesis employs self-reported and psychophysiological measurement tools, including skin conductance responses, to quantify episodic and chronic anxiety responses to outgroup stimuli, as well as examine the processes connecting episodic to chronic responses. Chapter 1 reviews the intergroup anxiety literature, with a focus on more recent behavioral and psychophysiological investigations (e.g., Blascovich et al., 2001). The literature review leads to the proposition of a learning model of intergroup anxiety that not only incorporates both episodic and chronic anxiety responding but also their interaction, suggesting that chronic responses moderate episodic ones. The four experimental chapters contained within this thesis provide an empirical test of the learning model of intergroup anxiety proposed in Chapter 1. Chapter 2 demonstrates that both direct and vicarious aversive experiences resulted in a comparable magnitude of episodic anxiety acquisition, and that acquisition is facilitated by increased perceived self-model similarity and increased model believability during vicarious experiences.

Chapter 2 also demonstrates the facilitating moderating role of chronic anxiety in the development of episodic anxiety and the protective role of past contact quality. Chapter 3 demonstrates that chronic responses, indexed by generalization of acquired anxiety responses to new outgroup members, were most pronounced when new outgroup exemplar stimuli were perceived as similar to the original CS+, and when self-model similarity was high. Chapter 4 demonstrates that the order in which one undergoes direct and vicarious aversive experiences affects anxiety acquisition and generalization: Undergoing a direct learning experience followed by a vicarious one caused anxiety responses of a higher magnitude, whereas undergoing a vicarious experience followed by a direct one resulted in a peak shifted response to a new member of the outgroup. Moreover, model anxiety and contingency awareness both facilitated episodic and chronic anxiety responses. A minimal group paradigm was used in Chapter 5's research to investigate the effects of aversive experiences towards artificial groups away from the influence of variables that typically confound interpretations of results from real social groups, including prior contact and group valence. This approach also enabled investigations into the relative contribution of group membership and facial cues to anxiety generalization. Results indicated that anxiety acquisition was stronger towards outgroup (vs. ingroup) stimuli, generalization was broader towards ingroup (vs. outgroup) stimuli, and group membership cues (vs. facial features) were more influential for generalization. Chapter 5 also confirmed that contingency awareness facilitates both episodic and chronic anxiety responses. Taken together, the research reported in the four empirical chapters provide empirical support for some of the proposed mediators and moderators of the learning model of intergroup anxiety, such as chronic anxiety and contact quality, and demonstrates the rich and dynamic interplay between episodic and chronic anxiety over the lifetime of an individual. Throughout the

thesis and particularly in Chapter 6, the implications of the research for the proposed learning model of intergroup anxiety, evolutionary theory, learning theory, and contact theory are discussed.

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Chapter 1.

Learning Anxiety in Interactions with the Outgroup: Towards a Learning Model of Anxiety and Stress in Intergroup Contact

Despite the well-established idea that intergroup contact improves intergroup relations because it increases knowledge about the outgroup (Allport, 1954), social psychological research using learning as an explanatory framework to investigate the consequences of intergroup contact is scant (Eller & Paolini, 2011). This may be because this tradition narrowly defines ‘learning’ as ‘knowledge learning’ or learning about outgroup characteristics and cognitions (see e.g., Pettigrew & Tropp, 2008). This is redressed by re-defining intergroup contact, more broadly, as *the process through which we learn about the outgroup.* From this broader stance, during intergroup contact, individuals do not simply acquire new knowledge about the outgroup and its members, but they also learn about modal affective responses, emotions, and evaluations typically associated with the outgroup (see also Stephan, 2014). For instance, intergroup contact offers the opportunity to learn to be anxious towards, and around the outgroup. Intergroup contact also provides the opportunity to revise those anxieties. This process of revising affective responses to the outgroup in light of new outgroup experiences will be called *anxiety learning*.

In this chapter, classical and contemporary research on intergroup anxiety in ingroup/outgroup interactions is reviewed using a new learning model of intergroup anxiety and stress. Intergroup anxiety is first defined and its central role is discussed within the intergroup contact literature; Blascovich and colleagues’ influential study is revisited (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001) by identifying two key components of the model. The following section outlines the model’s organizing principles and describes its key features and properties. A new generation of research is then discussed, which measures psychophysiological and behavioral manifestations of intergroup anxiety and stress to assess changes in anxiety over time (i.e., 'anxiety learning') during contact. It will be argued that these emerging time-sensitive methodologies are powerful tools for testing the predictions generated by the anxiety learning model. An overview of new data forming this thesis will also be provided, combining methods from the learning and conditioning research tradition and contemporary investigations of intergroup phenomena.

The aim is to demonstrate that the appeal of contemporary research on intergroup anxiety rests in its ability to test new complex segments of a time-bound process of intergroup anxiety learning. In particular, contemporary research can investigate whether, as predicted, episodic and chronic process variables interact over time in a complex and non-linear fashion. Using the learning model, some novel and untested predictions will be identified about how episodic and chronic process variables may interact, which it is hoped will guide future research.

Intergroup Anxiety Shapes Intergroup Relations, and Determines Whether Individuals Will Engage and Benefit from Intergroup Contact

Recent interest in intergroup anxiety reflects a broader cultural zeitgeist and a growing attention to how affect and emotions shape intergroup processes generally (Esses & Dovidio, 2002; Mackie, Devos, & Smith, 2000), and ingroup/outgroup interactions or 'intergroup contact' specifically (Devine, Evett, & Vasquez-Suson, 1996; Greenland & Brown, 1999).

Intergroup anxiety has acquired a central role in the intergroup contact literature. At the broadest level, intergroup anxiety stems from negative expectations about ingroup/outgroup interactions. Intergroup anxiety emerges when outgroup members are seen or expected to pose a threat to the ingroup or individual ingroup members' goals, motives, or sensitivities (Cottrell & Neuberg, 2005; Plant & Devine, 2003; Smith, 1993; Stephan, 2014; Stephan & Stephan, 2000). Empirical investigations, however, focus on a range of specific negative expectations (e.g., threats to physical integrity, Mallan, Sax, & Lipp, 2009; threats of rejection, Mendoza-Denton, Pietrzak, & Downey, 2008; threats of uncertainty, Plant & Devine, 2003). To complicate matters, several of these alternative sources of anxiety can co-exist at any given time and contribute to anxiety's net impact on the individual and group (Blascovich, Mendes, Hunter, & Lickel, 2000; Greenland, Xenias, & Maio, 2012).

There is growing evidence that indicates the detrimental effects of intergroup anxiety. Recent experimental research has started to isolate both acute and chronic adverse consequences of intergroup anxiety on health (Mendes, Gray, Mendoza-Denton, Major, & Epel, 2007b; Trawalter, Adam, Chase-Lansdale, & Richeson, 2012). Intergroup anxiety is also associated with increased concerns for the self (Vorauer & Kumhyr, 2001), negative emotions (Crandall & Eshleman, 2003), simplified information processing and reduced attention to disconfirming information (Wilder & Shapiro, 1989), increased dominant responses (Islam & Hewstone, 1993), and decreased task performance (Blascovich et al., 2001, Mendes, Blascovich, Hunter, Lickel, & Jost, 2007a).

The consequences of intergroup anxiety for the individuals and the groups involved in contact are also well documented. High intergroup anxiety is typically associated with negative intergroup judgments, including prejudice (Bizman & Yinon, 2001), low perceived variability (Islam & Hewstone, 1993), overt hostility (Plant & Devine, 2003), and unwillingness to engage in future outgroup contact (i.e., informal group segregation; Greenland, Masser, & Prentice, 2001). Conversely, *reduced* intergroup anxiety explains why intergroup contact typically *improves* intergroup judgments. For instance, investigations of first and second-hand experiences of cross-community friendship in sectarian Northern Ireland predicted and found reduced outgroup prejudice and heterogeneous outgroup perceptions, an effect mediated by sizeable reductions in intergroup anxiety (Paolini, Hewstone, Cairns, & Voci, 2004a).

In 2006, only ten studies were identified by documenting the mediating role of intergroup anxiety for the contact-prejudice link (Paolini, Hewstone, Voci, Harwood, & Cairns, 2006; see also Turner, Hewstone, Voci, Paolini, & Christ, 2007). This number has grown considerably since and now includes longitudinal mediational data (e.g., Binder et al., 2009; Swart, Hewstone, Christ, & Voci, 2011). Recent research has also led to the appreciation of the general nature of these effects: Similar mediational findings have been found for extended (e.g., Turner et al., 2007), vicarious (Mazziotta, Mummendey, & Wright, 2011), and imagined contact (West, Holmes, & Hewstone, 2011). Therefore, it is now generally recognized that virtually *any* positive outgroup interaction—whether face-to-face, imagined, or via conversations with ingroup members—can improve intergroup relations by reducing the anxiety individuals feel, or anticipate feeling, in the presence of the outgroup.

Pettigrew and Tropp (2008) recently conducted a meta-analysis of studies that tested for mediators of the contact-prejudice link to compare the mediating role of decreased anxiety, increased outgroup knowledge, and increased outgroup empathy after contact. While all three mechanisms demonstrated a significant mediating effect and contributed to explaining the contact-prejudice link, intergroup anxiety was found to be the most robust mediator (cf. Swart et al., 2011). Thus, among the various hypothesized psychological underpinnings of intergroup contact effects, reduced intergroup anxiety is prominent and is therefore a legitimate target for social interventions aimed at improving intergroup relations.

More recently, intergroup contact scholars have recognized that intergroup anxiety should be decreased not only to reduce its *direct* negative consequences on intergroup judgments (e.g., prejudice, stereotyping, etc.), but also as a means of containing its *indirect* negative effects on an individual's willingness to engage in further outgroup contact. Currently, experimental and longitudinal evidence now complements established correlational evidence of an anxiety-contact avoidance link (see Greenland et al., 2012; Henderson-King & Nisbett, 1996; Levin, Van Laar, & Sidanius, 2003; Page-Gould, 2012; Page-Gould, Mendoza-Denton & Tropp, 2008; Plant & Butz, 2006; cf. correlational evidence in Paolini et al.'s, 2006 Table 11.1) and demonstrates that intergroup anxiety typically *causes* people to avoid intergroup interactions. Based on functional analyses of emotions, anxiety and other negative affective states appear to signal threats to the safety and integrity of the organism, and as such, they trigger physiological and behavioral responses, the main function of which is to limit further damage and threat. Hence, one of the most common outcomes of these processes is the avoidance of potentially dangerous or threatening stimuli. In intergroup settings, this typically results in the avoidance of contact with outgroup members.

Yet, approach (vs. avoidance) motivators – including individuals' promotion focus, extroversion, motivation to self-expand, egalitarian worldviews etc. – have the potential to significantly attenuate and possibly even revert these adverse effects of intergroup anxiety (Mendes et al., 2007b; Page-Gould, 2012; Wright, Aron, & Tropp, 2002) by encouraging the individual to actively address and approach (vs. avoid) *subjectively positive* intergroup stressors and harness the associated heightened physiological activation towards increased task engagement, improved performance, and beneficial health responses (for initial evidence, see Epel, McEwen, & Ickovics, 1998; Mendes et al., 2007b; Page-Gould, 2012; Page-Gould et al., 2008; Page-Gould, Mendes, & Major, 2010). Hence, among some individuals, and under certain conditions, intergroup contact coupled with acute task demands can lead to beneficial changes in physiology and behavior both in the short term (e.g., preparatory and challenge responses; Mendes et al., 2007b) and long term (e.g., chronic health benefit responses; Page-Gould et al., 2010; Trawalter et al., 2012). Therefore, while contact avoidance following intergroup anxiety may be widespread and a default response for most people, physiological reactivity and anxiety are not always harmful for the individual, the intergroup interaction and, by extension, intergroup relations.

Efforts should focus on increasing knowledge of intergroup anxiety to ensure that intergroup harmony can be achieved and maintained through peaceful intergroup interactions and individuals' wellbeing during ingroup/outgroup interaction protected. This requires a more comprehensive understanding of how intergroup anxiety *develops* in the first place and *changes over time* (aka. anxiety learning), as individuals integrate a range of experiences with the outgroup over their lifespan.

To this aim, research by Blascovich and colleagues (2001) is revisited to show how their results integrate findings from two traditionally independent strands of research on intergroup contact and anxiety. Their paper is also reviewed to demonstrate how they capture two distinct effects of intergroup contact on anxiety, each with their own unique time course. These two effects will become key building blocks of the proposed learning model of intergroup anxiety.

Intergroup Anxiety is Exacerbated in the Present and Reduced in the Long Run: Recognizing Distinct Contact-Anxiety Links

In 2001, Blascovich, Mendes, and colleagues (Blascovich et al., 2001) published very influential research. In this work, non-stigmatized individuals (i.e., healthy White American college students) were asked to become familiar, and interact with, an unknown individual who was either a stigmatized individual (e.g., an individual with a facial birthmark, Black ethnicity, low SES; intergroup condition) or an unfamiliar non-stigmatized individual (i.e., a White/control individual; intragroup condition). After a short face-to-face interaction with their contact partner, participants were asked to deliver a short (anxiety-provoking) video-recorded speech, which they expected to be later reviewed by their contact partner. While delivering their speech, all participants were attached to physiological equipment that recorded changes in cardiac and hemodynamic (blood flow) output.

Across three experiments, intergroup contact participants displayed signs of heightened anxiety, whereas intragroup contact participants did not. Participants paired with a stigmatized partner exhibited cardiovascular reactivity indicative of a threat response, typical of a situation where people expect task demands to outweigh their task resources (Blascovich & Tomaka, 1996), and which usually results in contact avoidance. In contrast, intragroup contact participants exhibited reactivity indicative of a challenge response. A challenge response signals that individuals evaluated their personal resources to be sufficient, or in excess of task demands, a response typically associated with approach behavior. Moreover, the intergroup (vs. intragroup) participants showed poorer performance during a cooperative task (i.e., fewer words found in a word-finding task).

These systematic differences in psychophysiological and behavioral anxiety between the intergroup and intragroup contact participants reflect the *acute* anxiety-*provoking* effects that *discrete* experiences of intergroup contact can exert *in the present* – at least when individuals are engaged in motivated performance tasks like those extensively used in experimental tests of the contact-anxiety link. Hence, as the individual is pressed by a difficult task and/or social evaluation, *intergroup* exchanges typically cause *higher* levels of anxiety than intragroup exchanges.

While Blascovich and colleagues' 2001 article epitomizes a new generation of experimental research on intergroup contact and anxiety, their basic intergroup vs. intragroup effect is not entirely new. Similar evidence was isolated in earlier studies and has been replicated several times since. Table 1 (see footnote 1) summarizes intergroup contact work on physiological and/or behavioral anxiety, which has used an intergroup vs. intragroup contact experimental design, with most studies focusing on ethnicity as the intergroup dimension (however, cf. Townsend, Major, Gangi, & Mendes, 2011).

Table 1 classifies studies by operationalizing intergroup anxiety in four distinguishable ways. First, studies were classified along the tripartite operational definition of anxiety and threat responses (Blascovich et al., 2001; Mendes, Blascovich, Lickel, & Hunter, 2002). Drawing from multifaceted models of generic anxiety and emotions (Lang, 1985; Zajonc, 1998), these scholars discriminate between: (1) *physiological* markers (i.e., autonomic system responses, like sweating and increased heart rate), (2) *behavioral* markers (e.g., non-verbal cues, depleted performance, and contact avoidance), and (3) *subjective* markers (i.e., self-reported responses). Second, each anxiety measure was classified as an individual-level (individual-specific) or group-level (broadly representative of the entire outgroup) measure. Third, the appraisal source of the anxiety measures was classified using Greenland et al.'s (2012) distinction between *outgroup-focused* anxiety (i.e., anxiety resulting from perceived outgroup's threats) and *self-focused* anxiety (i.e., anxiety resulting from concerns over self and ingroup standards). Finally, measures were coded for whether they were continuous or discrete.

Irrespective of how anxiety is operationalized, the extant experimental work reveals convergent evidence for reliable differences in anxiety between intergroup and intragroup contact conditions. Critically, these differences are *always* in the direction of high*er* anxiety in the intergroup (vs. intragroup) contact condition (however, see Mendes & Koslov, 2012). Hence, it is evident that in the vast majority of experimental tests, discrete interactions with outgroup members cause an increase in anxiety levels—i.e., a positive and excitatory link between intergroup contact and anxiety.

Since anxiety is an aversive emotion, it typically has a negative impact on health and performance, acts as an avoidance motive for intergroup contact, and has detrimental effects on intergroup judgments. In other words, the outcome of discrete experiences of intergroup contact—*at least in the short term*—is detrimental for both the individuals immediately involved and the intergroup relations in which these individuals are embedded.

Curiously, while the immediate, often adverse effects of intergroup anxiety on health and performance have begun to be acknowledged in the literature (e.g., Mendes et al., 2007b; Trawalter et al., 2012; see earlier section), this is not the case for the short-term detrimental effects of intergroup contact on intergroup judgments, group-level variables, and intergroup relations more broadly. Thus, despite the straightforward negative *implications* of intergroup-intragroup differences in anxiety for intergroup relations, most current experimental tests of the contact-anxiety link have not tested these implications directly. Of 60 studies identified (Table 1), only seven (11.67%) included group-level variables—like measures of outgroup prejudice, outgroup

Table 1

Intergroup contact studies that have experimentally investigated physiological and behavioral forms of intergroup vs. intragroup anxiety

Study	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type and Anxiety Source*	Direction of Intergroup (vs.Intragroup) Effect**
Amodio (2009)	White American students interacting with a White or Black individual	A study about social attitudes	Physiological: Cortisol (I) Behavioral: Weapons Identification Task (G) Subjective: State Affect Checklist (S)	Physiological: Null effect Behavioral: Black-faced primes speeded responses to handguns compared to tools Subjective: Higher in intergroup
Amodio & Hamilton (2012)	White American female students interacting with a White or Black female partner	Discussing their views about social issues	Behavioral: IAT (G) Subjective: State Affect Checklist (S)	Behavioral: Unpleasant words categorized more accurately than pleasant words in the context of Black faces, whereas pleasant words categorized more accurately than unpleasant words in the context of White faces Subjective: Higher in intergroup
Blascovich, Mendes, Hunter, Lickel & Kowai-Bell (2001, Study 1)	American female students interacting with an individual with or without a birthmark	Study on “interpersonal styles and working together”.	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C)	Physiological: Increased cardiovascular threat
Blascovich, Mendes, Hunter, Lickel & Kowai-Bell (2001, Study 2)	American female students interacting with an individual with or without a birthmark	Study on “interpersonal styles and working together”.	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (I)	Physiological: Increased cardiovascular threat Behavioral: Depleted task performance via less words generated

Study	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type and Anxiety Source*	Direction of Intergroup (vs.Intragroup) Effect**
Blascovich, Mendes, Hunter, Lickel & Kowai-Bell (2001, Study 3)	Non-black American female students interacting with a White or Black individual of high or low SES	Study on “interpersonal styles and working together”.	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (I)	Physiological: Increased cardiovascular threat Behavioral: Depleted task performance via less words generated
Brown, Bradley & Lang (2006)	African American or European American students viewing African American or European American faces	Not provided	Physiological: Skin Conductance and Electromyogram (I, C) Behavioral: Viewing time (I, C)	Physiological: European American participants had larger skin conductance responses when viewing White faces; For the Electromyogram, African American participants had larger corrugator responses when viewing unpleasant Back faces than unpleasant white faces; Behavioral: Participants viewed pleasant pictures of their ingroup for longer than pleasant pictures of their outgroup

Study	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type and Anxiety Source*	Direction of Intergroup (vs.Intragroup) Effect**
Gray, Mendes & Denny-Brown (2008)	White or Black Americans interacting with a White or Black interviewer	Not provided	Physiological: Cortisol (I) Subjective: Research assistants rated participant's level of anxiety via a silent videotaped recording (O)	Physiological: Observer ratings of anxiety predicted cortisol changes; Same-race research assistants positively predicted cortisol increases whereas different race research assistants negatively predicted cortisol increases Subjective: Same-race research assistants rated participants as more anxious when engaging with an outgroup interviewer; No difference when the research assistant was of a different race to the participant.
Littleford, Wright & Sayoc-Parial (2005)	White, Black and Asian American students interacting with White, Black or Asian individuals	A study on the effect of interracial interaction on health and attitudes	Physiological: Blood Pressure (I, C) Subjective: Self-reported anxiety (CLQ) (G)	Physiological: Increased blood pressure Subjective: Higher in intergroup
Mallan, Sax & Lipp (2009)	Caucasian Australians viewing White or Asian faces	Not provided	Physiological: Skin Conductance and Startle Blink (I, C)	Physiological: Resistance to extinction (i.e., lack of reduction in anxiety)
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 2)	American male students interacting with a Male White or Latino partner of high or low SES	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: Increased cardiovascular threat Behavioral: Least amount of words found if paired with Latino high SES partner than all other conditions. Most words found if paired with White high SES partner

Study	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type and Anxiety Source*	Direction of Intergroup (vs.Intragroup) Effect**
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 3)	American female students interacting with a White or Asian Female partner, who had a Southern or regional accent	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Behavior coding (Affirmations and body language of participant) (O); Word-finding task (I)	Physiological: Increased cardiovascular threat Behavioral: Fewer affirmations and positive body language, as well as least amount of words found if paired with Asian Southern Accent partner than all other conditions. Most affirmations, positive body language and words found if paired with White Regional Accent partner
Mendes, Blascovich, Lickel & Hunter (2002)	Non-black American male students interacting with a White or Black individual	A study on interpersonal styles and working together	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: Increased cardiovascular threat Behavioral: Depleted task performance via less words generated
Mendes & Koslov (2012, Study 1a)	White and Black American students interacting with a White or Black female	A study on physiological responses during laboratory tasks	Behavioral: Behavior coding (smiles, nodding, laughing, positive statements) by research assistants of participant interaction with confederate (O)	Behavioral: White participants smiled, laughed and nodded more frequently when interacting with an outgroup member

Study	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type and Anxiety Source*	Direction of Intergroup (vs.Intragroup) Effect**
Mendes & Koslov (2012, Study 1b)	Female American students interacting with an individual with or without a birthmark	A study on getting to know each other	Physiological: Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Behavior coding (smiles, nodding, laughing, positive statements) by research assistants of participant interaction with confederate (O)	Physiological: Participants interacting with a stigmatized partner displayed a positive relationship between smiling frequency and physiological threat whereas those interacting with a non-stigmatized partner displayed a negative relationship between smiling frequency and threat Behavioral: Participants smiled more frequently when interacting with a stigmatized partner
Navarrete, McDonald, Asher, Kerr, Yokota, Olsson & Sidanius (2012)	White and non-white American students viewing white faces with different colored t-shirts	Not provided	Physiological: Skin Conductance (I, C)	Physiological: Higher levels of skin conductance to outgroup members relative to ingroup members following conditioning task
Navarrete, Olsson, Ho, Mendes, Thomsen & Sidanius (2009)	White and Black Americans viewing white faces with different colored t-shirts	A study that explores the mind-body connection in response to social groups	Physiological: Skin Conductance (I, C) Behavioral: IAT (G) Subjective: Explicit Race Bias (Attitudes Towards Blacks scale) (G)	Physiological: Resistance to extinction (i.e., lack of reduction in anxiety) Behavioral: Not reported Subjective: Not reported

Study	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type and Anxiety Source*	Direction of Intergroup (vs.Intragroup) Effect**
Olsson, Ebert, Banaji & Phelps (2005, Study 2)	White and Black Americans viewing White and Black faces	Not provided	Physiological: Skin Conductance (I, C) Behavioral: IAT (G)	Physiological: Resistance to extinction (i.e., lack of reduction in anxiety) Behavioral: White participants displayed negative stereotypes with Black Americans, whereas Black participants displayed no outgroup bias
Plant & Butz (2006, Study 1a)	Non-black American psychology students interacting with a Black or White partner	A study examining interracial interactions	Behavioral: Automatic attitudes (modelled after Fazio, Jackson, Dunton & Williams, 1995) (G) Subjective: Self-reported anxiety (Anxiety scale) (I)	Behavioral: Null finding Subjective: Higher in intergroup
Porier & Lott (1967)	White American males interacting with White and Black experimenters	Not provided	Physiological: Skin Conductance (I, C)	Physiological: Null effect
Rankin & Campbell (1955)	White American male students interacting with White and Black experimenters	Not provided	Physiological: Skin Conductance (I, C)	Physiological: Increased skin conductance responses
Townsend, Major, Gangi & Mendes (2011; Study 1)	European females interacting with Male interviewer, competing for position with either Male or Female	A study measuring the body's stress response during interview situations	Physiological: Cortisol (I) Subjective: Self-reported anxiety (Brief Symptoms Inventory; how often participant experienced anxiety symptoms) (S)	Physiological: Increased cortisol levels Subjective: Null effect
Trawalter, Adam, Chase-Lansdale & Richeson (2012, Study 1)	White American students viewing White and Black faces	Study on the physiology of social behavior during an interaction	Physiological: Cortisol (I)	Physiological: Increased cortisol levels

Study	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type and Anxiety Source*	Direction of Intergroup (vs.Intragroup) Effect**
Vanman, Paul, Ito & Miller (1997, Study 1)	White, non-Hispanic American students interacting with White and Black individuals	Not provided	Physiological: Electromyogram (I, C)	Physiological: EMG showed more positive facial affect for White, relative to Black, contact partners
Vanman, Paul, Ito & Miller (1997, Study 2)	White, non-Hispanic American students interacting with White and Black individuals	Not provided	Physiological: Electromyogram (I, C)	Physiological: EMG showed more positive facial affect for White, relative to Black, contact partners
Vrana & Rollock (1998)	Black and White American students interacting with White or Black partners	A study on the psychophysiology of emotional imagery	Physiological: Heart rate, Skin Conductance, and Electromyogram (I, C)	Physiological: Increased heart rate when interacting with an outgroup partner; Null for skin conductance; EMG displayed greater zygomaticus activity when interacting with an outgroup partner

Note. * For anxiety type, this table used Blascovich, Mendes and colleagues' tripartite definition of physiological, behavioral and subjective anxiety (Blascovich et al., 2001; Mendes et al., 2002). For anxiety source, this table used Greenland et al.'s (2012) distinction of anxiety appraisal sources. ** Unless otherwise indicated, effects are in the direction of anxiety being higher in the intergroup than intragroup condition. I = indicates individual level variable (episodic anxiety relevant to a specific individual outgroup member/s). G = indicates group level variable (chronic anxiety relevant to entire outgroup). O = indicates anxiety stemming from other individual(s). S = indicates anxiety stemming from participant self-reflecting on own anxiety; C = Continuous measure of anxiety (measure is not a one-off measurement but is rather collected continuously throughout the task; by exclusion all other measurements are discrete in nature).

stereotyping, outgroup trust etc.—as outcome variables (see footnote 2). Hence, these studies do not help ascertain whether laboratory intergroup interactions, besides heightening the contact partners' anxiety, also increase prejudice, stereotyping, and discrimination towards the entire outgroup and, thus, adversely impact the quality of intergroup relations more broadly.

The lack of experimental tests on group-level measures limits researchers' awareness that intergroup contact may have vastly different short-term vs. long-term effects. Any dissociations over time need to be investigated empirically and explained theoretically. As a result, this gap slows the development of a model that makes integrated predictions for both individual-level and group-level effects of intergroup contact over time, as well as their possible interactions.

Intergroup contact does not necessarily result in high intergroup anxiety, however: Blascovich et al. (2001) captured distinct short vs. long-term effects of intergroup contact on intergroup anxiety. In a third experiment, White/control individuals (i.e., non-stigmatized) interacted with a Black (intergroup) or White (intragroup) contact partner. The *overall amount* of close intergroup contact participants reported having had with Black people in general *prior* to coming to the laboratory moderated their physiological responses. Specifically, prior contact did not moderate physiological responses for intragroup contact participants. Threat responses among the intergroup contact participants were higher among those who reported having had *limited* prior contact with the outgroup; they were significantly weaker (and non-significant on some indicators) among those who had had *more* prior close contact. The findings with respect to moderation effects map closely onto extensive cross-sectional correlational research on anxiety and contact (see research listed in Table 11.1 of Paolini et al., 2006). In mainstream traditional correlational research, participants' prior *histories* (vs. discrete experiences) of contact with the outgroup typically ensue beneficial and *not* detrimental effects on intergroup anxiety (e.g., Paolini et al., 2004a; Paolini, Hewstone & Cairns, 2007; Pettigrew & Tropp, 2008). Hence, this research tradition returns an extensive body of evidence for a negative and inhibitory link between intergroup contact and anxiety.

Blascovich et al.'s (2001) approach was ground-breaking since it isolated in a single design immediate and acute anxiety-inducing effect of discrete contact experiences and the potentially slower anxiety-reducing effects of accumulated prior intergroup contact. That is, by randomly allocating participants to an intergroup-intragroup between-group design, and then showing that accumulated contact protected participants against acute or episodic anxiety experienced during a discrete contact experience, Blascovich and colleagues demonstrated that the immediate anxiety-provoking effects of discrete intergroup contact, once integrated over time through repeated and accumulated contact, produce a long-term beneficial anxiety-reducing effect.

This temporal integration between short-term and long-term effects of intergroup contact on anxiety is displayed in Figure 1. The diagram illustrates Blascovich et al.'s (2001) moderating effect of prior, accumulated contact as two group means along the episodic anxiety y-axis, for 'Low contact' and 'High contact', in the bottom panel. The diagram shows that this effect is the same beneficial effect of intergroup contact as captured in past correlational research, and as displayed by the inclined slope for the relationship between intergroup contact and chronic anxiety in the diagram's top panel. Also, while correlational studies typically do *not* include an intragroup/control condition, a dashed line was used in the diagram's top panel to indicate a hypothetical correlational data set showing no relationship (or a zero-slope)

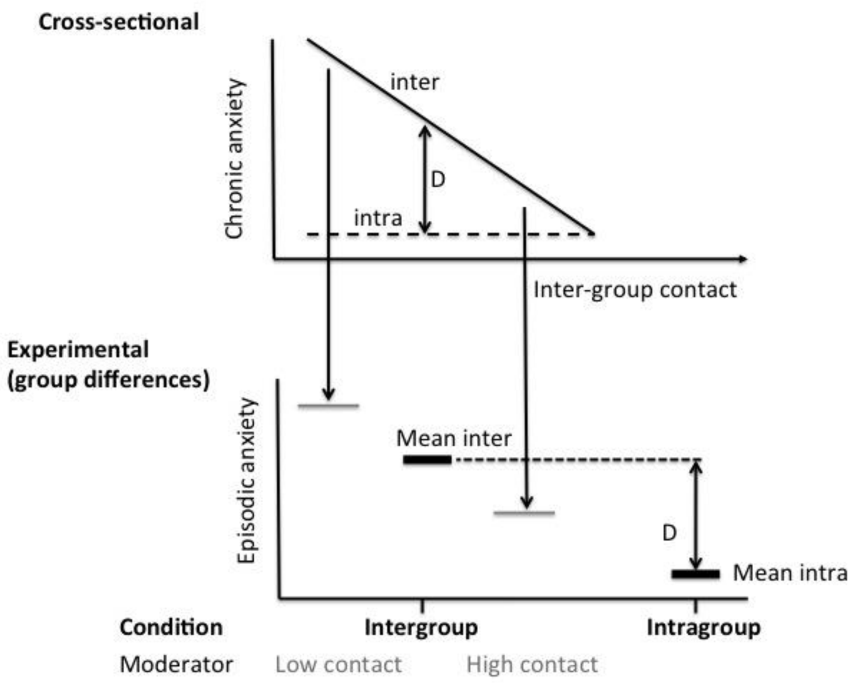

Figure 1. Explanatory diagram illustrating how Blascovich et al.'s (2001) ground-breaking design isolated simultaneously two distinct contact effects on anxiety traditionally investigated in separate research traditions by incorporating both an intragroup-intergroup between-group condition (intragroup/intergroup in the bottom panel) and a prior contact measured moderator (low contact/high contact moderator in the bottom panel).

between *inter*-group contact and *intra*-group anxiety. Thus, the graph identifies two equivalent inter/intra-group differences in anxiety (the 'D' in each of the top and bottom panels) in the two research traditions (see footnote 3) and unveils similarities between the findings of different research traditions otherwise masked by systematic differences in research designs.

From this vantage point, the two *prima facie* contradictory contact-anxiety effects detected by Blascovich et al. (2001) and by distinct research traditions are no longer at odds with each other; rather they fit together nicely in a temporally integrated outlook of intergroup contact experiences over time. However, it should be acknowledged that these distinct contact-anxiety effects can also be explained by invoking factors and processes other than temporal integration (see footnote 4).

Among the many factors that differentiate the methods in the experimental vs. correlational research traditions (Paolini et al., 2006), three stand out as suitable -- alternative but complementary -- explanations of distinct contact-anxiety effects: (i) contact valence, (ii) the on-line/memory-basis of the interaction, and (iii) individuals' motivational goals. In vivo interactions between the contact partners in most experimental tests are skewed towards negativity. These interactions are objectively more negative than positive, since the participants' primary task is to complete difficult cognitive-behavioral tasks under expected or actual social evaluation rather than enjoying the contact partner's company (see Blascovich & Mendes, 2010; Dickerson & Kemeny, 2004 for methodological foundations). This negativity bias may be further amplified by attentional and encoding biases towards negative (vs. positive) aspects of the interaction and contact partner during on-line processing (Baumeister et al., 2001).

In contrast, correlational studies are biased towards sampling more positive interactions (Graf, Paolini, & Rubin, 2014; Paolini, Harwood, & Rubin, 2010; Pettigrew, 2008), where researchers typically probe retrospective self-reports of past interactions with outgroup members, as they took place in the field or in structured prejudice-reduction settings (Pettigrew & Tropp, 2006). Thus, they recruit a more variable and positive range of motivational states and valences (Graf et al., 2014; Paolini et al., 2010); this potential positivity bias may be further amplified by retrieval processes that favor positive (vs. negative) contact experiences (Graf et al., 2014; Unkelbach, Fiedler, Bayer, Stegmuller, & Danner, 2008). Hence, experimental studies return positive contact-anxiety effects because they disproportionately focus on on-line negative contact experiences; whereas correlational studies return negative contact-anxiety effects because they focus on retrieved positive contact experiences.

From a theoretical perspective, however, these positive and negative contact-anxiety links are more than the mere byproduct of differences in negative and positive contact. They are the constituent building blocks of a novel model of anxiety learning in intergroup contact that temporally integrates contact effects on anxiety over the individual's lifespan.

The next section first outlines a broad learning meta-theoretical framework to intergroup contact effects, against which the proposed learning model of anxiety is anchored. The former is referred to as a 'meta-theory' and the latter a 'model' purposely, to stress the marked differences in breadth and supporting evidence: The former is a broad, overarching, testable, but as yet untested, theory; the latter is more narrow, and more precise in its predictions, and already enjoys supporting evidence.

A Learning Outlook to Intergroup Contact Effects

To discuss intergroup contact in a temporally integrated framework, intergroup contact is conceptualized as the process by which we learn about the outgroup. During intergroup contact, individuals acquire new knowledge about the outgroup and its members, and then learn about modal affective responses, emotions, and evaluations typically associated with the outgroup. As a consequence, responses towards the outgroup may change, for better or worse, over time – through a learning process. With relation to anxiety, intergroup contact offers the opportunity to learn to be anxious towards the outgroup, but also to revise those anxieties. It is these changes in outgroup anxiety over time that are operationally defined as 'anxiety learning'.

Organizing Principles of Inductive and Deductive Learning

Five organizing principles can be used to describe the time course of affective, evaluative, and cognitive processes during ingroup/outgroup interactions: (1) contact experiences are discrete learning experiences with individual outgroup members and about specific ingroup/outgroup interactions, which influence the cognitions, affect, emotions and evaluations associated with specific outgroup members and ingroup/outgroup interactions, and result in episodic or individual-level responses; (2) episodic/individual-level cognitions, affect, emotions, and evaluations form the basis of relatively context-free and time-free cognitive, affective, emotional, and evaluative responses towards, and expectations of, the outgroup as a whole and ingroup/outgroup interactions in general—what will be called chronic, or group-level responses; (3) chronic/group-level responses shape, in turn, episodic/individual-level responses; that is, expectations about the outgroup as a whole and ingroup/outgroup interactions in general, affect responses to specific outgroup members and ingroup/outgroup interactions; (4) this feedback effect linking episodic/individual-level responses to chronic/group-level responses [inductive learning or individual-to-group generalization], and feed-forward effect linking chronic/group level responses to episodic/individual-level responses [deductive learning or group-to-individual generalization], form a dynamic loop that is repeated continually as experience with the outgroup accumulates throughout one’s lifetime; (5) both episodic/individual-level and chronic/group-level responses to the outgroup change over the lifespan through reciprocal interaction, and the accumulation of repeated and diverse episodic contact experiences, reflecting individuals’ unique histories and intergroup contexts’ unique ecologies.

The distinction between episodic/individual-level and chronic/group-level responses was introduced in an earlier paper (Paolini et al., 2006; see also Page-Gould et al., 2008; Paolini, 2008). Here, this idea is extended further to encompass affect, emotions, cognitions, and evaluations. Consequently, labels *episodic* and *individual-level* variables are used interchangeably to refer to state and context specific variables tapping into affective, emotive, cognitive, and evaluative responses to *specific* outgroup members in *specific* ingroup/outgroup interactions (e.g., episodic intergroup anxiety coded as 'I' in Table 1). The labels *'chronic'* and 'group-level' variables are used to refer to more enduring, trait-like and relatively context-free variables, tapping onto affective, emotive, cognitive, evaluative responses to the outgroup as a whole and their members more generally and measured *without* reference to a specific intergroup encounter (e.g., chronic intergroup anxiety coded as 'G' in Table 1).

Principles (2) and (3) posit explicit links between episodic/individual-level responses and chronic/group-level responses. These links are suggested as being underpinned by two distinct forms of generalization relevant to intergroup contact experiences, namely inductive and deductive learning. In social psychology, inductive learning is often called individual-to-group (Brown & Hewstone, 2005) or member-to-group generalization (Paolini, Hewstone, Rubin, & Pay, 2004b; Stark, Flache, & Veenstra, 2013). Generalization of cognitions are typically the domain of stereotype change researchers (e.g., McIntyre, Paolini, & Hewstone, 2015; Paolini et al., 2004b). Intergroup contact researchers have traditionally focused on generalization of evaluations and global affect (for a discussion, Pettigrew & Tropp, 2011; Stark et al., 2013), but recently started to consider generalization of specific emotions (e.g., empathy, anxiety; Paolini et al, 2006; Paolini et al., 2010; Stephan, 2014). Similarly, deductive learning, going from chronic/group-level responses to episodic/individual-level responses, will be referred to as group-to-member or group-to-individual generalization (Wilder & Shapiro, 1991), which also potentially take place at the level of evaluations, specific emotions, cognitions and affect.

A Model of Anxiety Learning in Interactions with the Outgroup

When applied to intergroup anxiety, the five organizing principles described above take the shape of the model depicted in Figure 2. Central to the time-integrated model of anxiety learning, Figure 2 illustrates the temporal integration of chronic and episodic anxiety including the inductive feed-back and the deductive feed-forward links. Figure 2 also illustrates how episodic anxiety is generated by a specific, discrete experience of contact ('episodic contact') with outgroup members. In contrast, chronic anxiety takes its source in individuals' cumulative past history of contact with the outgroup (or simply, cumulative contact or 'CC' in Figure 2).

Critically, it will not simply be argued that episodic/individual-level processes and chronic/group-level processes should both be taken into consideration and measured. Rather, this anxiety learning model explains how episodic/individual-level processes and chronic/group-level processes *interact* to determine individuals' net anxiety responses: It enables us in to advance specific predictions for these interactions, identifying emerging evidence relevant to testing these predictions, and understanding where further research is needed. Figure 2 illustrates some of this emerging complexity (see next section). For example, it demonstrates how chronic anxiety and outgroup prejudice moderate inductive and deductive learning links, respectively.

There are several key differences between the proposed anxiety learning model and Blascovich and Tomaka's (1996) biopsychosocial model (BPSM) of challenge and threat. Firstly, the BPSM focuses most heavily on acute/episodic anxiety responses (i.e.,

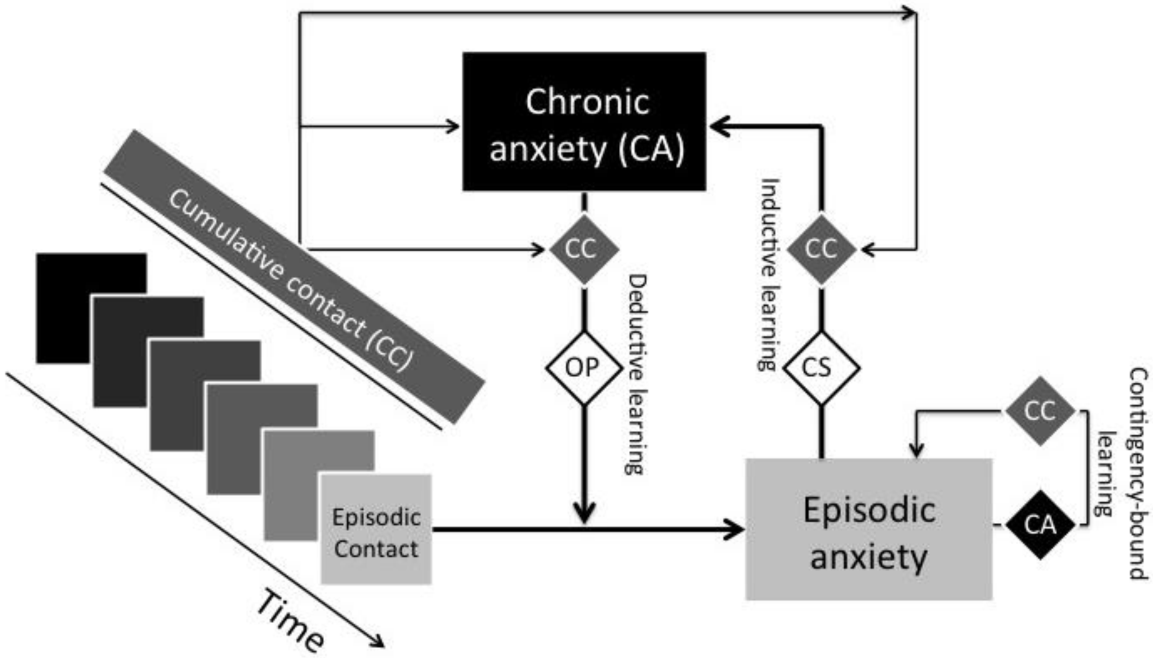

Figure 2. Diagram depicting the time-integrated model of anxiety learning. Diamonds depict moderation effects. Episodic contact causes episodic anxiety (link from 'episodic contact' to 'episodic anxiety'), as well as changes in those anxieties (loop indicating 'contingency-bound (anxiety) learning'). Passage of time from distant past to present is encoded using gradually lighter shades of black to grey. Past contact experiences accumulate over an individual's lifetime to form a repertoire of cumulative contact (CC; medium grey), which underpins chronic anxiety (CA), but also moderates deductive (feed-forward, group-to-individual generalization) and inductive (feed-back, individual-to-group generalization) learning links between chronic and episodic anxiety. Outgroup prejudice (OP) moderates deductive learning and category salience (CS) moderates inductive learning, while cumulative contact and chronic anxiety both moderate contingency-bound (anxiety) learning (see text for more details). The effects of contact valence are discussed extensively in the text, but are not depicted diagrammatically for the sake of clarity.

episodic contact-anxiety links), whereas the proposed anxiety learning model incorporates the impact that cumulative experiences of contact with the outgroup possibly exert on chronic and episodic anxiety responses (i.e., cumulative contact-anxiety links). Hence, even though the BPSM can be made to incorporate the effects of chronic anxiety responses by considering cumulative intergroup contact experiences as one of the resources individuals bring to episodic encounters, the BPSM's analysis of task demands is heavily weighted (but not exclusively generated) by episodic (i.e., task-specific) resources.

In contrast, the proposed learning model of intergroup anxiety advocates more explicitly the dynamic interaction between, and delves more deeply into, episodic *and* chronic experiences interacting over time. As such, it frames the acute anxiety responses of the BPSM in a more complex manner, which includes both acute *and* chronic anxiety and their interaction over time. Consequently, the proposed model is unique in explicitly addressing processes of generalization, linking episodic anxiety responses to more chronic, generalized anxiety responses, and in highlighting potential mechanisms and moderators of these processes. Thus, the proposed model brings to the forefront the mutual dynamic interplay of both acute and chronic anxiety responses over time.

This temporally dynamic outlook to intergroup anxiety raises potential complexities and dissociations that are difficult to conceive from more static outlooks of intergroup anxiety and contact. The next section clarifies how the proposed learning model of anxiety is consistent with emerging psychophysiological and behavioral evidence for the contact-anxiety link.

The Interplay Between Episodic and Chronic Intergroup Anxiety: Emerging Evidence and Directions for Future Research

Traditional research on anxiety in intergroup contact has failed to appreciate the complex and time-dependent interplay between episodic and chronic anxiety as individuals' experiences with outgroups accumulate over the lifespan (Paolini, 2008; Paolini et al., 2006). However, since Blascovich and colleagues' (2001) ground-breaking work, time-bound analyses of intergroup anxiety and stress have started to thrive. Advancements in unobtrusive, on-line, psychophysiological measurements of anxiety have revolutionized our understanding of episodic anxiety—including skin conductance responses, heart reactivity, cortisol release, etc. (see Guglielmi, 1999). Moreover, a growing use of time-sensitive research paradigms—including conditioning paradigms, cortisol release monitoring, and diary methods—make it possible to explore the processes that bridge episodic and chronic anxiety and their dynamic interplay.

In this section these emerging research outcomes are dissected using the proposed model of anxiety learning. This section starts by discussing the limited research on anxiety learning (i.e., Figure 2's link from 'episodic contact' to 'episodic anxiety', and the contingency-bound learning loop) and inductive anxiety learning (i.e., Figure 2's link from 'episodic anxiety to 'chronic anxiety'), and then moves onto more extensive work on deductive anxiety learning (i.e., Figure 2's link from 'chronic anxiety to 'episodic anxiety') and its key moderators (see diamonds on that link). Throughout the section, untested predictions and ideas for new research are proposed.

Initial Evidence for Intergroup Anxiety Learning

The strong emphasis on remedial intergroup interventions in social psychology has, to date, unduly constrained the scope of intergroup contact research to investigations on intergroup anxiety *reductions* (e.g. Paolini et al., 2004a, 2007; Turner et al., 2007). However, in order to gain a more complete understanding of the dynamic interplay between episodic and chronic anxiety, researchers cannot avoid investigating the conditions under which anxiety both *increases*, and *decreases*.

Olsson and colleagues (Olsson, Ebert, Banaji, & Phelps, 2005) have recently broken with the tradition of studying anxiety reductions. They used an aversive conditioning procedure to examine the stimulus-specific acquisition and extinction of intergroup anxiety ('contingency-bound learning' in Figure 2; see footnote 5). They presented White and Black participants with two White and two Black faces and repeatedly paired one of each with a mild electric shock, and another of each with no shock. Following aversive conditioning, participants were subject to an extinction procedure: faces were presented repeatedly without any shocks. Results revealed that participants acquired anxiety responses towards the ingroup and outgroup faces that were paired with shock, relative to the faces not paired with shock; however, learnt anxiety responses towards the outgroup (vs. ingroup) extinguished more slowly. Olsson et al. (2005) interpreted their findings within an evolutionary framework of learning preparedness, whereby outgroups constitute evolutionarily fear-relevant stimuli that are more strongly associated with fear, like spiders and snakes (Öhman & Mineka, 2001). From a learning perspective, these findings demonstrate that Pavlovian conditioning contributes to the first-hand learning of outgroup anxiety. They also suggest that the *dis*association from anxiety takes longer for outgroups relative to ingroups.

This thesis will attempt to extend Olsson et al.'s (2005) analysis to incorporate the acquisition of anxiety towards outgroups, i.e., second-hand learning (Harris, Griffin, & Paolini, 2015a; Harris, Paolini, & Griffin, 2015b; Chapter 2 and 3). Similar to Olsson et al., White Australian participants learnt to respond anxiously to the outgroup by experiencing pairings of a Black face and a mild electrical stimulation (i.e., 'first-hand' contingency-bound learning). In a second experimental condition, participants watched a video of a White individual receiving face-shock pairings and appearing to be uncomfortable when one Black face was presented, and relaxed when a different Black face appeared (i.e., 'second-hand' contingency-bound learning). These studies and their findings will be discussed in more detail in Chapters 2 and 3.

This behavioral evidence for the direct and observational anxiety learning in the intergroup domain is in line with recent neurophysiological and imaging data suggesting an overlap in the neural circuits involved in direct and vicarious fear learning (Olsson, Nearing & Phelps, 2007). This evidence suggests that people who indirectly witness positive ingroup/outgroup interactions are also able to learn to feel comfortable and respond positively to outgroups (Mazziotta et al., 2011; Paolini et al., 2004a, 2007; Turner et al., 2007; Wright, Aron, McLaughlin-Volpe, & Ropp, 1997). The same mechanisms of observational and vicarious learning are also involved when experiencing negative intergroup interactions (Weisbuch, Pauker, & Ambady, 2009), which helps explain how people become anxious and learn to respond negatively to outgroups in the first place.

Initial Evidence for Inductive Anxiety Learning

It will be demonstrated that the empirical research contained within this thesis on the observational learning of outgroup anxiety has also contributed to understanding the processes that underpin inductive anxiety learning or individual-to-group generalization (Harris et al., 2015b; Chapter 3)—the link going from 'episodic anxiety' to 'chronic anxiety' in Figure 2. How episodic anxiety generalizes from outgroup members directly involved in the aversive contact experience (e.g., paired with the shock) to outgroup members not directly involved will be explored. For this, face morphing software was used to generate progressively less outgroup-like variations of the target faces, as well as new faces of comparable “Black-ness”. Chapter 3 will discuss research that investigates whether episodic anxiety can generalize along a similarity-dissimilarity gradient. More specifically, this thesis will demonstrate whether, and to what extent, intergroup anxiety generalizes to Black faces that were configurally most similar (vs. dissimilar) to the target Black faces.

Importantly, the influence that social and intergroup dimensions of the observational learning experience play in the amplitude of these generalization effects will be explored. The generalization effects among individuals from an ethnic minority (Asian Australians vs. White Australians) and the effect of learning to become anxious from a majority group member (White vs. Asian model) will be explored in Chapter 3. Moreover, the mediating effects of perceived model believability and self-model similarity will be investigated, with the aim of confirming the need to embed any test of *intergroup* anxiety learning into the social and intergroup context within which these phenomena take place (Chapter 3).

A sophisticated understanding of the processes conducive to generalization is essential to managing intergroup relations; psychophysiological and behavioral research is scant in this area and more work is needed. Because of individual-to-group and group-to-individual generalization (i.e., inductive and deductive learning), discrete negative and positive experiences with the outgroup have far-reaching consequences on future intergroup interactions and relations. Similarly, because of these generalization processes, positive intergroup contact is a legitimate intervention tool to improve intergroup experiences, as well as responses of individuals and entire groups (Brown & Hewstone, 2005; Pettigrew & Tropp, 2006, 2011). Without generalizations, interventions designed to foster positive intergroup contact are limited to specific contact experiences with specific outgroup members. Any improvements in response to whole outgroups cannot transfer back to other individual outgroup members and future ingroup/outgroup interactions. Clearly, more research is needed in this area.

Possible moderation by category salience. Tests of moderation provide a way to improve our understanding of generalization of anxiety. There are important lessons to be learnt from existing evidence. Positive generalized changes in chronic/group-level evaluations and cognitions can be achieved after contact (Pettigrew & Tropp, 2006, 2011), facilitated by positive contact and high category salience, or awareness of the ingroup/outgroup category distinction (for a review, Brown & Hewstone, 2005). Therefore, consistent with classic cognitive analyses of generalization (Rothbart & John, 1985; Rothbart, Sriram, & Davis-Stitt, 1996), for successful individual-to-group generalization, the contact partners must see themselves as representatives or typical of their group, and the contact experience as an ‘intergroup’ (vs. interpersonal) interaction.

Whereas the above research dealt with generalization of evaluations and cognitions, category salience may play a similar moderating role in inductive learning of emotions, and, in particular, of anxiety (see CS diamond on the link from episodic anxiety to chronic anxiety in Figure 2). This was an idea contemplated by Eliot Smith (1993):

> Suppose almost every encounter with a group member leads to similar emotions and that *the ingroup/outgroup distinction is so salient* that the outgroup is viewed as quite homogeneous (…). Then the perceiver would end up reacting in the same way to just about any outgroup member (Smith, 1993, p. 305; emphasis added).

During the review process, initial evidence was found that supported Smith’s contention (see Paolini et al., 2006). Individuals that were more aware of their group memberships during intergroup contact displayed larger anxiety reductions after individual (Harwood, Hewstone, Paolini, & Voci, 2005, Study 2), or repeated, positive contact experiences with individual outgroup members (Voci & Hewstone, 2003a, 2003b). Conversely, those who were less aware of their group membership during contact exhibited poor (Harwood et al., 2005, Study 2; Voci & Hewstone, 2003a, Study 1) or no anxiety-reductions after contact (Voci & Hewstone, 2003a, Study 2; Voci & Hewstone, 2003b, Study 1). Hence, preliminary evidence suggests that category salience is a catalyst for anxiety reductions following positive contact.

Evidence suggests that category salience may play a stronger moderating role in anxiety *increases* (vs. decreases) after negative contact experiences. Recent research has indicated that category salience is higher when contact goes badly (Paolini et al., 2010; 2014). The implications of these valence-salience effects are poignant as they suggest that generalizations of negative consequences after negative contact may be comparably larger and more robust than generalizations of positive consequences after positive contact. Contact data confirming that asymmetries in generalization may occur for evaluations has recently been published (Barlow et al., 2012; Graf et al., 2014; however, cf. Stark et al., 2013). Future research should investigate whether these also hold for intergroup anxiety.

Evidence of Deductive Anxiety Learning

While research on the mechanisms of contingency-bound anxiety learning and inductive anxiety learning is still limited, evidence of deductive anxiety learning—i.e., group-to-individual generalization—is growing faster (see Table 2). In Figure 2, deductive learning is represented by connecting chronic anxiety (‘CA’) to the episodic contact-episodic anxiety link; depicted in this way, chronic anxiety moderates anxiety produced by episodic contact. In addition, several chronic or group level moderator variables are superimposed on the deductive learning link (see diamonds on deductive learning link in Figure 2) to show that these may moderate deductive learning, and hence the anxiety produced by episodic contact. Finally, chronic anxiety might moderate changes in anxiety as a consequence of the contact experience, as depicted by the diamond on the contingency-bound learning link in Figure 2.

Moderation by chronic anxiety. Based on the proposed organizing principles and learning model of anxiety, chronic/group-level anxiety should moderate (1) episodic/individual-level anxiety and (2) contingency-bound anxiety learning (Fig. 2) (see also Page-Gould et al., 2008). Consistent with the first prediction, Ofan, Rubin, and Amodio (2013) found that individuals' chronic social anxiety and situationally-induced intergroup anxiety moderated participants' attendance to interethnic differences. This has been identified as a key cognitive precursor of intergroup threat responses, as measured by the N170 component of brain event related potentials. A difference in N170 between White and Black faces appeared only among those high (vs. low) in dispositional social anxiety being monitored by the experimenter "for signs of prejudice" (a 'public' or 'audience' condition).

This prediction will be tested within Chapter 2. Specifically, the suggestion that chronic intergroup anxiety moderates stimulus specific *increases* in episodic anxiety (i.e., anxiety learning) following direct and observational aversive conditioning of interethnic anxiety will be investigated (Harris et al., 2015a; Chapter 2). This thesis will also investigate White Australians' chronic anxiety towards Black people *in general* (i.e., chronic anxiety) and test whether this moderates the acquisition of intergroup

Table 2

Intergroup contact studies that have experimentally investigated physiological and behavioral forms of intergroup anxiety and tested for moderation

Study	Moderator Category	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type* and Target of Anxiety (Individual vs. Group)	Moderation Effect**
Mendes, Gray, Mendoza-Denton, Major & Epel (2007b)	Attitudes (IAT)	White American students interacting with a White or Black interviewer	Not provided	Physiological: Catabolic and Anabolic Cortisol release and recovery (I) Behavioral: Task performance (I) Subjective: Interviewer ratings of participant anxiety (O)	Physiological: At low level of bias: Higher anabolic cortisol reactivity and faster cortisol reaction At high level of bias: Lower anabolic cortisol reactivity and slower cortisol reaction Behavioral & Subjective: At low level of bias: Higher anxiety ratings by interviewer during task performance At high level of bias: Lower anxiety ratings by interviewer during task performance
Trawalter, Adam, Chase-Lansdale & Richeson (2012, Study 1)	Chronic Anxiety (motivation to respond without prejudice)	Black and White American students interacting with White and Black research assistants	Study on the physiology of social behavior during an interaction	Physiological: Cortisol (I) Behavioral: Behavior coding (smiles, eye gaze) by research assistants of participant interaction with confederate (O)	Behavioral & Physiological: At low motivation to respond without prejudice: Lower Behavioral and physiological indicators of stress At high motivation to respond without prejudice: Higher Behavioral and physiological indicators of stress

Study	Moderator Category	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type* and Target of Anxiety (Individual vs. Group)	Moderation Effect**
Trawalter, Adam, Chase-Lansdale & Richeson (2012, Study 2)	Chronic Anxiety (motivation to respond without prejudice); Past Contact (quantity)	Black and White American students who reported on daily intergroup interactions	Not provided	Physiological: Cortisol slopes (I) Behavioral: Self and other initiated intergroup contact throughout the year (G) Subjective: Attitude towards Blacks scale (G, S)	Physiological: At low motivation to respond without prejudice: Greater cortisol slopes during spring the more interracial contact they had during the year At high motivation to respond without prejudice: Greater cortisol slopes during spring the less interracial contact they had during the year Behavioral: Not tested for moderation Subjective: Not tested for moderation
Page-Gould (2012)	Past Contact (intergroup friends)	Canadian participants who reported on cross-group ethnic contact	Not provided	Behavioral: Approach/avoidance (G, S) Subjective: Initiation of intergroup contact (G, S)	Behavioral: At low cross-group friendships: Unrelated to social support following conflict At high cross-group friendships: Sought cross-group social support following conflict Subjective: At low cross-group friendships: Less intergroup interactions initiated following intergroup conflict At high cross-group friendships: No change in intergroup interactions initiated following intergroup conflict
Page-Gould, Mendes & Major (2010)	Past Contact (friendship quality)	Black and White (American or Canadian) adults interacting with a White or Black partner	Not provided	Physiological: Respiratory Sinus Arrhythmia and Parasympathetic activity (I, C) and Cortisol (I)	Physiological: For low contact quality: Less respiratory sinus rebound and slower cortisol recovery after and intergroup stressor For high contact quality: Greater respiratory sinus rebound and faster cortisol recovery after an intergroup stressor

Study	Moderator Category	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type* and Target of Anxiety (Individual vs. Group)	Moderation Effect**
Page-Gould, Mendoza-Denton & Tropp (2008)	Past contact (Quantity); Chronic Anxiety (Rejection Sensitivity); Attitudes (IAT)	American students who interacted with White or Latino/a partner	Study on the effect of friendship on college adjustment	Physiological: Cortisol (I) Subjective: Daily intergroup contact diary (G, S)	Physiological: For low contact: Cortisol reactivity was positive for high rejection sensitivity; flat effect for low rejection For high contact: Cortisol reactivity was negative for high rejection sensitivity; flat effect for low rejection At low level of bias: No relationship between cortisol and time as friendships developed At high level of bias: Lower cortisol reactivity across time as friendships developed Subjective: At low level of bias: No effect of friendship condition At high level of bias: More cross-group contact was self-initiated and reduced anxious mood reported following cross-group contact in the lab
Blascovich, Mendes, Hunter, Lickel & Kowai-Bell (2001, Study 3)	Past Contact (quantity)	Non-black American female students interacting with a White or Black individual of high or low SES	Study on "interpersonal styles and working together".	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: For low contact: Lower Ventricular Contractility and Cardiac Output, but higher Total Peripheral Resistance For high contact: Higher Ventricular Contractility and Cardiac Output, but lower Total Peripheral Resistance, all indicative of threat Behavioral: Not reported
Olsson, Ebert, Banaji & Phelps (2005, Study 2)	Past contact (interracial dating)	White and Black Americans viewing White and Black faces	Not provided	Physiological: Skin Conductance (I, C) Behavioral: IAT (G)	Physiological: For low interracial dating: Greater extinction bias towards outgroup faces For high interracial dating: Lower extinction bias towards outgroup faces Behavioral: Not reported

Study	Moderator Category	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type* and Target of Anxiety (Individual vs. Group)	Moderation Effect**
Navarrete, Olsson, Ho, Mendes, Thomsen & Sidanius (2009)	Past Contact (quantity)	White and Black Americans viewing white faces with different colored t-shirts	A study that explores the mind-body connection in response to social groups	Physiological: Skin Conductance (I, C) Behavioral: IAT (G) Subjective: Explicit race bias (Attitudes Towards Blacks scale) (G)	Physiological: For low contact: Inflated physiological responding to outgroup male faces was reduced more slowly For high contact: Inflated physiological responding to outgroup male faces was reduced more readily Behavioral: Not reported Subjective: Not reported
Jamieson, Koslov, Nock & Mendes (2013)	Expectancy Violation (attributional ambiguity)	Black and White Americans interacting online with a White or Black avatar	A study on how the nature of communication has changed now that our social lives are increasingly moving online	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C); Cortisol (I) Behavioral: Behavior coding (approach and avoidance) by research assistants of participant interaction with confederate (O)	Physiological: For outgroup feedback (attributionally ambiguous): Higher Cardiac Output and lower Total Peripheral Resistance For Ingroup feedback (attributionally non-ambiguous): Greater increases in cortisol following the interaction compared to outgroup rejection Behavioral: For outgroup feedback (attributionally ambiguous): More observed anger
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 1)	Expectancy Violation (ethnicity crossed with SES)	American female students interacting with a Female White or Latina partner of high or low SES	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: For stereotype consistent: Lower physiological threat responses For stereotype inconsistent: Higher physiological threat responses. Behavioral: No moderation effect found

Study	Moderator Category	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type* and Target of Anxiety (Individual vs. Group)	Moderation Effect**
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 2)	Expectancy Violation (ethnicity crossed with SES)	American male students interacting with a Male White or Latina partner of high or low SES	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: For stereotype consistent: Lower physiological threat responses For stereotype inconsistent: Higher physiological threat responses Behavioral: For stereotype consistent: More words were generated For stereotype inconsistent: Less words were generated
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 3)	Expectancy Violation (ethnicity crossed with accent)	American female students interacting with a White or Asian Female partner, who had a Southern or regional accent	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Behavior coding (Affirmations and body language of participant) (O); Word-finding task (Boggle) (I)	Physiological: For stereotype consistent: Lower physiological threat responses For stereotype inconsistent: Higher physiological threat responses Behavioral: For stereotype consistent: More observable positive behavior and more words were generated For stereotype inconsistent: Less observable positive behavior and less words were generated

Study	Moderator Category	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type* and Target of Anxiety (Individual vs. Group)	Moderation Effect**
Mendes, Major, McCoy & Blascovich (2008)	Expectancy Violation (Acceptance/rejection by partner)	Black and White American students interacting with a White or Black confederate	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Behavior coding (vigilance, external negative emotions, positive emotions) by research assistants of participant interaction with confederate (O) Subjective: Stephan & Stephan's (1985) intergroup anxiety scale (S)	Physiological: For high rejection from different race partner: lower Cardiac Output, but higher Total Peripheral Resistance For high rejection from same-race partner: Increased cardiac output, but lower Total Peripheral Resistance For high acceptance from same-race partner: Higher Cardiac Output, but lower Total Peripheral Resistance For high acceptance from different-race partner: Lower Cardiac Output but higher Total Peripheral Resistance for Black participants; Higher Cardiac Output, but lower Total Peripheral Resistance for White participants Behavioral: For high rejection: Increased anger when interacting with different-race evaluators; For high acceptance: Increased vigilance when interacting with cross-race evaluators Subjective: For high rejection: Greater negative emotion when rejected by a different-race evaluator For high acceptance: Increased positive emotion when interacting with same-race evaluators

Study	Moderator Category	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type* and Target of Anxiety (Individual vs. Group)	Moderation Effect**
Townsend, Major, Sawyer & Mendes (2010, Study 1)	Expectancy Violation (system justifying beliefs regarding status differences)	Latina female participants interacting with a white female confederate who was purportedly prejudiced or not against ethnic minorities	A study on interactions among coworkers	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C)	Physiological: For endorsing meritocracy: Greater threat responses when interacting with a White peer who was purportedly prejudiced against ethnic minorities than a non-prejudiced White peer For prejudice: Less threat responses when interacting with a White peer who was purportedly prejudiced against ethnic minorities, than a non-prejudiced White peer
Townsend, Major, Sawyer & Mendes (2010, Study 2)	Expectancy Violation (system justifying beliefs regarding status differences)	White female participants interacting with a White male confederate	A study of effective interviewing	Physiological: Heart Rate, Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Confederate rating of how nervous participant appeared (O)	Physiological: For endorsing meritocracy: Same level of threat, following a sexist or merit rejection, during tasks including speech preparation and delivery, the cognitive task and after the interview For prejudice: Lower threat responses, following a sexist (vs. merit) rejection, during tasks including speech preparation and delivery, the cognitive task and after the interview Behavioral: For endorsing meritocracy: Rated by confederates as equally nervous in the sexist and merit conditions For prejudice: Rated by confederates as less nervous in the sexist (vs. merit) condition

Note. * For anxiety type, this table used Blascovich, Mendes and colleagues' tripartite definition of physiological, behavioral and subjective anxiety (Blascovich et al., 2001; Mendes et al., 2002). For anxiety source, this table used Greenland et al.'s (2012) distinction of anxiety appraisal sources. ** Unless otherwise indicated, effect is in the direction of anxiety being higher in the intergroup than intragroup condition. I =

indicates individual level variable (episodic anxiety relevant to a specific individual outgroup member/s). G = indicates group level variable (chronic anxiety relevant to entire outgroup). O = indicates anxiety stemming from other individual(s). S = indicates anxiety stemming from participant self-reflecting on own anxiety; C = Continuous measure of anxiety (measure is not a one-off measurement but is rather collected continuously throughout the task; by exclusion all other measurements are discrete in nature).

anxiety. In particular, the thesis will investigate whether skin conductance responses to the faces paired with shock are larger among those who reported a high chronic anxiety towards Black people than among those who are less chronically anxious, in both direct and observational learning conditions. Hence, this thesis will investigate whether chronic anxiety is a catalyst for anxiety learning across both direct and vicarious anxiety learning.

While the above research shows that chronic anxiety moderates acute anxiety responses and stimulus-specific learning of acute anxiety, recent work by Trawalter and colleagues (2012) demonstrates that chronic anxiety *at the onset* moderates also the *development* of chronic anxiety over time (i.e., chronic anxiety as the end point or outcome of inductive anxiety learning; for simplicity this effect is omitted in Figure 2). Using a diary method to monitor daily intergroup contact of college students, the researchers took repeated measurements of cortisol release to assess healthy and unhealthy stress responses following contact. They found that the proportion of intergroup contact that participants reported for the previous day predicted the amplitude of cortisol boosts the following day. This suggests that *all* participants experienced intergroup exchanges as stressful and extra resources were required. However, chronic intergroup anxiety—operationalized as concerns about appearing prejudiced—moderated the long term outlook of these cortisol boosts (i.e., chronic anxiety as outcome). Over the academic year, individuals initially low in chronic intergroup anxiety showed a steepening of cortisol diurnal rhythms following increases in interethnic contact, indicative of healthy chronic stress responses and increased resilience over time. However, individuals initially high in chronic intergroup anxiety showed a progressive flattening of cortisol slopes, indicative of chronic ill health and stress. The findings indicate that chronic anxiety increases the attendance to threat related cues, accelerates the acquisition of episodic intergroup anxiety and leads to the establishment of chronic stress responses.

However, chronic anxiety is not necessarily a predictor of negative outcomes; rather it may act more generally as an amplifier of episodic anxiety responses and anxiety learning in either direction. Page-Gould, Mendoza-Denton and Tropp (2008) measured acute stress responses as intergroup friendships between White and Latino/a college students across three sessions. Declines in cortisol reactivity as friendships developed were observed exclusively among participants high in race-sensitivity, another variant of chronic intergroup anxiety (Mendoza-Denton et al., 2008), or among individuals high in implicit race prejudice. These results indicate that chronic intergroup anxiety can act as the catalyst of both positive and negative changes in anxiety.

Moderation by outgroup prejudice. Individual difference variables that are highly correlated with chronic intergroup anxiety may mimic the potentially complex and dissociated moderating effects that were discussed earlier for chronic anxiety (see e.g., Mendes & Koslov, 2012; see the moderation outgroup prejudice ('OP') diamond for outgroup prejudice in Figure 2). Westie and De Fleur's (1959) pioneering study on the physiology of intergroup relations exposed the anxiety-exacerbating effects of prejudice. They found that prejudiced individuals displayed higher skin conductance responses to Black than White photographs, whereas non-prejudiced individuals did not.

Importantly, as Westie and De Fleur's (1959) participant groups were carefully matched along a variety of social demographics (age, sex, social class, residential history), including *previous contact with Black people*. Thus, their results indicate that the higher anxiety of the prejudiced group was driven by differences in prejudice. A recent study by Mendes and colleagues (2007b) demonstrates that prejudice may also be associated with *fewer* positive outcomes. When monitoring acute neuroendocrine stress responses during a stressful task performed in front of a White vs. Black evaluator, Mendes et al. found that all intergroup and intragroup participants displayed a similar pattern of malignant stress responses (catabolic/cortisol releases) to the stressful task, irrespective of their implicit race prejudice on a race Implicit Association Test (IAT). Implicit prejudice, however, moderated the presentation of the benignant stress counterpart (anabolic/protective responses): Those allocated to the Black evaluator and who were higher on implicit prejudice did *not* display the salutary stress responses displayed by those allocated to the Black evaluator and low in implicit prejudice. This suggests that prejudiced individuals suffer from both the presence of malignant intergroup stress and the *lack of* benignant intergroup stress.

However, the outlook of moderation by prejudice is not necessarily bleak. As indicated earlier, in Page-Gould et al.'s (2008) experimental study of intergroup friendship formation, it was *only* those who had scored high (vs. low) on implicit race prejudice (or race-sensitivity) at pre-test, who (a) displayed significant declines in cortisol release as intergroup friendship developed, (b) showed reduced anxious mood on the days in which they engaged in intergroup interactions, and (c) reported more self-initiated intergroup interactions. Hence, while prejudiced individuals might suffer from higher anxiety levels, there is evidence that they also benefit the most from prejudice and anxiety reduction interventions (for more data, see Hodson, 2011).

Moderation by prior outgroup contact. As you move outward from the core of the proposed anxiety learning model, it is expected that individuals' past outgroup contact will play a key moderating role (see Figure 2's moderation diamond for cumulative contact on the deductive learning link). Through reviewing the research, emerging evidence was found that individuals' histories of positive outgroup contact protect against intergroup anxiety and intergroup anxiety learning. As discussed earlier, Blascovich and colleagues (2001, Study 3) measured the amount of quality outgroup contact non-Black participants had with Black people before attending their lab session (e.g., 'how much contact have you had with African-Americans as close friends?', p. 261). This study found reduced and, at times, no evidence of cardiovascular threat responses during interactions with a Black confederate among those participants who had a history of extensive and positive outgroup contact. Similarly, this thesis will measure participants' pre-test levels of quality contact with Black people (e.g., 'thinking about the past interactions you have had with Black people, are most interactions pleasant?') and will investigate whether this chronic variable acts as a buffer against the stimulus-specific acquisition of outgroup anxiety during both a direct and an observational aversive conditioning procedure (Harris et al., 2015a; Chapter 2). In other words, this thesis will investigate whether White individuals with histories of positive contact with Black people are less likely to learn to become anxious of Black faces when faced with negative outgroup experiences.

Extending this reasoning, Olsson and colleagues (2005) checked the moderating effects of prior outgroup contact on the *extinction* of intergroup anxiety, as acquired during a direct aversive conditioning procedure. At pre-test, they measured the number of interracial dates as a proxy of prior quality contact with Black people, and found a significant negative correlation with the number of times a Black (vs. White) face needed to be presented without shock to reduce participants' heightened arousal. Essentially, the more past quality contact participants had with the outgroup, the faster they recovered physiologically from an aversive intergroup experience.

Results from a diary study by Page-Gould (2012) shed some initial light on the processes contributing to the anxiety-buffering effects of intimate intergroup contact.

Page-Gould found that individuals who had a relatively broad and intimate network of intergroup friends were more likely to initiate (vs. avoid) new intergroup interactions following interpersonal conflict with an outgroup member—an obviously anxiety-provoking experience; whereas individuals with fewer intergroup friends were more likely to avoid outgroup members altogether after conflict. Mediation tests revealed that the network of intergroup friends acted as a buffer against the contact avoidance effects of interpersonal conflict with outgroup members by offering (intergroup) social support post-conflict.

To summarize, there is increasing and convincing evidence that positive prior contact shapes anxiety learning and mitigates a variety of negative outcomes in ways that are consistent with the proposed model (Figure 2): It protects against anxiety experienced during intergroup exchanges, mitigates the development of intergroup anxiety following aversive first-hand and observational intergroup contact, accelerates the return to normality after heightened intergroup anxiety and encourages outgroup approach (vs. avoidance).

Altogether this evidence advances our understanding of how *past* contact with the outgroup shapes the presence of anxiety during intergroup contact in the *present* and *over time*. Yet, there are at least three areas where more research is needed.

First, future research should test the moderating effects of individuals' *negative* histories of past contact. Intergroup contact research has been criticized for a focus on positive contact experiences and a neglect of sub-optimal and negative contact (see Paolini et al., 2010; Pettigrew, 2008; Pettigrew & Tropp, 2011). This critique extends to extant tests of moderation. Future research should test the robustness and invariance of the buffering effects discussed earlier and ascertain the extent to which these beneficial effects are restricted to cumulative positive experiences with the outgroup, like those associated with intergroup friendship and intergroup dating. Histories of negative intergroup contact, like those more frequently experienced in conflict areas (e.g., Northern Ireland, Cyprus, South Africa, etc.), should result in diametrically opposite outcomes. Rather than buffering, they should exacerbate anxiety responses and anxiety learning, and increase the amplitude of inductive and/or deductive generalization effects, possibly through their associations with chronic anxiety.

Consequently, this review calls for replications of Blascovich et al. (2001), and Olsson et al. (2005) in contexts where reasonable variations in past contact quality—positive *and negative*—are observed and can be measured. Experimental analogues of these field tests could involve *priming* or remembering positive vs. negative experiences of outgroup contact (e.g., through a biographical recall task) *prior* to the implementation of aversive vs. appetitive conditioning procedures. The implications of these predicted dissociations in anxiety learning along positive vs. negative chronic moderators are important. These dissociations would imply that new ingroup/outgroup interactions are most likely to *confirm* (vs. disconfirm), pre-existing expectations about the *typical* ingroup/outgroup interaction, thus, leading to a negative or positive spiraling of intergroup relations where expectations are already negative or positive, respectively.

Second, moderation evidence relies on indices that incorporate both quality and quantity of past outgroup contact such as *number* of intergroup *friendships* or intergroup dates (Allport, 1954; Brown, Maras, Masser, Vivian, & Hewstone, 2001; Voci & Hewstone, 2003a). As a result, it is unclear whether the effects of these chronic variables are driven by valence of past ingroup/outgroup interactions, by their number, or by an interaction between the two. Knowing this is the key to designing effective interventions (Paolini et al., 2006). Based on human and animal learning research (Kent, 1997; Lubow, 1998; Mineka & Cook, 1986), there may be more scope to change (increase/decrease) anxiety early in one's experience with the outgroup. Hence, contact quantity *in its own right* might have a unique effect on learning trajectories during contact. This idea is consistent with putative mechanisms of moderation advanced by Blascovich (e.g., Blascovich et al., 2001; Mendes et al., 2002) whereby contact quantity decreases anxiety and limits anxiety learning because it increases perceived control, reduces perceived uncertainty about future ingroup/outgroup interactions, and leads to increased intergroup self-efficacy (for a similar point, see Olsson et al., 2005; Plant & Devine, 2003). Because of decreasing uncertainty about the outcome of intergroup contact as contact quantity increases, this chapter also advances the possibility that the quality of discrete contact experiences might matter more at early stages of outgroup acquaintance (see Paolini et al., 2006 for predictions drawn from the mere exposure literature).

More generally and more importantly, the psychological underpinnings of moderation by chronic variables, as detected so far and discussed above, are interesting but remain substantially untested conjectures (for an isolated notable exception, Page-Gould, 2012). Hence, as evidence of moderation grows, researchers must learn more about the exact mechanisms that chronic variables—like chronic anxiety, outgroup prejudice, prior contact quantity and quality—recruit as the individuals' experience of contact with the outgroup evolves over time. This, is where the challenges of future research lie and future research should concentrate.

Summary and Conclusions

Previous contact research has failed to look at the dynamic interplay between episodic and chronic intergroup anxiety and, as a consequence, has returned a static and selective understanding of intergroup contact effects (Paolini, 2008). In 2006, around 30 studies of intergroup anxiety in intergroup contact were identified (Paolini et al., 2006), with the evidence reflecting a sharp disconnect between experimental tests isolating the anxiety-provoking effects of episodic contact and correlational tests isolating the anxiety-reducing effects of cumulative outgroup contact. In this review of the literature, it has been explained how these two usually separate traditions were bridged for the first time in a single design by Blascovich and colleagues' (2001) ground-breaking research.

This article has built up on earlier analyses and reviews of the evidence. It has been argued that there is a need for a learning model of anxiety and stress responses during ingroup/outgroup interactions. This should encompass both episodic and chronic anxiety towards the outgroup and their interactions. It is anticipated that episodic experiences crystallize over time into more chronic responses, and that these chronic responses in turn, inform future episodic experiences. Hence, this learning model of anxiety attempts to provide a temporal integration of intergroup contact effects over the lifespan. With this learning outlook in mind, recent empirical advancements have been documented and discussed.

Recent psychophysiological and behavioral investigations of intergroup anxiety by prominent intergroup contact researchers—including, among others, Blascovich, Mendes, Mendoza-Denton, Page-Gould, Richeson, Shelton, and Trawalter—as well as novel extensions of conditioning paradigms to the intergroup domain—e.g., by Olsson, and Phelps—all share a common learning framework; I made this explicit, here, in terms of five organizing principles. This research is revolutionary and paradigm-shifting since it investigates how cumulative outgroup contact and chronic responses to the outgroup equip the individual for new contact encounters and shape, for better or worse, their episodic responses to the outgroup. In so doing, these studies look at multiple segments of a complex and time-bound learning process of anxiety and reveal a non-linear and dynamic outlook of contact effects.

A model that incorporates both episodic and chronic process variables, as well as their dynamic interplay, has significant theoretical and empirical merits. Theoretically, it is sufficiently flexible and broad to potentially accommodate a disparate number of process variables (e.g., emotions, affect, evaluations and cognitions). Empirically, it helps reconcile mixed and complex contact evidence, as well as formulate new and untested predictions. From a more pragmatic point of view, it provides a stronger and more powerful platform to predict changes in intergroup relationships over time.

It must be recognized, however, that the methodological and analytical costs of testing learning models of contact as they are defined here are not small. These advantages can be fully enjoyed only if both episodic and chronic measures of key process variables are included in the research design and if the latter allows for repeated assessments of these variables over time and as individuals' experience with the outgroup grows.

It is worth noting that this review chapter has provided a limited discussion of longitudinal contact research because, while longitudinal tests of intergroup contact effects have recently flourished (see e.g., Brown et al., 2007; Christ et al., 2010, 2014; Tropp et al., 2012; see also recent symposium by Gonzalez and Tropp, 2014), only some of these tests have included measures of intergroup anxiety (Binder et al., 2009; Eller & Abrams, 2003, 2004; Levin et al., 2003; Swart et al., 2011). Furthermore, only one study (Page-Gould et al., 2008) fits the physiologically-centered inclusion criteria for this review of new generation research and thus was described in detail. Longitudinal designs have the potential to contribute to this analysis of complex dynamic changes in intergroup anxiety over the time course and to be instrumental in testing the proposed anxiety learning model. Yet, those studies currently available offer limited insight in the complexities discussed therein as they have been driven by either a focus on cross-lagged relationships between contact and anxiety (Binder et al., 2009; Eller & Abrams, 2003, 2004; Levin et al., 2003) or more recently by a focus on cross-lagged relationships between anxiety and other mediators of contact-prejudice links (see e.g., Swart et al. 2011 for longitudinal links between anxiety and empathy). Hence, even in investigations where changes in anxiety (episodic and/or chronic) over time could have been explored, these changes were either not investigated, or were reported for the sole purpose of ascertaining construct stability over time or establishing baseline model estimates (see e.g. Swart et al.'s, 2011 discussion of imposed load equivalence in auto-regressive models of anxiety).

For example, conditional growth curve modelling—via multi-level or Structural Equation Modelling (SEM)—is a promising alternative to past approaches to the modelling of longitudinal anxiety data. This powerful and flexible analytical approach can significantly advance our understanding of the dynamics of intergroup anxiety over an individual's life-span by surpassing traditional approaches in important ways (see Christ & Wagner, 2012; Curran, Obeidat, & Losardo, 2010). Once optimal baseline anxiety growth models are established (i.e., functional forms of the anxiety trajectories over time), these growth models can be expanded to include one or more predictor(s) of growth; for example, the chronic variables as discussed in this article (e.g., chronic anxiety, outgroup prejudice, accumulated past contact). Critically for the dynamics at stake in the proposed anxiety learning model, these predictors can be treated analytically as time-invariant (i.e., not changing over time), or as time-varying covariates (i.e., as themselves changeable over time). The former type of predictor is involved in traditional moderation analysis, whereby stable or invariant characteristics of the individual or experimental treatments are used to predict lower (vs. higher) starting points in the outcome (i.e., anxiety intercepts) and/or steeper (vs. flatter) rates of change over time (i.e., anxiety slopes). Alternatively, analyses with time-varying predictors assume that any given repeated measure of anxiety at any point in time is jointly determined by the underlying growth factors (i.e., the autoregressive component) and the impact of the time-varying (chronic) covariate at that time period. This means that conditional growth models that include time-varying chronic variable predictors can be expanded to incorporate changes in these chronic variables over time, and changes in the magnitude of their effects over time, as well as interactions between multiple covariates over time (for an extensive and accessible discussion, Christ & Wagner, 2012). As such, this type of model is the way of the future in testing the dynamic and complex interplay between episodic and chronic anxiety (as well as other concurrent and potentially interacting learning processes involving other intergroup emotions, cognitions, and evaluations) over an individual's lifespan.

To conclude, in advancing the proposed learning model of intergroup contact-anxiety effects, it has been argued that five broad learning principles—about the time course of affect, emotions, cognitions and evaluations in ingroup/outgroup interactions—implicitly underpin large sections of contemporary intergroup research. It has been pointed out that while testable, these learning principles most often remain 'assumed' and 'untested' (hence, *meta-theoretical* principles). Nevertheless, recruiting and expanding these broad learning principles allows development of a more narrow, fully testable model of anxiety learning during ingroup/outgroup interactions. This model is gaining some traction and is accruing significant amounts of supporting evidence. It has been suggested that this transition from a meta-theoretical learning framework to a testable learning model is not restricted to intergroup anxiety; as it is possible, and indeed, desirable in parallel areas of intergroup research. Ultimately, the hope is that the learning framework advanced here may provide a theoretically unifying umbrella that encompasses models and evidence from *within* the contact literature, as well as from outside the contact literature (e.g., stereotyping, attitudes, evaluative conditioning, etc.). The next level of complexity in the analyses of contact effects over time will most likely require the integration of what is known from these traditionally separate research areas, towards the investigation of even higher order interactions between learning of affect, emotions, cognitions *and* evaluations over time. It is hoped that the present analysis assists intergroup researchers with the first steps of the research endeavors that lie ahead.

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Footnotes

1. The articles listed in Tables 1 and 2 were located in Psycinfo and Pubmed. Reference lists of located articles and key authors' publication pages were also used to identify relevant publications. Articles were included in the review if they investigated outgroup anxiety or compared outgroup anxiety with ingroup anxiety (i.e., intergroup-intragroup comparisons) on psychophysiological and/or behavioral markers of anxiety. Studies including exclusively self-reports of anxiety were excluded (see Paolini et al.'s 2006 for a review of this literature), but findings on self-report measures were considered if reported side-by-side psychophysiological or behavioral findings.
2. This research trend is at odds with the research practices of mainstream and traditional correlational research of the contact-anxiety link; there the inclusion of group-level outcomes was a standard routine (see Table 11.2 in Paolini et al., 2006; n = 17 out of 18 studies or 94.44% of reviewed studies at that time included outgroup-level variables) because of a concurrent interest in the broader contact-prejudice link.
3. Future research still needs to identify the conditions under which D, i.e., the inter/intra-group difference in anxiety, tends to zero (bottom panel), which is equivalent to the intergroup and intragroup lines intersecting in the top panel.
4. In earlier work (Paolini et al., 2006), researchers offered an extensive discussion of several important methodological differences between experimental and correlational investigations of intergroup contact and anxiety. In this article, the intention is not that of providing a comprehensive explanation of this apparent disconnect between research traditions. Hence, after discussing the possible

involvement of systematic differences in contact valence, the on-line/memory-basis of the interaction, and individuals' motivational goals, the discussion selectively turns to methodological differences that are most relevant to an explanation of this apparent research disconnect in terms of temporal integration of contact experiences over the lifespan—i.e., the proposed learning model of anxiety.

5. In reviewing emerging physiological and behavioral research, the term 'anxiety learning' will be used in a narrower and more technical way than in earlier sections of this article to refer to changes in episodic anxiety that are *stimulus-specific* or *contingency bound*; a process called in the learning literature 'acquisition' of anxiety.

Synopsis

The learning model of intergroup anxiety and its associated organizing principles provide a solid theoretical grounding for future research on intergroup anxiety. The literature review underpinning the model highlights a number of limitations that are evident within the current literature. These include: common use of self-report measures or subjective outcome measures; a focus on either episodic or chronic anxiety measures within a single design (cf. Blascovich et al., 2001); and the reliance on the effects of positive intergroup contact experiences to infer how anxiety develops in the first place.

The research in this thesis will test aspects of the learning model of intergroup anxiety and its associated organizing principles, whilst also attempting to address some of the limitations inherent within the literature to date. This will be done by using an aversive learning procedure, which allows for the investigation of the impact of negative experiences with outgroup members.

The aversive learning procedure used in this thesis involves the presentation of a negative stimulus co-terminating with the presentation of one neutral stimulus (e.g., an outgroup face; CS+), while no negative stimulus co-terminates with the presentation of a different neutral stimulus (e.g., another outgroup face; CS-). Hence, the CS+ becomes associated with negativity, whilst the CS- does not, during the training or conditioning procedure. Before and after this training segment of the aversive learning procedure, the training stimuli (i.e., the CS+ and CS-) are typically presented to obtain baseline (pre-test) and post-test responses. Due to the aversive training, individuals usually display selective increases in psychophysiological responding towards the CS+ (CS-), indicative of a basic learning effect, demonstrating increases in anxiety towards that specific individual, and therefore, episodic anxiety learning. During pre-test and post-test, additional stimuli can be presented to obtain measures of responding towards the group category more broadly. This is typically indexed through responses to additional neutral stimuli (e.g., other outgroup faces) not involved in the training segment. This approach obtains a measurement of the spread, or generalization, of acquired anxiety responses to new outgroup exemplars with implications for the entire group. In this thesis, I will treat generalization as a group-level response and classed it as a chronic response. Hence, the research in this thesis will use learning or acquisition data as a proxy for episodic anxiety responses, and generalization as a proxy for chronic anxiety responses. Truly group-level self-report measures will also be included.

The practice of investigating increases in anxiety in the research laboratory is established (e.g., Mallan, Sax & Lipp, 2009; Navarrete et al., 2009; 2012; Olsson, Ebert, Banaji & Phelps, 2005; Olsson, Nearing & Phelps, 2007). The research reported within this thesis received ethical clearance. This clearance required the inclusion of numerous mechanisms to guarantee the wellbeing of the individuals who consented to participate. These mechanisms included prescreening of participants' medical condition, a full and immediate written and oral debriefing, an extinction procedure that continually presented the CS+ and CS- until anxiety responding returned to baseline or pre-test levels, and a positive visualization task about the target group under investigation. Participants were also continually reminded that they were free to withdraw at any point, without penalty. Ethical clearance was provided by the University of Newcastle's Human Research Ethics Committee (approval numbers 2009-0104 and 2009-0044; see Appendix B and C respectively).

While psychophysiological measures have advantages over self-report measures, they also have some limitations. In particular, the merit of psychophysiological measures rests in their non-obtrusive nature, however, they are limited to episodic or stimulus-bound responses. Hence, unlike self-report measures where researchers can ask participants to report their responses to the outgroup as a whole, and therefore capture chronic responses, psychophysiological measures cannot. However, if presented with sufficient stimuli, patterns of group-level responding, and therefore chronic responses, can be inferred using psychophysiological measures. This is the approach that the research contained within this thesis took. Hence, the research within this thesis will use the term chronic anxiety to incorporate both chronic (i.e., truly group-level) responses, as well as chronic-like (i.e., representative of group members) responses. This is consistent with Chapter 1, since the studies that incorporate the literature review and the tables were coded in this manner.

This methodology will allow pursuing the following research aims:

1) Investigate whether outgroup anxiety can be learned (Chapters 2, 3, 4, and 5)
2) Investigate whether episodic outgroup anxiety can be learned both directly and vicariously (Chapters 2, 3, 4, and 5)
3) Investigate whether chronic anxiety can be generated both directly and vicariously (Chapters 3, 4, and 5)
4) Investigate the influence of episodic anxiety on chronic anxiety (Chapters 3, 4, and 5)
5) Investigate the influence of chronic anxiety on episodic anxiety (Chapter 2)
6) Investigate potential mediating and moderating factors of anxiety responses, including perceived self-model similarity (Chapters 2 and 3), model believability (Chapter 2), chronic anxiety (Chapter 2), contact quality (Chapter 2), similarity to the CS+ (Chapter 3), stimulus similarity (Chapter 2, 3, 4 and 5), model anxiety (Chapter 4), and contingency awareness (Chapters 4 and 5)

7) Investigate episodic and chronic anxiety in the absence of real social groups (Chapter 5)

The four empirical Chapters 2, 3, 4, and 5 present experimental data from studies that used the aversive learning paradigm outlined above and allowing the investigation of the acquisition and generalization of intergroup anxiety. Chapter 2 presents two studies that investigate the acquisition of episodic intergroup anxiety. The focus of Study 1 is to determine if intergroup anxiety can be acquired vicariously by comparing this to direct experiences. Study 2 investigates the effect of model ethnicity on the vicarious acquisition of episodic intergroup anxiety. Chapter 3 reports the generalization data, or chronic anxiety data, from Study 1 and 2. Chapter 4 investigates order effects of direct and vicarious acquisition. In particular, the research in Chapter 4 aims to determine the impact of aversive intergroup experiences on episodic and chronic anxiety when undergoing direct and then vicarious learning, or vicarious and then direct learning. Chapter 5 investigates episodic and chronic anxiety following allocation into arbitrary groups using a minimal group paradigm to remove the influence of prior group history.

All four studies include tests of potential mediator and moderator variables such as chronic anxiety, prior contact quality, contingency awareness, and perceived stimulus similarity. These analyses followed Spencer, Zanna, and Fong (2005) and used a 'moderation-of-process design' plus a 'measurement-of-process design' for focal variables; a 'measurement-of-process' only design (a within-subject extension of the Baron and Kenny's approach; Judd & Kenny, 1981; Yzerbyt et al., 2004) was used to assess additional process variables that were expected to be partly overlapping and more difficult to manipulate, but still contributing to the overall effects of interest. This combination of distinct but related approaches towards isolating psychological underpinnings of key effects is becoming more frequent and is regarded as the most stringent approach to use (see Spencer, Zanna, & Fong, 2005). I am proud that this PhD work reflects the latest generation methodology in social psychology. Although this thesis is not a thesis by publication, the chapters in this thesis have been written as manuscripts. Hence, the reference list will appear at the end of each chapter and endnotes will be used instead of footnotes.

By testing the learning model of intergroup anxiety and its organizing principles, the studies reported in this thesis have the potential to provide a more complete understanding of the mechanisms underpinning the acquisition and generalization of intergroup anxiety. These studies also have the potential to demonstrate the interaction between episodic and chronic anxiety responses, the impact of cumulative past experiences with the outgroup, and episodic anxiety's crystallizing over time into chronic responses. Hence, these studies have the potential to provide a theoretical and practical foundation for intervention strategies. By understanding how anxiety develops and spreads in the first place, interventions will be better placed to develop and implement more efficacious anxiety reduction strategies.

Chapter 2.

Learning about the World from Watching Others: Vicarious Fear Learning of Outgroups and Moderation by Prior Outgroup Contact and Chronic Outgroup Anxiety

Contemporary research on fear learning of outgroups is limited by a focus on acquiring fear through direct or first-hand experience (Navarette et al., 2012; Olsson, Ebert, Banaji, & Phelps, 2005). Mass media communication and modern technology, however, make indirect or vicarious learning about outgroups increasingly prevalent and relevant (Harwood, 2010; Weisbuch, Pauker, & Ambady, 2009; Wright, Aron, McLaughlin-Volpe, & Ropp, 1997). Television, the internet and social networking sites provide a rich and growing array of opportunities to learn about outgroups in a vicarious manner. Understanding the mechanisms and consequences of vicarious learning is important for a more complete knowledge of the processes that underlie the development of outgroup fear and anxiety. This fuller understanding can inform more effective anxiety reduction strategies to not only reduce current levels of intergroup anxiety, but also prevent the development of outgroup fear and anxiety in the first place.

This chapter reports two experimental studies on the vicarious acquisition of outgroup fear. Study 1 compared the effects of direct and vicarious aversive experiences with outgroup stimuli on physiological skin conductance fear responses. Study 2 investigated the role that variations in observer-model ethnic similarity play in the vicarious learning of outgroup fear. Both studies also explored the extent to which vicarious fear learning is exacerbated vs. alleviated by chronic expectations of outgroup anxiety, and a history of positive contact with the outgroup. In so doing, this research proves the recruitment of basic associative learning mechanisms in observational outgroup fear learning and highlights the importance of individual differences in past experiences with the outgroup in preparing vs. protecting from the vicarious learning of outgroup fear.

The Potency and Widespread Nature of Vicarious Learning

Vicarious learning, or the learning through observation of other individuals, is an important method of acquiring social information (Meltzoff, 1988), and has a solid theoretical grounding in Albert Bandura's pioneering work (Bandura, 1977, 1989). One of Bandura's earliest and most influential series of studies involved the inflatable Bobo Doll (Bandura, Ross, & Ross, 1963a, b) where children observed an adult model behaving either aggressively or passively towards a doll. After this observational experience, the children behaved similarly to the model—hence demonstrating *vicarious learning* (Bandura et al., 1963a, b). Twenty years later, Vaughan and Lanzetta (1980) showed that observing the pain response of a model who received an electric shock caused observers to behave as if they were anticipating, and expecting to experience, the shock themselves. This finding suggests that individuals observing a model are able to vicariously experience events through the model's eyes.

Not only is vicarious learning successful, some evidence suggests that vicarious learning might be as powerful as direct or first-hand learning in shaping individuals' responses (Olsson & Phelps, 2004) and may involve the same core neural mechanisms (Olsson, Nearing & Phelps, 2007). The potent nature and ubiquity of aversive vicarious learning is evident in animal research (for a review, see Griffin, 2004). Cook and Mineka conducted seminal studies of vicarious learning with lab-reared rhesus monkeys with no direct experience of their natural predators (Cook & Mineka, 1987, 1989, 1990). Initially, their monkeys showed no fear of snakes; however, after they had observed another rhesus monkey exhibit a fear response towards a snake, they too become fearful of snakes. Similar vicarious conditioning has been documented in a broad range of taxa—from fish to mammals—pointing to the evolutionary significance and survival benefits of the ability to learn about danger vicariously (vs. directly) (Boyd & Richerson, 1988).

On the contrary, social psychological research suggests the possibility that direct learning might have primacy over vicarious learning (e.g., Christ, et al., 2010; Fazio, 1990; Lolliot, Hewstone, & Schmid, 2014; Paolini, Hewstone, & Cairns, 2007). From this standpoint, first-hand learning should produce larger learning effects than second-hand experiences because the salience of personal recollections leads to more accessible attitudes, increases the emotional intensity associated with the learning experience, or offers multi-sensory recall cues (Fazio, 1990). As a consequence, first-hand (vs. socially mediated) experiences should result in responses that are more stable, easier to retrieve, and resistant to change (Fazio & Zanna, 1978).

Despite this growing knowledge base about vicarious learning and its possible implications for intergroup relations (Gomez & Huici, 2008; Mazziotta, Mummendey & Wright, 2011; Ortiz & Harwood, 2007; for an overview, see Harwood, 2010), conditioning studies in humans have typically demonstrated the powerful nature of vicarious aversive learning *without the use of outgroup-relevant stimuli* (Navarrete et al., 2012). For example, Olsson, Nearing and Phelps (2007) found that participants displayed elevated levels of physiological arousal in response to a geometric shape systematically paired with a model's fear response (a CS+ or unsafe stimulus); they displayed less physiological arousal in response to a different geometric shape never paired with the model's fear (a CS- or safe stimulus)—a pattern indicative of vicarious fear learning. Hence, the literature currently falls short of demonstrating that individuals ‘catch’ outgroup fear from observing other individuals having unpleasant and unsuccessful interactions with outgroup stimuli, possibly through the recruitment of basic mechanisms of vicarious learning.

Acquiring Outgroup Fear and Anxiety Vicariously

Fear of outgroups or threat responses associated with outgroup members contribute to people’s subjective experiences of outgroup anxiety (Greenland, Xenias, & Maio, 2012), broadly defined as the anxiety experienced when interacting or anticipating interacting with outgroup members (Stephan & Stephan, 1985). Outgroup anxiety can stem from concerns about one’s safety from real threats, as well as from symbolic threats, like concerns of appearing prejudiced, ridiculed, or misunderstood (Stephan, 2014).

Irrespective of its exact appraisal source (Cottrell & Neuberg, 2005), anxiety in intergroup settings is typically associated with increases in physiological arousal, like heart rate (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001), skin conductance (Olsson et al., 2005) or cortisol release (Page-Gould, Mendoza-Denton, & Tropp, 2008). It results in difficult interpersonal and intergroup transactions (Paolini, Hewstone, Voci, Harwood, & Cairns, 2006), increased prejudice towards the outgroup (Pettigrew & Tropp, 2008), and a self-perpetuating cycle of debilitating affect and cognitions (Trawalter, Adam, Chase-Lansdale, & Richeson, 2012; for a review, see Paolini, Harris, & Griffin, 2015; Chapter 1) and avoidance of the outgroup.

Conversely, averting or reducing subjective experiences of outgroup fear and anxiety has proved to bring about significant positive intergroup outcomes (Paolini et al., 2006); this extends to cases in which individuals learn about the outgroup exclusively indirectly, through observation (Gomez & Huici, 2008; Mazziotta et al., 2011; Ortiz & Harwood, 2007). This social psychological research demonstrates that *knowledge* of ingroup members having *positive* and *successful* interactions with outgroups (i.e., the so called '*extended* contact' or '*indirect* intergroup friendships') leads to reduced outgroup anxiety, and more positive intergroup attitudes, above and beyond the effects of first-hand positive experiences with the outgroup (Paolini, Hewstone, Cairns, & Voci, 2004; Turner, Hewstone, Voci, Paolini, & Christ, 2007; Turner, Hewstone, Voci, & Vonofakou, 2008; Wright et al., 1997).

Hence, there is an extensive body of evidence demonstrating outgroup anxiety's negative consequences (Paolini et al., 2006; Paolini et al., 2014) and the benefits for intergroup relations of *reducing* intergroup fear and anxiety, first-hand or vicariously (Turner et al., 2007). Comparatively very limited attention has been devoted to investigating the *vicarious acquisition* of outgroup fear and anxiety and to isolating the exact mechanisms involved and the factors that facilitate vs. possibly negate its *development*. This, in my view, limits a fuller understanding of outgroup fear / anxiety, as well as our ability to design effective and efficient prevention methods and corrective strategies.

Paolini, Harris, and Griffin's (Paolini et al., 2015; Chapter 1) learning model of intergroup anxiety advances pointed predictions about individual differences most likely implicated in fear learning of outgroups. Drawing from extensive literatures on the etiology of phobias and intergroup contact, and from a growing body of experimental evidence on the psychophysiology of intergroup interactions (Paolini et al., 2006; Paolini, 2008; Paolini et al., 2014), this model argues for the temporal integration over the individual's lifespan of episodic and chronic fear and anxiety responses to outgroups. *Episodic* fear, threat responses, or anxiety are context- and stimulus-specific and would be experienced during one particular interaction with the outgroup. *Chronic* fear, threat responses, or anxiety, defined as overall, global anxiety responses towards the outgroup as a whole, would instead reflect the culmination of all previous outgroup contact experiences; as such, they would be relatively context-free and generalized in nature. Through this learning outlook to outgroup anxiety, Paolini and colleagues hypothesize the existence of an interaction between the episodic learning of outgroup anxiety and individual differences in chronic outgroup anxiety and in histories of contact with the outgroup: Chronic outgroup anxiety should amplify or exacerbate the episodic learning of outgroup fear and anxiety; whereas histories of positive contact with the outgroup should attenuate or protect against such anxiety learning.

Recent research of *direct* or first-hand anxiety learning supports these tenets (for an extensive discussion and review of evidence, see Paolini et al., 2014). Olsson and colleagues (2005) used a conditioning paradigm involving first-hand pairing of outgroup faces with electric stimulation (CS+ or unsafe stimuli) and found that participants' past close relationships with the outgroup (e.g., intergroup dating) moderated the acquisition of intergroup anxiety: The larger the individuals' past history of positive contact with the outgroup the slimmer the difference in outgroup anxiety between pre- and post- aversive conditioning (i.e., an attenuation or protective effect of past outgroup contact; see also Blascovich et al. , 2001). In a similar vein but on the anxiety-reduction side of the spectrum, Page-Gould, Mendes, and Major (2010) found that past intergroup contact predicted faster physiological recovery (autonomic and neuroendocrine reactivity) after a stressful intergroup task, and thus acted as a protective factor in the development of intergroup threat responses. Trawalter and colleagues (Trawalter et al., 2012) recently showed moderation by chronic anxiety. In this study, they used a diary method to monitor college students' daily first-hand intergroup contact and took repeated measurements of cortisol release to assess healthy and unhealthy stress responses following contact. Trawalter and colleagues found that all participants experienced intergroup exchanges as stressful and required the mobilizing of extra resources. However, participants' chronic intergroup anxiety—operationalized in this study in terms of individuals' concerns over appearing prejudiced—moderated the long term outlook of cortisol release following intergroup contact. Over the academic year, those individuals with high chronic intergroup anxiety showed a progressive flattening of cortisol slopes, indicative of learning of malignant ill health responses and stress.

Hence, there is some emerging new evidence for the interaction between prior outgroup contact, chronic outgroup anxiety, and processes of anxiety learning through direct, first-hand experience. However, to the best of my knowledge, there is currently no research on the interplay between episodic and chronic responses to outgroups in vicarious aversive learning. The present research attempts to initiate such a test. The aim was to isolate protective factors, as well as risk factors in the development of outgroup fear and anxiety through observation. To this end, this study tested whether individual differences in past outgroup contact and chronic outgroup anxiety moderated the amplitude of vicarious learning of outgroup fear (i.e., reductions vs. increased differences in outgroup fear pre-post vicarious aversive conditioning). Increased knowledge of the protective and risk factors in the observational learning of outgroup fear and anxiety has the potential to inform prevention and remedial social interventions that are suited and viable in modern mass-mediated societies.

The Present Research: Design, Paradigm, and Hypotheses

This paper reports two experimental studies on the vicarious acquisition of fear. By focusing on vicarious aversive learning, this work breaks not only with much of the past intergroup contact research, which has a distinct focus on the *reduction* of outgroup anxiety and threat responses, but also with much of the associative learning research, which has had a strong emphasis on *direct* first-hand fear learning. Study 1 compared the effects of direct and vicarious aversive experiences with outgroup stimuli on the development of physiologically marked fear of an ethnic outgroup; the study measured outgroup fear with skin conductance responses. Study 2 investigated the effect of the observer-model ethnic similarity on the vicarious acquisition of outgroup fear. Within this context, this chapter also assessed the moderation predictions stemming from Paolini et al.'s (2015) learning model of anxiety (Chapter 1) and tested the extent to which vicarious fear learning is exacerbated by chronic outgroup anxiety, and alleviated by quality of prior outgroup contact.

To isolate the learning processes involved in the vicarious acquisition of outgroup fear and anxiety, this study adapted Olsson et al.'s (2007) conditioning paradigm to an ethnicity context. Participants watched a video of another participant displaying fear responses to an outgroup (a conditioned excitor/CS+ or, simply, an *unsafe* face) and relaxation responses to another outgroup face (a conditioned inhibitor/CS-, or a *safe* face). Two features are critical to the validity of this paradigm as analogous of vicarious learning. First, that the participants never experience the aversive stimulus (a mild electric shock) first-hand, but do so only through the vicarious experience of another individual (the model). Second, that changes in responses elicited by the CS+ are greater than those elicited by the CS-. As the CS- in this type of within-subject designs acts as a control stimulus, it accounts for non-associative learning (Rescorla, 1988), and allows to control for any changes in responsiveness towards the CS+ that may occur as a consequence of mere repeated exposure to the CS or the shock.

In this paradigm, it was expected that participants would display a similar level of physiological arousal to the CS+ and CS- at pre-test, but higher levels of physiological arousal to the CS+ relative to the CS- at post-test; this pattern of skin conductance responses is called a ‘basic’ vicarious aversive learning effect. Based on Paolini et al.’s (2015) learning model of outgroup anxiety (Chapter 1) and early evidence from direct learning settings (Olsson et al., 2005; Page-Gould et al., 2010; Trawalter et al., 2012), it was predicted that this basic vicarious aversive learning effect would be moderated by the individual’s positive history of contact with the outgroup and their chronic expectations of outgroup anxiety. It was also expected that quality of prior outgroup contact would inhibit, and chronic anxiety would exacerbate the development of outgroup fear (i.e., a negative contact-fear learning link and a positive chronic anxiety-fear learning link). The study measured these individual difference variables pre-conditioning one week prior to the laboratory learning session.

This research also initiated a systematic investigation into the relationship between observer and model as the key psychological underpinning of vicarious learning. Bandura’s social learning theory (1977) suggests that individuals are more likely to vicariously acquire social information from models that are similar (vs. different) to them. This is because a high level of self-model similarity increases the psychological connection with the model – i.e., the observer relates more with models that are similar to them -- this leads to the observer to display similar responses and ultimately show larger vicarious learning effects. In ethnicity contexts, ethnicity should be a particularly central dimension in individuals’ appraisals of self-model similarity, but other social psychological dimensions may also be chronically accessible to observers (e.g., gender, age, etc.). Vaughan and Lanzetta (1980) argued for the centrality of perceptions of models as ‘believable’ and noted the systematic co-variation between self-model similarity and the model’s believability. This reasoning implies that, in intergroup contexts, greater self-model similarity along ethnicity (and potentially other key social dimensions) should inform perceptions of model's believability and contribute to explain (i.e., mediate) vicarious learning effects.

Drawing from this literature, it was predicted that self-model similarity and model believability would explain the vicarious acquisition of outgroup fear and expressed anxiety and tested these hypotheses in two ways. In Studies 1 and 2, these process variables were measured and tested for their mediational role in vicarious learning effects (i.e., a measurement-of-process design; Spencer, Zanna, & Fong, 2005). Study 2 moved to a more incisive test and also experimentally manipulated observer-model similarity (vs. dissimilarity) along ethnicity (i.e., a moderation-of-process design; Spencer et al., 2005). Findings from this research are envisaged to inform theory and interventions for the amelioration of problem-ridden relations between groups in society.

Study 1

As part of what is believed to be the first controlled test of vicariously acquired outgroup fear, this study benchmarked the newer vicarious learning effects with the more researched and established effects of direct or first-hand aversive learning (Mallan, Sax & Lipp, 2009; Navarrete et al., 2009, 2012; Olsson et al., 2005). To ascertain whether direct and vicarious learning produce comparable or different learning effects, half of the participants observed a model who simulated distress to one outgroup face, but not another (*vicarious learning* condition) and half directly received an aversive stimulus (electric shock) to one outgroup face, but not to another (*direct learning* condition). If changes in physiological arousal to the CS+ (vs. the control, CS-) face are comparable in size after direct and vicarious learning, the results would be consistent with predictions from the learning and psychophysiological literatures (e.g., Olsson & Phelps, 2004); if changes in physiological arousal are more pronounced after direct learning, the results would support predictions from the social psychology literature (e.g., Fazio, 1990).

Method

Participants and Design

Participants were 66 White Australian students (22 males; 44 females; mean age of 21.26, *SD* = 3.92) from a large regional Australian university, who were offered course credit or AU$25 for their participation. Thirty-four participants were randomly assigned to a direct learning condition and thirty-two to a vicarious learning condition of a 2 Condition (Direct/Vicarious) x 2 Stimulus (CS+/CS-) x 2 Time (Pre/Post-Learning) design, with Time and Stimulus as repeated measures. The research protocol complied with the APA's ethics guidelines for research with human participants and was approved by the local institutional review board for research ethics.

Apparatus and Stimulus Materials

The face morphing software FaceGen was used to create eighteen 25-year old male faces with a neutral expression. Six faces were developed for each of three ethnic groups: Asian, Black-African and Middle Eastern. To select the target ethnic outgroup, sixteen White participants rated the faces along perceived anxiety, familiarity and typicality (1 = *not at all*; 6 = *very much*). The Black faces were chosen since they were rated as the most typical (i.e., representative of their group), least anxiety inducing (which allows for increases in anxiety to be studied), and relatively low in perceived familiarity (thus, increasing the incisiveness of the moderating tests for prior outgroup contact). The pilot data were also used to select the two Black faces that would serve as the training stimuli, where one face would be paired with electrical shock (CS+) and the other would not (CS-). Two Black faces were identified as being comparable in attractiveness (*M* = 4.17, *SD* = .86 vs. *M* = 4.22, *SD* = .88), anxiety (*M* = 2.16, *SD* = .97 vs. *M* = 2.01, *SD* = .81), and typicality (*M* = 5.06, *SD* = .73 vs. *M* = 5.16, *SD* = .82), all *t*s < 1.

During material development, four videos were filmed across two female models. In order to select the most convincing sequence, six White participants rated the videos (1 = *not at all*, 7 = *very much*) along model believability (5 items, e.g., "the facial expressions of the research participant in the video looked genuine", α = .88), participant anxiety (1 item, "how anxious or apprehensive did you feel while watching the video"), and perceived model reliability (3 items, e.g., "the research participant behaved in a way I would expect most people to behave under the same circumstances"; α = .81). The video sequence that was rated by participants as the most believable (*M* = 6.15, *SD* = .54), reliable (*M* = 5.84, *SD* = .98), and anxiety inducing (*M* = 6.02, *SD* = .49), was selected as the vicarious training video, F (3, 5) = 7.66, p = .040, η_p^2 = .61; F (3, 5) = 7.35, p = .042, η_p^2 = .60, F (3, 5) = 50, p = .076, η_p^2 = .50, respectively.

Procedure

Approximately one week prior to attending a laboratory session, participants completed an online questionnaire, which included among filler items, items regarding individuals' prior contact with Black people (e.g., "thinking about the past interactions you have had with Black people, are most interactions pleasant"; Islam & Hewstone, 1993), as well as their chronic anxiety towards Black individuals ("thinking about the past interactions you have had with Black people, are most interactions anxiety provoking*"*, Stephan & Stephan, 1985; all ratings, 1 = *not at all*, 7 = *very much*). Exploratory factor analysis confirmed that the items loaded onto two related, *r* (68) = -.50, but distinguishable factors which were labeled *quality of prior outgroup contact* (6 items, α = .82; see Appendix D for full set of items) and *chronic outgroup anxiety* (single item). Our Australian participants reported having relatively high quality contact with (*M* = 5.45, *SD* = .86), and low chronic anxiety towards Black people (*M* = 2.06, *SD* = 1.16)

Approximately one week later, participants attended a laboratory session. Participants first cleaned their fingers with a humidified wipe. Shock and skin conductance electrodes (stainless steel; AD Instruments) were then attached to their fingers to elicit and measure physiological arousal, respectively. Skin conductance electrodes were attached to the index and middle finger, along with an isotonic gel to improve skin contact and recording quality. Participants were connected to the skin conductance electrodes for approximately 20 minutes before the recording began to allow skin conductance responses to stabilize, and to allow the researcher time to set-up the next task. A respiration belt was also used to correct for breathing abnormalities and artefacts, such as yawns (Greco & Baenninger, 1991). At this point, participants completed a so-called "work-up" procedure to self-select a level of shock that they identified as "uncomfortable but not painful" (Lovibond, Saunders, Weidemann, & Mitchell, 2008; range of 1-20 mA). To reinforce the study's cover story, participants in the vicarious condition also completed the "work-up" procedure.

Next, participants were shown the CS+ and CS- among a larger set of eight faces (see footnote 7 and Appendix E), to obtain baseline, or pre-test, Skin Conductance Responses (SCRs). Following pre-test, participants underwent either direct or vicarious training. During training, participants were shown the same CS+ and CS- from pre-test, five times each (See Appendix F). For those undergoing direct training, each presentation of the CS+ co-terminated with a 2ms shock at the level chosen during the “work-up” procedure, whereas the CS- was never paired with shock delivery.

For those in the vicarious condition, participants were instructed to watch the video of another individual to familiarize with the experimental procedure they “would themselves subsequently experience” (Olsson & Phelps, 2004). To ensure both model and stimuli were appropriately attended, the video was edited so that the sequence of faces was displayed on one side of the monitor and the model’s sequential responses to each of the stimuli on the other side of the monitor. As in Olsson and Phelps (2004), participants were told to “Please pay attention to both sections of the screen. That is, pay attention to both the behavior of the participant, and also to what she is seeing on her screen. The video is important as you will undergo the same experience straight after the video is finished”. The outgroup faces presented to the vicarious learning participants were identical to those of the direct learning participants, except that no shocks were administered to ensure that learning was due to socially-mediated, indirect means rather than first-hand experience. Instead, the video displayed a White female in her twenties (See Appendix G)who simulated distress when one Black face was presented on a computer screen in front of her (CS+) and a relaxed expression when another Black face was presented (CS-). Similar to the direct training condition, there were five presentations of the CS+ (where the model responded anxiously), and five presentations of the CS- (where the model responded with an expression of relief). The faces acting as the CS+ and CS- were counterbalanced across participants using two separate versions of the video. The faces were presented for 10s, with an average inter-stimulus-interval of 30s (range 20-40s).

After training, all participants were shown the same CS+ and CS- without any shock pairings to obtain post-test SCRs. Those in the vicarious condition at this point completed a brief questionnaire regarding the video they had watched. They rated model believability (see pilot test and Appendix H) and perceived self-model similarity (single item index: “overall, I see the research participant as being similar to me”) as moderately high (believability, $M = 5.11$, $SD = 1.34$; self-model similarity, $M = 4.06$, $SD = 1.80$ on a 1-7 scale) and predictably related ($r = .51$, $p < .01$). To ensure individuals left the laboratory with pre-conditioning levels of arousal and with positive reactions to the outgroup, participants’ physiological responses to the CS stimuli were extinguished and all participants were asked to watch a five minute video clip portraying Black people in a positive light.

Results and Discussion

Skin conductance responses (or SCRs) were analyzed using a 2 Condition (Direct/Vicarious) x 2 Stimulus (CS+/CS-) x 2 Time (Pre-test/Post-test) mixed model ANOVA, with Stimulus and Time as repeated measures. In both studies, SCRs were calculated using standard methods (see e.g., Mallan et al., 2009 baseline and response method recording upwards inflections occurring within the 1-4 second time interval post-stimulus presentation) and corrected for any breathing artefacts, such as yawning (Greco & Baenninger, 1991).

The ANOVA revealed a significant interaction between Stimulus and Time, F (1, 64) = 24.89, $p < .01$, $\eta_p^2 = .28$ (see Figure 3). A paired samples t-test confirmed no significant difference at pre-test, t (65) < 1, $p = .77$, indicating that the CS- ($M = .04$, $SD = .19$), and CS+

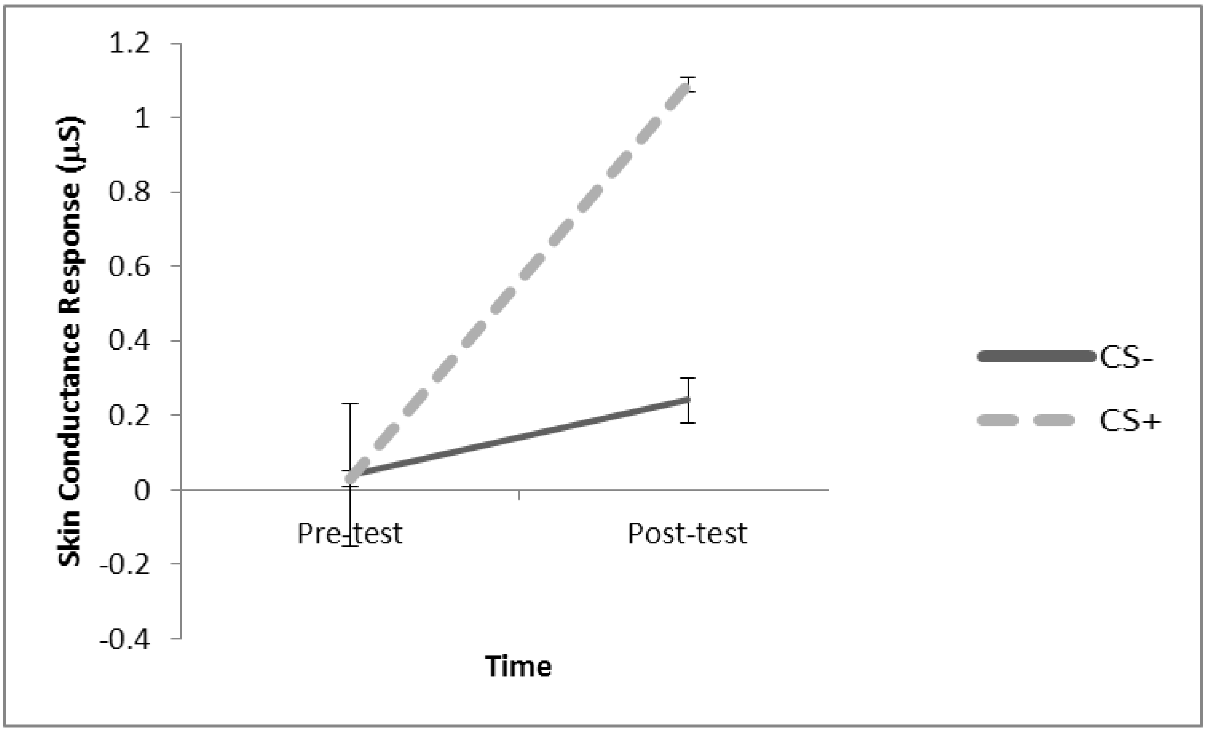

Figure 3. Physiological responses, SCR (µS), as a function of stimulus and time (Study 1).

(*M* = .03, *SD* = .15) evoked similar levels of arousal before training. As predicted, however, after training the CS+ evoked a significantly greater SCR (*M* = 1.10, *SD* = 1.53), compared to the CS- (*M* = .24, *SD* = .49), t (65) = 5.25, $p < .01$, indicative of a basic vicarious aversive learning effect. Importantly for the sake of the direct-indirect learning comparison, the three-way interaction between Condition, Stimulus and Time was not significant ($F < 1$), meaning that participants in the direct and vicarious conditions displayed similar levels of fear learning. This pattern is consistent with the predictions stemming from the learning and psychophysiological literatures.

As expected, the results suggested that quality of prior outgroup contact had a protective role in the acquisition of outgroup fear, whereas chronic outgroup anxiety had an excitatory role. A single score was calculated to capture increases in physiological arousal over time [(post-test CS+ - pre-test CS+) – (post-test CS- - pre-test CS-)]. Quality of prior outgroup contact was negatively correlated with increases in physiological arousal over time (across all participants: r = -.25, p < .05; direct condition: r = -.17; vicarious condition: r = -.31), whereas chronic outgroup anxiety was positively related (across all participants: r = .24, p < .05; direct condition: r = .20; vicarious condition: r = .29). Hence, the *more* positive contact White participants had with Black people prior to attending the testing session, and the *lower* the chronic anxiety they reported experiencing towards Black people in general, the smaller the increases in SCRs both direct and vicarious learning participants displayed between before and after conditioning. These correlations confirm the moderation hypotheses and also indicate that the outgroup was a salient appraisal source for the fear responses in this experiment (i.e., the fear was *intergroup* in nature).

To explore whether, among vicarious learning participants, the interaction between Stimulus and Time—reflecting a basic vicarious aversive learning effect—was mediated by the perceived believability of the model and the perceived self-model similarity, these two variables were included in turn as covariates in a Stimulus x Time ANCOVA for the vicarious participants (refer to Judd, Kenny, & McClelland, 2001; Yzerbyt, Muller & Judd, 2004 for mediation tests for within-subject designs). In line with the mediational hypotheses, both perceived model believability and perceived self-model similarity made the Stimulus x Time interaction non-significant, *from* F (1, 31) = 13.34, p = .001, η_p^2 = .301, *to* F (1, 30) = 2.14, p = .15, η_p^2 = .07 and *to* F (1, 30) < 1, p = .36, η_p^2 = .01, respectively. This mediational evidence demonstrates that discriminative increases in physiological arousal towards the CS+ (vs. the within-subject control CS-) as a result of vicarious aversive learning were due to vicarious participants perceiving themselves as similar to the model and perceiving the model to be a believable means of social learning.

These results assert the power of vicarious learning for the acquisition of outgroup fear and the expression of outgroup anxiety. The results have demonstrated experimentally and unequivocally that, to become anxious of ethnic others, people do not necessarily need to experience aversion of the outgroup *directly*; rather it is sufficient for them *to witness* another individual experiencing such aversion. Vicarious aversive learning indeed was so effective that, consistent with earlier data from *outside* the *ethnicity* domain (Olsson & Phelps, 2004; Olsson et al., 2007), it was found to be as powerful as first-hand aversive learning -- and power analysis confirms that this is not due to insufficient power to detect a difference (see footnote 6). This study was also the first to isolate factors, from within the individual's repertoire of past experiences and chronic responses to the outgroup, that act as protective and risk factors against the vicarious (as well as the direct) learning of outgroup fear. Consistent with predictions stemming from a learning outlook to anxiety learning during intergroup contact (Paolini, 2008; Paolini et al., 2014), quality of prior outgroup contact buffered individuals from becoming anxious when facing—firsthand or secondhand—aversive experiences with the outgroup; chronic intergroup anxiety instead exacerbated fear learning. Finally, mediational evidence demonstrated that key dimensions of the model-observer relationship—in terms of model believability and self-model similarity—behave as key psychological underpinnings of vicarious fear learning. These process variables were explored more extensively in Study 2.

Study 2

Study 1 demonstrated that vicarious fear learning is powerful, and that the believability of the model, as well as the participant's perceived self-model similarity, are important factors in this type of learning. This finding is consistent with, and provides empirical support for, Bandura's social learning theory (1977), which predicts that individuals will learn vicariously more when they observe a model that is similar, rather than dissimilar, to them (Bandura, 1971; Brown & Inouye, 1978; Rosenthal & Zimmerman, 1978). This is because similar others are perceived as a more valid and reliable source of information about appropriate and normative responses in a given context (Schunk & Hanson, 1985). Hence, it would be expected that the more similar a model is perceived to be to an observer, the more likely the observer should deem the model's behaviors to be acceptable and a suitable guide to behavior (Zimmerman & Koussa, 1975).

Study 2 focused on vicarious learning and investigated the role of similarity between the observer and model along the focal dimension (ethnicity) using both a moderation and mediation approach. With a moderation-of-process design in mind (Spencer et al., 2005), *objective* observer-model similarity was experimentally manipulated by recruiting White and Asian participants and systematically varying the model's ethnicity so that half of each ethnic participant group observed a same-ethnicity model (White-White; Asian-Asian) and the other half observed a different-ethnicity model (White-Asian; Asian-White). Drawing on Bandura's tenet, it was expected that the participant's and model's ethnicity would qualify the basic Time x Stimulus interaction that was found in Study 1. Specifically, it was expected that a four-way interaction (Time/Stimulus/Participants' ethnicity/Model's ethnicity) would reflect greater learning in the White-White and Asian-Asian conditions than in the White-Asian and Asian-White conditions. However, since judgments of self-model similarity can be made on a number of bases other than ethnicity, the study also included measures of *perceived* self-model similarity along ethnicity, age, and gender and once again tested for mediation using a measurement-of-process design (Spencer et al., 2005) to ascertain whether individuals who display more vicarious fear learning do so *because* they have higher perceived self-model similarity.

Study 2's design also made it possible to assess possible minority-majority asymmetries in vicarious fear learning. Because majority individuals are encountered -- by definition -- more often in society than minority individuals, and typically have also higher status (Philpott & Hess, 2007), both majority and minority individuals may have a readiness to learn from them. Hence, they may be considered experts across a variety of domain areas, especially in the eyes of minority group members. In contrast, since minority individuals are less common and rarely have a position of authority, only other minority individuals (vs. both minority *and* majority individuals) may have a readiness to learn from minority ethnic models (see Gomez & Huici, 2008 for an analysis of authority in vicarious learning processes). Follow-ups to a significant Time by Stimulus by Participant and Model Ethnicity interaction will clarify if these majority-minority asymmetries along ethnicity hold in vicarious learning settings. To my knowledge, this research is very first at testing these important social dimensions to vicarious aversive learning in general and with reference to ethnicity in particular.

To summarize, it was predicted that, especially majority individuals, participants would learn more from models of similar ethnicity and that perceived self-model similarity would once again mediate the vicarious learning of outgroup anxiety. Moreover, the results were expected to replicate Study 1's moderating effects of quality of prior outgroup contact and chronic outgroup anxiety.

Method

Participants

Participants were 127 students (43 males; 84 females; *M* = 22.48 years, *SD* = 3.31), including 64 White and 63 Asian, from a large regional Australian university, who received course credit or AU$20 reimbursement for their participation. The study had a 2 Participant Ethnicity (White/Asian) x 2 Model Ethnicity (White/Asian) x 2 Stimulus (CS+/CS-) x 2 Time (Pre/Post) design, with Stimulus and Time as repeated measures. There were between 31 and 32 participants per cell.

Stimulus Materials

The apparatus and materials were identical to those used in Study 1 except for the use of an additional training video, depicting a model of Asian appearance (see Appendix I). To develop this training video, four female Asian models were filmed and a pilot test was conducted to select the most convincing video sequence, and ensure that the Asian model was comparable to the White model used in Study 1 (see Appendix G)and to be used again in Study 2 with half of the White and Asian participants. Fifteen White and eleven Asian participants rated the four videos on model believability, anxiety, and reliability (1 = *not at all*, 7 = *very much*). The video sequence that was rated by participants as significantly more believable (M = 6.60, SD = .90), F (3, 72) = 7.66, p = .04, η_p^2 = .61, reliable (M = 5.18, SD = 1.10), F (3, 72) = 7.35, p = .04, η_p^2 = .60, and anxiety inducing (M = 5.15, SD = 1.32), F (3, 72) = 20.47, p < .001, η_p^2 = .58, was selected. Participant ethnicity did not qualify these effects, all *p*s > .13, meaning that both White and Asian participants rated the chosen video as comparable on these dimensions. When the ratings for the selected Asian model were compared with the ratings for the White model, paired samples t-tests across all participants confirmed that model's ethnicity did not qualify these ratings either, all *p*s > .20.

Procedure

The pre-laboratory online questionnaire contained Study 1's items surveying the quality of prior outgroup contact, and chronic anxiety towards Black people. To improve on the single-item chronic anxiety index, this study added Stephan and Stephan's (1985) intergroup anxiety scale (all ratings, 1 = *not at all*; 7 = *very much*). Exploratory factor analysis confirmed two related, r (122) = .652, yet distinct factors, conveying *quality of prior outgroup contact* (7 items, α = .60; see Appendix D) and *chronic outgroup anxiety* (5 items, α = .93; see Appendix J). Participants reported moderate quality of prior outgroup contact (M = 4.71, SD = 1.12), and low chronic anxiety (M = 2.78, SD = 1.18) towards Black people.

The learning task procedure was identical to that used in Study 1's vicarious learning condition. To manipulate objective self-model ethnic similarity (vs. dissimilarity), participants were randomly assigned to a condition where they watched a model of either the same or different ethnicity as themselves. This meant half of the participants watched the video of the White model used in Study 1, and the other half watched the new video of the Asian model. After post-test, participants completed a brief questionnaire about the video including an enlarged set of items for perceived self-model similarity, along ethnicity ("I think the research participant has a similar ethnicity to me"), age ("I see the research participant as being a similar age to me"), and gender ("I see the research participant as having a similar gender to me"; all ratings, 1 = *not at all*, 7 = *very much*). Participants reported averaged self-model ethnic (M = 3.64, SD = 1.97), and age similarity (M = 3.77, SD = 1.65), and high self-model gender similarity

(M = 5.97, SD = 1.66; rs ranging between .016 and .466; see footnote 8).

Results and Discussion

The skin conductance data were subjected to a 2 Participant Ethnicity (White/Asian) x 2 Model Ethnicity (White/Asian) x 2 Stimulus (CS+/CS-) x 2 Time (Pre/Post) mixed model ANOVA, with Stimulus and Time as repeated measures. The ANOVA revealed a significant two-way interaction between Stimulus and Time, F (1, 123) = 89.02, p < .001, η_p^2 = .42. An unexpected difference between the CS+ and CS- was detected at pre-test, t (126) = -2.29, p = .02, reflecting higher SCRs to the CS- (M = .22, SD = .62), than CS+ (M = .14, SD = .41). This difference, however, was overridden by the aversive vicarious learning effect. As expected, at post-test, the SCR to the CS+ was significantly higher (M = 2.99, SD = 3.12) than the control CS- (M = .68, SD = 1.45), t (126) = 8.58, p < .001. This pattern was evidence of a basic vicarious aversive learning effect across all participants.

The Participant Ethnicity by Stimulus by Time three-way interaction was also significant, F (1, 123) = 14.52, p < .001, η_p^2 = .11, indicating that participants responded differently to the vicarious learning experience depending on their own ethnicity. When followed up along ethnicity, the Stimulus x Time interaction was found to be larger for Asian, F (1, 62) = 51.15, p < .001, η_p^2 = .45, than White participants, F (1, 63) = 32.46, p < .001, η_p^2 = .34. The three way-interaction between Model Ethnicity, Stimulus and Time was also significant, F (1, 123) = 12.57, p < .001, η_p^2 = .09, reflecting the fact that participants responded differently depending on the ethnicity of the model that they observed. The Stimulus x Time interaction was larger for the White model, F (1, 62) = 52.91, p < .001, η_p^2 = .46, than the Asian model, F (1, 63) = 27.22, p < .001, η_p^2 = .30, suggesting that, on average, majority group models resulted in greater vicarious aversive learning. Since extra care was taken during pilot testing to equate the White and Asian models on a variety of important social perception variables, this effect is unlikely to reflect a mere video clip effect.

Contrary to predictions, the four-way interaction between Participant Ethnicity, Model Ethnicity, Stimulus and Time was not significant ($F < 1$) – power analysis confirms that this is not due to insufficient power (see Footnote 6). However, when perceived self-model similarity along *ethnicity* was entered as a covariate to test for its causal involvement (Judd et al., 2001; Yzerbyt et al., 2004), the results revealed a pattern that was indicative of a suppression effect (for explanations that suppression effects reflect mediation, see Judd & Kenny, 1981; MacKinnon, Krull, & Lockwood, 2000; MacKinnon, Lockwood, Hoffman, West & Sheets, 2002): The expected four-way interaction was not significant without the covariate; it approached significance when the covariate was entered, *from* $F < 1$ *to* $F(1, 100) = 3.52$, $p = .06$, $\eta_p^2 = .03$ (see footnote 9). Similar but slightly weaker suppression patterns were found when the indices of perceived self-model similarity along gender and age were entered as covariates, for gender: *from* $F < 1$, *to* $F(1, 100) = 2.89$, $p = .09$, $\eta_p^2 = .03$; for age: *to* $F(1, 100) = 2.55$, $p = .11$, $\eta_p^2 = .03$. This evidence suggests that *perceived* self-model similarity along ethnicity and, to some degree, along age and gender, all acted as the psychological mechanisms of the vicarious learning effects that had been elicited through the objective manipulation of observer-model similarity along ethnicity.

The four-way interaction was followed-up by assessing the Stimulus x Time interaction separately in the four combinations of the two between-subjects factors (Participant Ethnicity and Model Ethnicity) with four 2 Stimulus x 2 Time ANCOVAs having self-model ethnic similarity entered as a covariate. These effects are displayed in Figure 4. The two-way interaction between Time and Stimulus was always significant for Asian participants, independent of model ethnicity; with the White model, F (1, 19) = 7.762, p = .012, η_p^2 = .29; with the Asian model: F (1, 19) = 11.188, p = .003, η_p^2 = .371. For White participants, the interaction between Time and Stimulus was significant only with the White model, F (1, 29) = 7.626, p = .01, η_p^2 = .208, but not with the Asian model, F (1, 30) = 1.73, p = .30, η_p^2 = .05. As expected from a majority-minority asymmetry perspective, this pattern reflected no significant differences between the CS+ and CS- at pre-test, all ps > .16, and significant differences at post-test in all conditions, ps < .001, except the White participants-Asian model condition, p = 59. In this latter condition, participants displayed a stimulus non-specific increase in anxiety indicative of non-associative learning (Rescorla, 1988). Overall, these results indicate that majority-minority differences exist in vicarious aversive learning of outgroup fear, such that self-model ethnicity similarity is potentially more critical for majority than minority individuals. Perceived self-model ethnic similarity moderated (see Figure 4) and mediated (see ANCOVA results) vicarious learning, such that individuals learnt better *if*, and *because*, they perceived themselves to be similar to the model that they observed.

Similar to Study 1, it was tested whether participants' prior histories of contact with the outgroup moderated the learning of interethnic anxiety. Once again, the quality of prior outgroup contact was found to be negatively correlated with differential changes in physiological arousal over time for the CS- vs. CS+ faces (r = -.42, p < .001), thus protecting against the development of outgroup fear during aversive learning. There was also, once again, a positive correlation between chronic anxiety towards Black people and the differential changes in physiological arousal (r = .24, p < .05), indicating that more chronic anxiety predicted larger increases in outgroup fear.

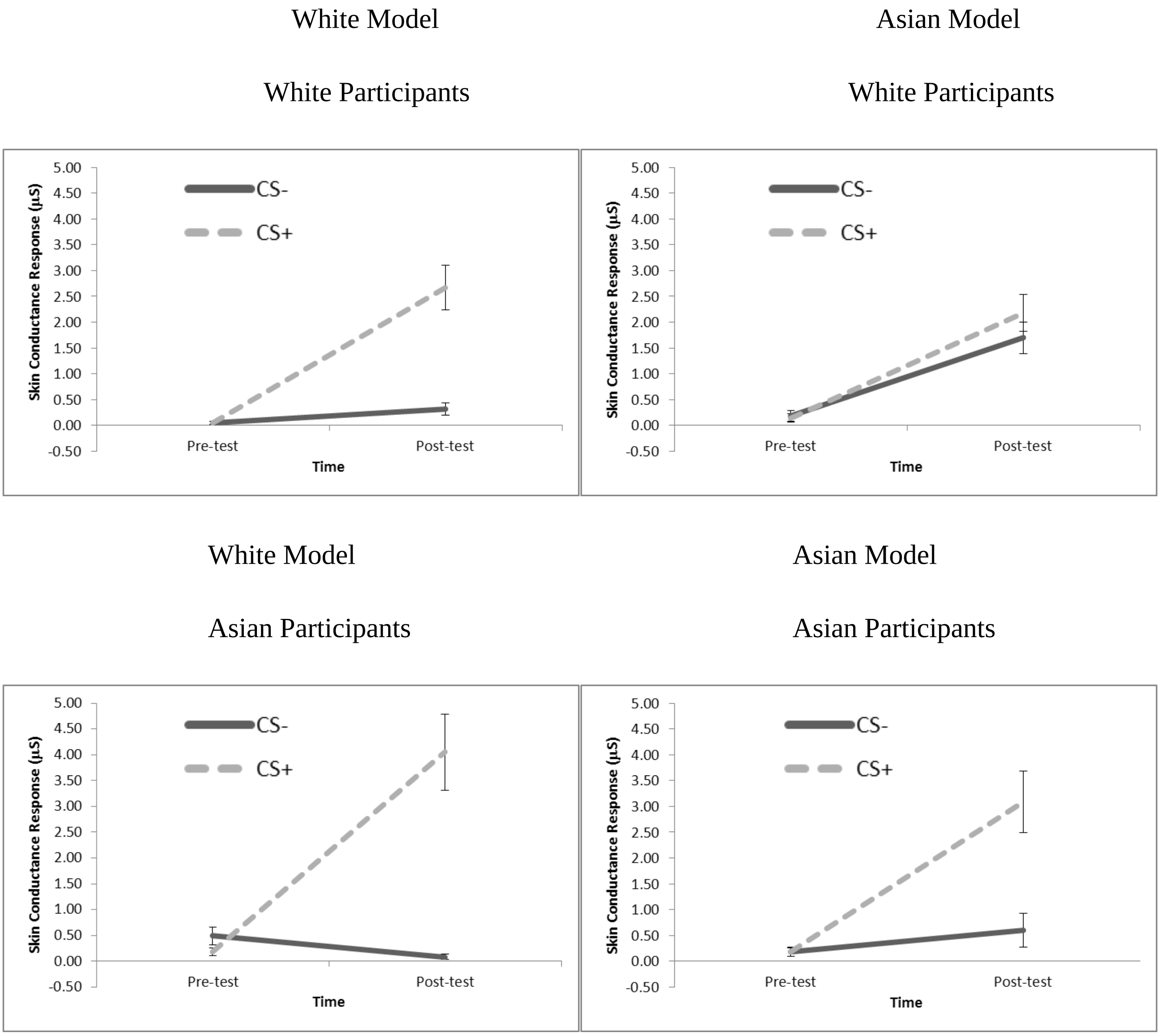

Figure 4. Physiological responses, SCR (μS), as a function of stimulus, time, participant ethnicity and model ethnicity, with observer-model ethnicity entered as a covariate (Study 2).

General Discussion

This research makes a significant contribution to the literature on outgroup fear and intergroup anxiety and to the growing understanding of the involvement of associative learning mechanisms in key intergroup phenomena. In two studies, these data showed experimentally that individuals learn to become fearful of ethnic outgroup individuals through mere observation of models displaying fear when exposed to outgroup relevant stimuli. This vicarious learning of outgroup fear was found to be comparable in size to that triggered by first-hand aversive learning. Moreover, these studies found evidence that learning was driven by perceived similarity between the self and the model; that it is exacerbated by chronic anxiety expectations associated with the outgroup, but attenuated by the individual's quality of prior outgroup contact. Below, I will elaborate on the key implications of these findings for theory and interventions.

Experimental Evidence of Vicarious Learning of Outgroup Fear

Both of the experimental studies provide incisive evidence that individual's can 'catch' outgroup fear and anxiety vicariously by simply observing others' fear and anxiety. This pattern of findings was observed among both White and Asian participants exposed to faces of Black individuals systematically paired (vs. unpaired) with a noxious stimulus. This contribution goes over and above previous research showing that individuals can vicariously learn from and behave similarly to a model that they feel *a sense of merged identity with* (Goldstein & Cialdini, 2007). Unlike previous research, these two studies did not attempt to create a merged identity between observer and model. The participants merely observed an *unfamiliar* model's behavior and yet displayed fear learning towards outgroup stimuli.

Interestingly, Study 1 reveals that the magnitude of aversive learning through observation is similar to that attained through direct, first-hand experiences; this was not a byproduct of insufficient power. As such, this finding contradicts the prediction from the social psychological literature that first-hand learning should have larger effects on behavior than socially mediated learning (e.g., Christ et al., 2010; Fazio, 1990; Lolliot et al., 2014; Paolini et al., 2007). Instead, it contributes evidence towards a theoretical proposition, originally stemming from animal learning research (Galef, 1988; Heyes, 1994) and more recently embraced and tested in human learning research (Olsson & Phelps, 2004; Olsson et al., 2007), that the two types of learning are similar on several aspects. Critically, a recent functional imaging study has confirmed that, in humans, the amygdala—the core circuitry underpinning first-hand fear conditioning—is also activated during vicarious learning of an arbitrary signal of fear (geometrical shapes; reviewed by Phelps & LeDoux, 2005). The study provides ground-breaking neural evidence that direct and vicarious learning processes engage the same associative learning mechanisms (Olsson et al., 2007), as was suggested by an earlier psychophysiological analysis (Olsson et al., 2004).

By demonstrating that vicarious aversive learning recruits contingency-driven mechanisms (i.e., the attendance of US-CS pairings) and that socially mediated aversive learning is of similar magnitude to direct aversive learning, this research makes an important contribution to emerging human data (Olsson & Phelps, 2004; Olsson et al., 2007), and—for the first time—extends methodologies and conclusions to an ecologically socially relevant context, that of ethnicity-based relations. These studies demonstrate that the basic and fundamental learning processes that are involved in the learning of fear of arbitrary stimuli or ingroup individuals contribute, and are recruited also when learning to be fearful of individuals of outgroups – individuals of groups to which we do not belong.

While direct and vicarious learning of outgroup fear were found to be of comparable magnitude in this research, I am far from arguing that these two modes of learning share the same social weighting: Vicarious learning is likely to have far broader implications for intergroup relations at a societal level than direct learning

(Wright et al., 1997). As individuals, not only do we learn from others whom we observe, but others also learn from us. As such, vicarious learning, unlike direct learning, which stops with the recipient, can produce a chain reaction that amplifies the effects of one individual's aversive direct experience in a ripple effect and well beyond the individual's own experience.

An interesting avenue for future research is to compare and contrast different types of indirect exposure to outgroups. This research involved participants vicariously observing an ingroup or outgroup model's behavior first-hand; other forms of indirect exposure involve hearing second-hand verbal accounts (Norton, Monin, Cooper, & Hogg, 2003), or even simply imagining intergroup contact (Turner, Crisp & Lambert, 2007). It will be interesting to compare this chapter's mode of vicarious exposure with these other modes of indirect contact to see the extent to which the underlying mechanisms are shared vs. distinctive, as well as whether they are equally or differentially effective at modifying intergroup anxiety towards various outgroups associated with negativity. Obviously, these different modes of vicarious exposure map onto different phenomena in society (i.e., observation vs. heresay vs. conjecture), and therefore are deserved of deeper investigation in their own right.

At the broadest level, this research highlights the significant contribution that vicarious fear learning can play in the *deterioration* of ethnic-based relations in society and in the exacerbation of intergroup friction and negativity (see Weisbuch et al., 2009). Against a backdrop of extensive research on the merits of interventions designed to *reduce* outgroup fear, outgroup anxiety and threat of the outgroup towards the amelioration of intergroup relations (Paolini et al., 2004, 2006; Pettigrew & Tropp, 2006; Turner et al., 2007), the present data offer an insight onto the learning mechanisms responsible for the *development* of unproductive responses to outgroups (e.g., Blascovich et al., 2001; Greenland et al., 2012; Major & O'Brien, 2005; Trawalter, Richeson, & Shelton, 2009; for a review of data on the psychophysiology of intergroup interactions, see Paolini, Harris, & Griffin, 2015; Chapter 1). It is well established that outgroup fear and anxiety hinders smooth interactions between members of opposing groups; it encourages outgroup avoidance and works as the catalyst for outgroup prejudice. This chapter and its research explains how these aversive responses can develop in the first place.

Self-Model Similarity Mediates and Moderates Vicarious Learning of Outgroup Fear

This chapter's studies also investigated the involvement of self-model similarity on learning processes. It was found that *perceived* self-model similarity *mediated* the acquisition of vicarious interethnic anxiety learning in a standard mediational way in Study 1 and in a suppression fashion in Study 2, such that the more similar participants perceived themselves to be to the model, the greater their receptivity to the modeling of fear learning. Broadly, Study 2's findings confirm that *objective* observer-model similarity (vs. dissimilarity), as operationalized in terms of systematic differences in participant and model ethnicity, moderated vicarious outgroup fear learning (see below for further qualifications). Altogether, this evidence provides support for social learning theory and social learning theory-based interventions (Bandura et al., 1963a, b; Griffin, 2004; 2008; Mineka & Cook, 1988; Olsson & Phelps, 2004; Olsson et al., 2007) and extends this research to ethnic-based relations.

The manipulation of *objective* observer-model ethnic similarity in Study 2 was instrumental in demonstrating that, as predicted, individuals' ethnicity and model's ethnicity moderated the magnitude of vicarious learning of outgroup fear. First, across both White and Asian participants, greater vicarious learning was found with majority group models than minority group models. As this study carefully constructed the White and Asian models' videos to equate on several important perceptual dimensions, it is unlikely that this effect – as considered against the more complex higher-order interaction involving participant ethnicity and model ethnicity captured by the analysis of covariance – is a byproduct of the experimental materials' shortfalls in stimulus sampling (Wells & Windschitl, 1999). This pattern of results, in fact, is in line with research showing that members of majority groups enjoy greater social authority (e.g., Smith, 2002) and suggests that majority models typically trigger greater learning, perhaps because they are perceived to be a more valid, reliable, and normative source of information. Future research should establish the invariance of these findings with further systematic variations in the complex relationships between whom we learn *from* and who we learn *about*. In this chapter, it has been examined how White and Asian individuals in Australia learned about a shared outgroup (Black individuals). Future research could test, for example, whether majority group members remain the most valued models when minority individuals learn to become fearful of other ingroup (vs. outgroup) members (e.g., Asian individuals learning about Asian individuals from White vs. Asian models).

Second, this chapter found that Asian individuals in Australia were generally more vulnerable to vicarious learning of fear of Black individuals than their White counterparts—i.e., they learnt to become fearful of the minority outgroup irrespective of the ethnicity of the model; whereas White individuals learned only when exposed to a White (vs. Asian) model—at least when accounting for variability in perceived ethnic self-model similarity. While future research should establish the generalizability of these findings to other ethnic groups and social contexts, this evidence suggests the intriguing possibility that members of minority groups are more vulnerable to 'catching' fear of other minority groups in society through observation of both ingroup members or outgroup members. Due to histories of stigmatization and social disadvantage resulting in minorities' suspicions over other group members' intentions during inter-ethnic contact (Tropp & Pettigrew, 2005), negative experiences of contact are likely to be relatively frequent among minority members (for some discussion of minority-minority relationships, see Barlow, Sibley, & Hornsey, 2012). Research on minority-minority relationships is very scarce in the intergroup psychology literature and will benefit from investigations onto whether a greater prevalence of negative contact experiences by minority individuals, combined with a greater readiness to vicariously learn to become anxious of other minority outgroups, offers a serious basis for social unrest in modern multi-ethnic societies. The present work contributes to initiate this analysis by demonstrating that theoretical analyses and applied programs managing vicarious learning in intergroup settings (e.g., inter-ethnic relations in the media, on social networks; Harwood, 2010) must take into account both observer and model ethnicity and their reciprocal relationship.

Importantly, the results speak of the composite and multidimensional nature of individuals' appraisals of self-model similarity in real social settings characterized by multiple and cross-cutting social categories (Crisp & Turner, 2012). The mediational analysis in Study 1 relied upon a coarse, global measure of observer-model similarity (i.e. a single item question "overall, I see the research participant as being similar to me"). This measure proved nevertheless to work as a straight mediator of basic fear learning effects. The subsequent experimental manipulation of self-model similarity along a single dimension—ethnicity—in Study 2, on the other hand, failed to isolate simple evidence for the higher order interaction expected to capture moderation of basic fear learning effects by ethnic self-model similarity. Further analyses, however, were the key to understanding why this simple moderation effect failed to materialize: Suppression analyses in Study 2 indicated that the participants appraised self-model similarity along a multitude of dimensions, including ethnicity, age, and gender. Thus, ethnicity—at least among the White and Asian participants—was just one component of an integrated multidimensional perception of self-model similarity. Thus, self-model similarity is possibly more amenable to coarse and global assessments like that used in Study 1 and that explained variations in the magnitude of vicarious aversive learning.

In addition to unraveling the multidimensional nature of perceived self-model similarity, this work elucidated its possible links with other theory-driven global evaluations of the model. In Study 1, it was found that perceived model believability did parallel the effects of perceived self-model similarity, and also acted as a significant mediator of vicarious fear learning. Together with previous work indicating that people find models more similar to themselves more believable (Vaughan & Lanzetta, 1980), this finding suggests that the reason why self-model similarity facilitates vicarious learning is that it makes the model more believable, thereby increasing the impact of the model on the observer. Coming back to Olsson et al.'s (2007) ground-breaking functional imaging analysis of brain activity during human vicarious learning, the activation patterns they found included, beyond the amygdala, other neural circuits (i.e., medial pre-frontal cortex and superior temporal sulcus) that are traditionally implicated *in thinking about the mental states of others* and more generally in social cognition (Gallagher & Frith, 2003). Future research should establish if appraisals of model believability and self-model similarity are underpinned by the activation of these additional circuits during the vicarious experience. Also, Study 2 tested the involvement of ethnic self-model similarity using a 'moderation-of-process design' *plus* a ‘measurement-of-process design’ (Spencer et al., 2005), but only the latter (i.e., a within-subject designs’ extension of the Baron and Kenny’s, 1986, traditional approach as by Judd et al., 2001; Yzerbyt et al., 2004) for model believability. Future investigations into the mechanisms of vicarious learning may extend the application of the more stringent approach that was used here with self-model similarity to investigate the multiplicity of dimensions that are likely to contribute to individuals’ appraisals of model believability in ethnicity contexts and other social contexts.

Quality of Prior Outgroup Contact Protects and Chronic Outgroup Anxiety Predisposes to Learning

The present research is also the very first to establish that vicarious learning of outgroup fear and anxiety is shaped by the individual’s own repertoire of past experiences and expectations about the outgroup—thus, adding to extant evidence for *direct* aversive learning *only* (Olsson et al., 2005; Page-Gould et al., 2010; Trawalter et al., 2012). In both studies, it was found that the magnitude of vicarious aversive learning significantly correlated with the quality of prior outgroup contact experiences, as well as with expectations of chronic anxiety to the outgroup. Consistent with Paolini’s (2008) and Paolini et al.’s (2015) learning model of outgroup anxiety (Chapter 1), the quality of prior outgroup contact entertained a negative relationship, and chronic anxiety a positive relationship, with vicarious aversive learning effects. This means that the quality of contact with the outgroup prior to undergoing aversive conditioning acted as a protective factor against new anxiety learning, decreasing one’s proclivity to vicariously acquire new anxiety towards outgroup members. By the same token, chronic expectations of anxiety associated with the outgroup acted as a risk factor, exacerbating the vicarious learning of new anxiety towards individual outgroup members. These effects have important practical implications as they clarify what intergroup conditions must be fostered and which conditions must be fostered towards more harmonious intergroup relations.

These correlations with prior *outgroup* contact and chronic *outgroup* anxiety also shed a light on the kind of fear and anxiety responses gauged with this particular conditioning paradigm. Previous conditioning research has isolated outgroup-ingroup asymmetries in direct fear learning, showing a readiness to become fearful of outgroups, more than fearful of ingroups (e.g., Olsson et al., 2005). Like Plant and Butz (2006), this research focused on outgroup fear and anxiety only, and delved with differences and similarities between different forms of aversive learning (direct, first-hand vs. indirect, vicarious). Finding that the physiological arousal that was measured was systematically correlated with unequivocally ethnicity-related measures (e.g., quality of prior *outgroup* contact and chronic *outgroup* anxiety) provides credence to the notion that the responses that were assessed here were outgroup relevant responses, rather than merely social or non-social fear responses.

In light of the finding involving past outgroup contact, one might be tempted to think that negative vicarious experiences are potentially critical only in relatively isolated (e.g., Tuvalu) or segregated societies (e.g., Northern Ireland, Cyprus, South Africa; Christ et al., 2010; Turner et al., 2007), where direct experiences with outgroup members are relatively uncommon or discouraged. Instead, there may well be an accelerating trend for their impact in *all* modern societies. In contexts where modern technologies, mass communication, and social media are wide-spread, and potentially more accessible, vicarious learning is likely to become progressively more common and more influential in shaping social attitudes and behaviors.

It is difficult to predict whether vicarious learning is a better recipe for social degradation or for social repair. It is possible that the accelerating trends in modern societies of mass-mediated communication for the *negative* side of vicarious learning that were investigated here may apply equally to the *positive* forms of vicarious learning, like those involved in extended contact and indirect cross-group friendship effects (Paolini et al., 2007; Turner et al., 2007; Wright et al., 1997). Over a century of conditioning research, however, points towards a more pessimistic outlook: It indicates that negative experiences are learnt fast, and are hard to extinguish (Fanselow, 1990), whereas positive experiences take longer to learn and are quicker to extinguish (Balsam, 1984). This extant (not necessarily intergroup) literature suggests at least a note of caution, if not the prospect of a net overall increase in negative influences over time—making the present research timely, relevant, and advanced.

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Footnotes

6. Our power estimates were based on conditioning research using similar methods. Olsson et al. (2005) used an *n* of 35 per cell when investigating *direct* fear learning of *outgroup* faces; Olsson et al. (2007) an *n* of 11 when investigating *vicarious* fear learning of *geometric* shapes, and Olsson and Phelps (2004) an *n* of 29 per cell when comparing direct and vicarious fear learning of masked and unmasked angry faces. Power estimates computed with G*Power for a 2 x 2 (Study 1) and a 2 x 2 x 2 (Study 2) mixed model design aimed at detecting a Cohen's moderate effect size of .25 with an alpha value of .05 indicated that this study needed a total of 66 participants in Study 1 and a total of 68 in Study 2. Hence, Study 1 had adequate power and Study 2 was overpowered.
7. The larger pool of faces (presented once at pre-test and again at post-test) were included to investigate research questions regarding generalization of effects from the target stimuli to other Black outgroup faces. As this area of inquiry is beyond the scope of this article, these data won't be discussed here; it is the focus of this thesis' discussion elsewhere (Chapter 3).
8. The conditions did not differ in variability on self-model similarity along ethnicity, Levene's F (3, 122) = .526, p = .666, or age, Levene's F (3, 122) = 1.112, p = .347, but did on self-model similarity along gender, Levene's F (3, 122) = 6.476, p < .001, due to a few more male participants in the White participant-Asian model condition.
9. A suppression effect occurs where a third variable (*the suppressor*—in this case self-model ethnic similarity), when excluded from the model, hides or suppresses a key effect between the focal variables (participant's and model's ethnicity on SCRs), making it appear smaller or of opposite sign. However,

when the suppressor is accounted for in the model, the key effect strengthens. Critically, while the statistical effects of a suppressor and (standard) mediator variable are starkly different (increases vs. reductions of the effect), both can equally enjoy the causal status of psychological underpinning of the effect (for an extensive discussion, MacKinnon et al., 2002).

Chapter 3.

Similarity Helps: Similarity Underpins Generalization of Outgroup Anxiety During Aversive Observational Learning

Social psychology has a long history of interest in generalization, or transfer of experiences from familiar to new stimuli (Reber, 1988). One notorious study of generalization was conducted by Watson and Rayner (1920), who taught a child, Little Albert, to fear a white rat by making a loud sound each time Albert saw it. Before any such rat-aversive sound pairings, Albert showed no fear reactions to the rat or to an array of other stimuli, including a rabbit, a dog, or cotton wool. However, after Little Albert developed a fear of the white rat via associative learning, this fear generalized to similar-looking stimuli, such as a white rabbit and cotton wool (Watson & Rayner, 1920). From these empirical studies, one can derive the potential implications of generalization for intergroup relations; experiences with a single outgroup member can impact one's perception, attitudes, stereotyping, prejudice and anxiety towards the entire outgroup. Hence, understanding the underlying mechanisms of generalization could potentially explain intergroup phenomena such as inter-group tension, anxiety, and discrimination. In particular, understanding which factors within an inter-group interaction determine whether, and how much generalization occurs may allow us to design interventions that maximize intergroup harmony. Hence, understanding the mechanisms underpinning generalization of intergroup anxiety, and, in particular the role of stimulus-stimulus, and participant-model similarity, constituted the aims of the present research.

Generalization

Individual-to-group generalization involves the transfer of experiences from an individual outgroup member to the entire outgroup (Paolini, Hewstone, Rubin, & Pay, 2004), and is a well-established phenomenon within the literature. Studies have consistently demonstrated that experiences with an individual outgroup member influence one's perception of the entire outgroup (Herek & Capitanio, 1996; Paolini, Crisp, & McIntyre, 2009; Voci & Hewstone, 2003; Wright, Aron, McLaughlin-Volpe, & Ropp, 1997). In a study of homosexual attitudes, Herek and Capitanio (1996) found that individuals who reported a higher incidence of individual level contact with homosexual individuals reported more positive attitudes towards homosexuals in general. A recent meta-analysis of 515 studies and 713 independent samples revealed that contact with outgroup members is positively correlated with attitudes and prejudice towards the entire outgroup, indicative of individual-to-group generalization (Pettigrew & Tropp, 2006). Hence, experiences with individual outgroup members have been shown to affect evaluations of the entire outgroup. However, to fully understand individual-to-group generalization, one must first understand individual-to-individual generalization, which is the transfer of experiences from an individual outgroup member to a new *individual* outgroup member (e.g., Ranganath & Nosek, 2008). In the example given above, this might mean that a positive experience with one homosexual individual will positively influence a future contact experience with a new, unfamiliar homosexual individual.

Generalization and Observational Learning

Despite the abundant literature on generalization, there have been no investigations of generalization under conditions where learning occurs observationally.

Both direct and observational learning share common properties (Olsson & Phelps 2007), which provides a basis from which to predict how generalization should occur in an observational design. Empirical research examining the properties of direct learning has long established that similarity between experienced stimuli and new ones underpins generalization (Moore, 1972). Consequently, one might expect similarity to also operate in generalization during observational learning, but to the best of my knowledge, this prediction has not been tested.

Both direct and observational designs can measure generalization along a gradient (Honig & Urcuioli, 1981). Generalization along a gradient involves the transfer of an individual's response to new stimuli that look slightly different to the experienced stimulus. For example, after learning about an initial stimulus (e.g., a Black-African face), another stimulus may be shown (e.g., a morphed version of the original Black-African face). This new face is similar, but does not share all of the initial face's features (e.g., color/shade, elongated nose, eyes further apart, etc.). Generalization along a gradient suggests that transfer of learned responses from the experienced face to the new face will be all the greater that the new face is similar to the experienced face (Till & Priluck, 1999). Mechanisms of generalization along a gradient have been studied extensively within the learning literature using arbitrary stimuli that have little ecological meaning (Honig & Urcuoli, 1981; Till & Priluck, 1999). To date, no studies have investigated how learned *intergroup* anxiety generalizes along a gradient. Rather, studies have investigated general anxiety or learned anxiety towards non-social stimuli such as circles of different sizes (Lissek et al., 2010).

Another method of investigating generalization is referred to as generalization to a new exemplar. Here, one presents a completely new stimulus, which shares group-defining properties (e.g., ethnicity as marked by black skin), but varies on individual features (e.g., face structure, eye position etc.) (Pettigrew, 2008). That is, generalization to a new exemplar involves the presentation of a new person that shares group membership, but looks quite different. For example, Zabrowitz, White and Wieneke (2008) demonstrated that exposure to outgroup faces increased the likeability of novel faces from that outgroup. Moreover, Dunsmoor, White and LaBar (2011) demonstrated that generalization is greatest to stimuli that are conceptually similar to a CS+ following direct fear learning. Hence, the degree of similarity between the experienced face and a new outgroup face in terms of group membership should influence generalization. In sum, similarity may underpin both generalization along a gradient and generalization to a new exemplar.

Similarity in Observational Learning

Although one can predict that there should be some overlap in the mechanisms underlying generalization within direct and observational learning, there are also some aspects unique to observationally learned experiences. In particular, in using another individual as a ‘model’ for how to behave, the model becomes an important facet of the experience. Consequently, the similarity between an observer and the model may influence generalization (Schunk, 1987). Work on non-intergroup observational learning has indicated that self-model similarity in terms of age (Barry & Overman, 1977), gender (Bandura, Ross, & Ross, 1963b; Weeks et al., 2005) and ethnicity (Pratt, Hauser, Ugray, & Patterson, 2007) plays a determining role in observational learning. Specifically, the more similar the observer perceives him/herself to be to the model, the more he/she learns from, or mimics, the observed model. However, this line of research has yet to be extended to the intergroup setting, as well as to the interethnic anxiety domain.

In addition to similarity, other factors may affect generalization when learning occurs observationally. In particular, subjective dimensions, such as perceived believability of the model, model anxiety, and participant anxiety, may provide additional influences. If the observer believes the model is reacting in a genuine manner, then they are more likely to learn from, and thus generalize, the observed model's responses (Grierson & Gallagher, 2009). Moreover, the perceived level of the model's anxiety may influence generalization, since more salient or intense model reactions (see US, defined below) are associated with increased observer responses (Cook & Mineka, 1990; Mineka & Cook, 1993). Finally, the participant's anxiety during the observation phase should influence learning and thus, generalization.

Study 1

This study investigated the role of similarity in generalization of observationally learned intergroup anxiety, including generalization along a gradient, generalization to a new exemplar, and learner-model similarity. It was elected to use an observational learning approach because not every individual has the opportunity to engage personally in intergroup contact due to isolation or segregation. Observational contact may also amplify the effects of an initial encounter and therefore, has the potential to reach a wider audience. This study adapted Olsson and Phelps' (2007) aversive observational learning paradigm in which participants observed a filmed model displaying fear and relaxation responses. The model used within this study exhibited a fearful reaction towards an image of one Black outgroup face (conditioned excitor, CS+, or unsafe face), while a different Black outgroup face evoked a response indicative of relief (conditioned inhibitor, CS-, or safe face). The model's reaction to each face played the role of an unconditioned stimulus (US).

Before and after observational learning, participants were shown a pool of eight Black faces. Of these, two were to become the training faces (CS+ and CS-). Four others were obtained by morphing the CS+ and CS- such that they became less Black and more racially ambiguous. Two successively more different-looking morphs (75% similarity, 50% similarity) were obtained for the CS+, and the CS- respectively, to measure generalization along a gradient. To measure generalization to new exemplars, two new Black faces were generated and displayed to participants. Participants were connected to psychophysiological equipment to measure skin conductance levels, a known measure of arousal, often utilized as an indicator of anxiety (Mallan, Sax & Lipp, 2009; Navarrete et al., 2009; Olsson, Ebert, Banaji & Phelps, 2005).

Participants' perceived self-model similarity was measured in both Study 1 (White university students) and Study 2 in order to test for the effect of self-model similarity on generalization using a mediation model. In addition, Study 2 manipulated the self-model ethnic similarity (match vs. mismatch) experimentally by using White and Asian participants, as well as a White and Asian model.

It was predicted that similarity would be critical to the generalization of interethnic anxiety. Specifically, it was predicted that participants would generalize their acquired arousal response along a gradient from the CS+ to its closest variation. For generalization to new exemplars, it was predicted that participants would generalize their acquired arousal response to the new Black faces. However, since one Black face (CS+) was paired with an aversive stimulus, whereas the other Black face (CS-) was not, it was predicted their arousal would generalize only if participants perceived the new Black face to be more similar to the CS+ than the CS-. Finally, it was expected that subjective dimensions of observational learning would mediate these similarity effects. Specifically, it was predicted that participants would display broader generalization when they perceived the model to be 1) more similar to them, 2) more believable, and 3) more anxious, and 4) when they self-reported themselves to be more anxious during the observation phase.

Method

Participants and Design

Thirty-two (11 male; 21 female) White Australians (mean age of 20.81 years, *SD* = 3.89) were recruited from a large regional university in Australia and provided course credit or offered AU$25 for their participation. The design was 2 Stimulus (CS+/CS-) x 2 Time (Pre/Post) repeated measures.

Apparatus and Stimulus Materials

Skin conductance levels were measured via an AD Instruments model ML116 GSR amplifier and AD Instruments model MLT116F stainless steel bipolar finger electrodes attached to the distal phalanges of the middle and ring fingers of the left hand in conjunction with a 0.05 M NaCl electrode cream to improve electrode contact. Respiration was also monitored to check for artefacts using an AD Instruments MLT1132 piezo respiration belt transducer attached around the chest. All physiological data were recorded with an AD Instruments Power lab Model 8/30 data acquisition system interfaced with a PC. Electric stimulations were administered using an AD Instruments MLADDF30 stimulating bar electrode. All face presentations were controlled automatically by a custom-built software program running in E-Prime version 2.0.

The face morphing software FaceGen (Singular Inversions, 2004) was used to create standardized faces of Black-African appearance. Faces were set to be of 25 year-old males with a neutral expression. A pilot study (*N* = 16) was conducted to select the faces that would act as the CS+ and CS- (i.e., paired vs. not paired with a model's fear and relaxation responses). The two chosen faces were comparable on attractiveness (*M* = 4.17, *SD* = .86; *M* = 4.22, *SD* = .88), anxiety (*M* = 2.16, *SD* = .97; *M* = 2.01, *SD* = .81) and typicality (*M* = 5.06, *SD* = .73; *M* = 5.16, *SD* = .82; all ratings 1-7), all *p*s > .20.

The final set of faces consisted of eight Black faces (se Appendix E). This included the CS+ and CS- (see Appendix F), two morphs of the CS+, two morphs of the CS-, and two other novel outgroup faces. In order to test generalization along a gradient, the CS+ and CS- were morphed along the ethnicity factor. One CS+ morph was generated by modifying the ethnicity parameter within FaceGen from Black (100%) to less Black (75% similar to original face), while the second CS+ morph was generated by making the ethnicity even less Black (50% similar to original face). The same procedure was applied to the CS-. This morphing procedure made each face appear less Black and more like the average of the four ethnicity groups available within FaceGen (i.e., a mixed race appearance of Asian, Black-African, Middle Eastern and White). All other facial characteristics (age, gender, symmetry etc.) remained constant between the original CS+ and CS- faces and their respective 75% and 50% similarity morphs. Finally, two new faces of Black appearance (100% Black) were also created in order to measure generalization to a new exemplar.

Procedure

Prior to attending the laboratory session, participants were asked to complete a short online questionnaire. Within the questionnaire, participants used a 7-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*) to indicate how similar they perceived each pair of Black faces that were to be presented in the laboratory testing session (see

Appendix K). Every pair of the larger pool of eight faces was presented once (28 pairs in total).

Participants were then invited to attend a two-hour laboratory testing session that they expected to investigate “how people become anxious”. Upon their arrival, participants were seated in a comfortable chair in front of a 17-in. flat screen Dell computer monitor that projected stimuli synchronized with a 60-Hz vertical refresh rate. Participants were asked to clean their fingers with a humidified wipe, after which a shock electrode was fitted to the distal phalange of the second digit of their left hand, while skin conductance electrodes with a thin layer of electrode cream were attached to the distal phalanges of the middle and ring digits of their left hand. A respiration belt was fitted around their chest to measure any breathing artefacts (e.g., coughing, sneezing) that can cause spurious variation in the skin conductance electrode trace (Greco & Baenninger, 1991). Participants then completed a “work-up” procedure to determine their individually selected level of shock to be delivered during the experiment. Participants were asked to select a level that was “uncomfortable but not painful” (Lovibond, Saunders, Weidemann, & Mitchell, 2007), within the equipment’s range of 1 to 20 mA. Although this was a vicarious learning study in which participants received no direct shocks, it was important that the participants believed that they were about to undergo the same procedure as the model in the video in order to ensure that they were motivated to learn from watching her. In addition, it was considered more ethical to make the participants aware of how a shock may feel rather than for them to proceed without this knowledge. Approximately 20 minutes after the physiological equipment was attached, in which time participants underwent the work-up procedure, were provided a brief demonstration and introduction to the physiological equipment, and listened to some relaxation music, physiological recording started.

A learning paradigm used in previous research (Olsson & Phelps, 2004) was adapted to investigate observational learning of ethnic anxiety. Participants were shown each of the eight Black faces in a randomized order to obtain baseline skin conductance levels. They then underwent observational training for which they were shown a video of a White female in her early twenties who was filmed, connected to the same physiological recording equipment and the shock electrode as the participants, viewing faces on a monitor in front of her and simulating receiving five CS+/shock and CS-/no shock pairings, as well as the resulting acquired anxiety (CS+, *unsafe face*), and relief (CS-, *safe face*) reactions to these outgroup faces (see Appendix G). All faces were presented for 10s, with an average inter-stimulus interval of 30 s (range 20-40 s). The original video sequence had been selected from a pool of four different videos filmed with two different actors based on pilot testing in which the actor's responses were rated by White participants (N = 6) on believability, reliability, and how much anxiety the actor's behavior induced (for more details, see Chapter 2). To allow participants to see the faces the model was responding to on her own monitor more clearly, the video was edited such that the model was presented on the left side of the participant's monitor and face stimuli on the right side. Participants were told that the face stimuli displayed on the right side of their screen were the stimuli that the model was observing on the computer monitor. Participants were told to "pay attention to both sections of the screen. That is, pay attention to both the behaviour of the participant, and also to what she is seeing on her screen." Participants were led to believe that they would undergo a similar experiment to the one the model was undergoing in the video following the conclusion of the video (i.e., they expected to view faces and to receive shocks). In reality, no shocks were administered to participants, which participants learned only at the conclusion of the study. To obtain post-training skin conductance levels to the set of eight faces, participants were shown the eight faces once again in a random order after conditioning.

After the learning task, the physiological equipment was removed so that the participants could complete a brief questionnaire regarding the video of the model they had observed. All items were answered on a 7 point Likert-type scale (1 = *not at all,* 7 = *very much*). A principal components analysis confirmed that the questionnaire's items measured distinct dimensions of the observational learning experience, including model believability (5 items, e.g., "the facial expressions of the research participant in the video appeared genuine", α = .88; see Appendix H), model anxiety (3 items, e.g., "in the segments of the video in which the research participant looked anxious or apprehensive, how anxious or apprehensive did she appear?" , α = .81; see Appendix L), participant anxiety (1 item, "how anxious or apprehensive did you feel while watching the video?") and perceived self-model similarity (1 item, "overall, I see the research participant as being similar to me"). Participants reported average self-model similarity (*M* = 4.06, *SD* = 1.80), and participant anxiety (*M* = 4.44, *SD* = 1.68), and high model believability (*M* = 5.11, *SD* = 1.34), and model anxiety (*M* = 5.24, *SD* = .95). These variables were predictably related (*r*s ranging between .123 and .553, median .263).

To ensure individuals left the laboratory without any heightened arousal and with positive reactions towards the outgroup, participants were reconnected with the physiological equipment so that their physiological responses to the CS stimuli were extinguished by repeatedly presenting the CS+ and CS- until they no longer evoked any skin conductance response (mean number of face presentations until responses extinguished: 20.34, *SD* = 7.28; range: 10-50 trials) and all participants watched a five minute video clip portraying Black people in a positive light.

All research procedures complied with the APA's human ethics guidelines, with the relevant approval provided by the local institutional review board for human research ethics (see Appendices B and C for ethics clearances, and Appendices M, N, O and P for participant forms).

Scoring of Skin Conductance Levels

Skin conductance levels were measured for each face presentation as the baseline to peak amplitude difference in skin conductance level (in μS) that commenced within the 1 to 4 s latency window following stimulus onset (Mallan, Sax, & Lipp, 2009). The minimum response criterion was 0.02 μS. Responses were screened for any breathing artifacts, such as coughing, sneezing and yawning, which are known to affect skin conductance (Greco & Baenninger, 1991).

Results and Discussion

Skin conductance levels to the face stimuli were analyzed using two different methods to investigate generalization along a gradient and generalization to a new exemplar, respectively. A 2 Stimulus (CS+, CS-) x 2 Time (pre-test, post-test) x 3 Similarity Gradient (Training faces, 75%, 50%) repeated measures ANOVA was used to analyze generalization along a gradient. All three two-way interactions were significant; Stimulus x Time, F (1, 31) = 24.54, $p < .001$, $\eta_p^2 = .44$; Stimulus x Similarity Gradient, F (2, 62) = 5.18, $p = .008$, $\eta_p^2 = .14$; Time x Similarity Gradient, F (2, 62) = 7.52, $p = .001$, $\eta_p^2 = .20$. The main effects of Stimulus, Time and Similarity Gradient were also significant, Stimulus, F (1, 31) = 25.88, $p < .001$, $\eta_p^2 = .46$; Time, F (1, 31) = 26.46, $p < .001$, $\eta_p^2 = .46$; Similarity Gradient, F (1, 62) = 5.17, $p = .008$, $\eta_p^2 = .14$.

Importantly, the ANOVA revealed a significant 3-way interaction between Stimulus, Time and Similarity Gradient, F (2, 62) = 5.03, p = .009, η_p^2 = .14; see Figure 5. When followed up along the Similarity Gradient factor, the Stimulus x Time interaction was found to be significant for the training faces, F (1, 31) = 13.34, p < .001, η_p^2 = .30, and the 75% similar variations, F (1, 31) = 23.56, p < .001, η_p^2 = .43, but not for the 50% similar variations, F (1, 31) < 1, p = .664, η_p^2 = .006 (see footnote 10). Paired samples t-tests revealed no significant differences between the training faces or their variations at pre-test, training faces, t (31) < 1, p = .520; 75% similar variations, t (31) = 1.52, p = .138; 50% similar variations, t (31) = -1.35, p = .188, indicating that the CS+ and CS- faces and their variations evoked similar levels of arousal before training. As predicted, however, the unsafe face (CS+) evoked a significantly greater skin conductance level relative to the safe face (CS-) after training, t (31) = 3.67, p < .001, as did the 75% similar variation relative to its CS- equivalent, t (31) = 4.91, p < .001, but not the 50% similar variation relative to its CS- equivalent, t (31) < 1, p = .723. Thus, participants displayed generalization from the trained CS+ face to its closest untrained variation, consistent with generalization along a similarity gradient.

To explore whether the generalization effect captured by the 3-way interaction between Stimulus, Time and Similarity Gradient was mediated by the key subjective dimensions of the observational learning experience identified within the principal components analysis (see above), these variables were included in turn as a covariate within the Stimulus x Time x Similarity Gradient ANOVA (Judd, Kenny, & McClelland, 2001). When entered into the analysis, perceived self-model similarity, model anxiety, participant anxiety and model believability all removed the 3-way

Table 3

Mediation results and correlations between mediators and generalization (Study 1)

	F	df	P	η_p^2	Generalization from CS+ to 75% Variation		Generalization from CS- to 75% Variation	
					r	p	r	p
Original Effect	5.03	2, 62	.009	.14				
Perceived Model Believability	1.70	2, 60	.191	.05	.310	.084	.237	.192
Self-Model Similarity	< 1	2, 60	.687	.01	.183	.317	-.171	.349
Model Anxiety	< 1	2, 60	.749	.01	.269	.136	.067	.710
Participant Anxiety	< 1	2, 60	.986	< .01	.245	.176	.017	.927

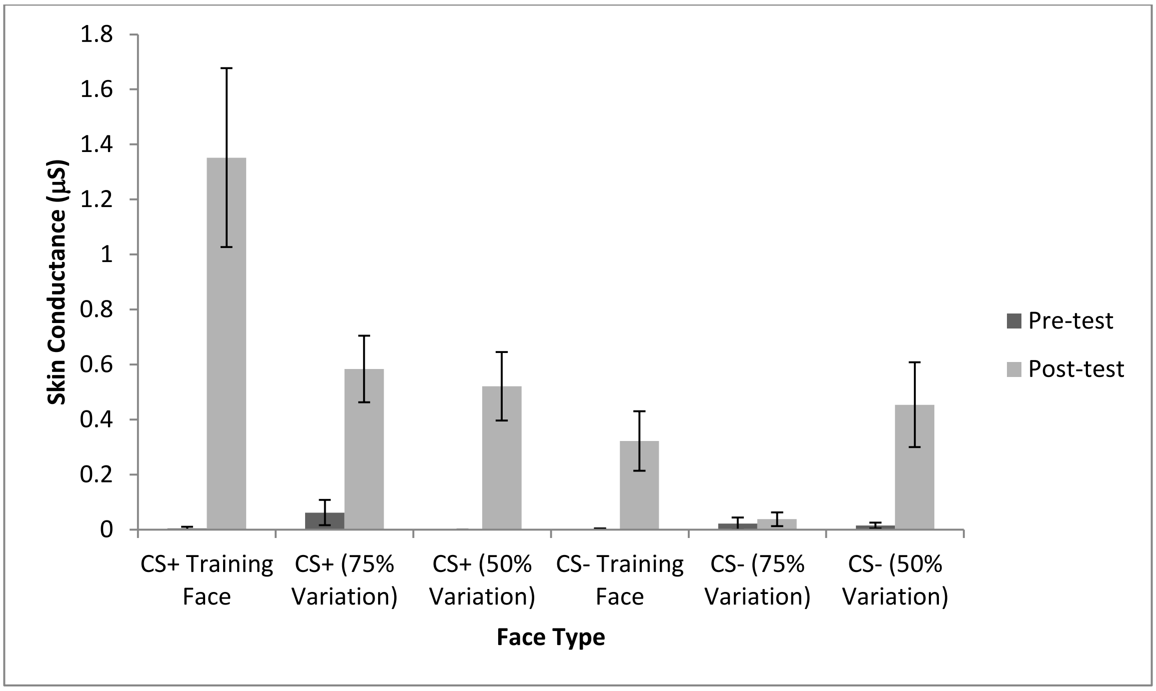


Figure 5. Three-way interaction between stimulus, time and similarity gradient (Study 1).

interaction (see Table 3), suggesting that these variables played an influential role in the generalization process.

In order to establish whether similarity operated on generalization in the expected direction (i.e., increasing generalization with increasing similarity), each of the covariates (self-model similarity, model anxiety, participant anxiety and perceived model believability) were correlated with an index of generalization to the most similar face. The index was calculated as follows, where SCL stands for skin conductance level:

Index Generalization = - ([post SCL for CS+] – [pre SCL for CS+]) – ([post SCL for 75% CS+ similarity variation] – [pre SCL for 75% CS+ similarity variation]).

This index encompasses a difference of two differences. The larger the first difference, the greater the acquired response to the CS+; the larger the second difference, the greater the acquired response to the non-trained 75% CS+ similar variant. Hence, large negative values indicate little generalization, while small negative values indicate increased generalization. If generalization is complete, then the index is equal to zero. Relationships between the subjective dimensions of observational learning and the breadth of generalization for the CS+ were all in the predicted direction, with a positive correlation found between the generalization index and self-model similarity, model anxiety, participant anxiety, and perceived model believability (see Table 3). The positive correlations demonstrate that higher levels of perceived self-model similarity, self-anxiety, model anxiety, and model believability were associated with greater levels of generalization of the acquired arousal responses from the CS+ to the 75% similar variant. In contrast, a correlation examining generalization from the trained CS- to the 75% similar variant revealed no significant relationship between any of the subjective dimensions of observational learning and generalization (see Table 3). These mediation results demonstrate that several subjective dimensions of observational learning experiences underpin whether, and how much generalization occurs.

To analyze generalization to a new exemplar, participants' pre-training ratings of face similarity were analyzed and the moderating role of perceived similarity between the new Black faces and the trained stimuli (CS+ and CS-) was investigated. For each new face of Black appearance (100%), a new between subjects variable was created to separate those who perceived the new Black face as being more similar to the CS+ than the CS-, those who perceived the new Black face as being more similar to the CS- than the CS+, and those who perceived it equally similar to both (see footnote 11). For each of the two new outgroup faces, a 3 New Face Similarity (similar to CS+, similar to CS-, equally similar to CS+ and CS-) x 2 Time (pre-test, post-test) mixed model ANOVA was performed on the skin conductance level data.

For the first new face, there was a main effect of Time, F (1, 28) = 17.02, p < .001, $\eta_p^2 = .38$, and a main effect of New Face Similarity, F (2, 28) = 10.28, p < .001, $\eta_p^2 = .42$. The same pattern of results emerged for the second new face, Time, F (1, 28) = 12.37, p = .002, $\eta_p^2 = .31$; New Face Similarity F (2, 28) = 9.62, p = .001, $\eta_p^2 = .41$. Critically, the ANOVA also revealed a two-way interaction between New Face Similarity and Time for both the first, F (2, 28) = 13.01, p < .001, $\eta_p^2 = .48$; see Figure 6 (top pane), and second new face, F (2, 28) = 9.61, p = .001, $\eta_p^2 = .41$; see Figure 6 (bottom pane). Paired samples t-tests revealed no significant differences over time in the skin conductance levels both when the new Black face was perceived as similar to the

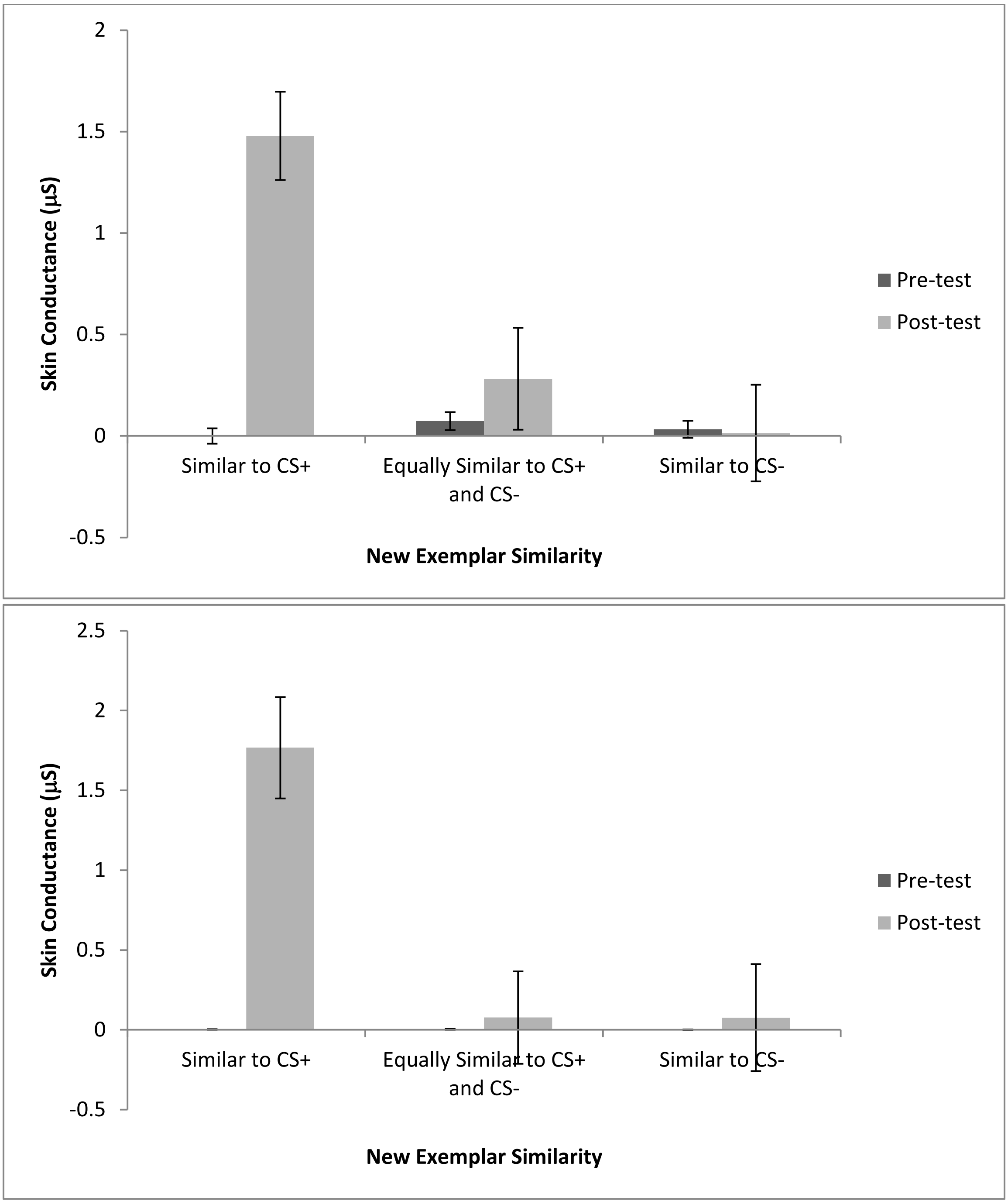


Figure 6. Two-way interaction between similarity and time for the first (top pane) and second (bottom pane) new exemplar faces (Study 1).

CS-, and when it was perceived to be equally similar to the CS+ and CS-, *t*s < 1.63, *p*s > .14. However, there was a significant difference in participant responses to the new face between pre-test and post-test when the new face was perceived to be similar to the CS+

for both the first, $t = 4.61$, $p = .001$, and second, $t = 3.20$, $p = .011$, new face, demonstrating that participants displayed generalization of physiological arousal from the CS+ face to the new face if it was perceived to be similar to the CS+.

Taken together, these results reveal the rich variety of ways in which similarity determines generalization within an observational learning experience. First, it was found that anxiety responses generalized to the most similar variation (75%) of the CS+ face, but not to the more dissimilar (50%) variation, indicating that generalization of observationally acquired anxiety takes place along a similarity gradient. This generalization was found to be mediated by subjective dimensions of the observational learning experience, including model anxiety, participant anxiety and perceived model believability, but also an additional similarity dimension, namely perceived self-model similarity. If individuals perceived themselves to be similar to the model, then they were more likely to display generalization of observationally acquired anxiety. Second, it was found that observationally acquired anxiety generalized not only along a similarity gradient, but also to novel outgroup faces, which shared membership defining features, but only as long as the new Black faces were perceived as similar to the CS+, suggesting that individual features are the primary driver of generalization. Taken together, the data suggest that generalization effects of observational learning are underpinned by perceived similarity: similarity of new outgroup stimuli to the outgroup stimulus experienced in the original aversive experience, and similarity of the observer to the model.

Study 1 demonstrated that perceived self-model similarity, a subjective dimension of observational learning experiences, affects generalization. It is not clear, however, which components of perceived similarity affect generalization. This is because perceived similarity was measured as overall perceived similarity to the model.

It is therefore unclear whether overall perceived similarity to the model determined generalization, or whether perceived similarity along specific model characteristics such as age, gender or ethnicity was more critical. Study 2 aimed to tease apart the factors contributing to perceived similarity using manipulation and more detailed measurement.

Study 2

In Study 2, the ethnic similarity (vs. dissimilarity) of participants to the model was experimentally manipulated by incorporating a model of either the same or a different ethnicity to the participant into the experimental video and expanding the participant pool to include both White and Asian participants. It was decided to manipulate the ethnicity match (vs. mismatch) between the model and the participant rather than other dimensions (e.g., age, gender) because of this thesis' focus on ethnicity and the paradigm being an observational analogue of an influential conditioning study involving ethnic stimuli (Olsson et al., 2005), reflecting a growing interest in applying conditioning to ethnic behavior. Hence, the design included Asian participants who again observed either a model of either the same (Asian) or different (White) "ethnicity". Past research has demonstrated that people are better at detecting and mimicking emotions from same group individuals than different group individuals (Barrett, 2006; Elfenbein & Ambady, 2002a, 2002b, 2003; Russell, 1994), including being more likely to mimic ingroup displays of anger and fear relative to outgroup displays of these emotions (Van der Schalk et al., 2011). As a result, it was expected that participants would show heightened generalization of physiological arousal after observing a same (vs. different) ethnic model. Based on the intergroup literature, it was also expected that minority participants would be more likely to learn, and therefore, generalize acquired fear, from watching a majority group model. In contrast, it was expected that majority group participants would be less likely to learn and generalize, from watching minority group models. This meant that it was expected that Asian participants observing White models would learn and generalize fear acquired to the CS+ (vs. CS-) more than White participants observing Asian models.

While ethnic similarity to the model was manipulated by having participants observe a model of either the same or different ethnicity to themselves, this study also measured perceived similarity to the model along several additional dimensions, including perceived age, gender, and ethnic similarity. This was because Study 1 suggested that the perceived overall similarity (vs. just ethnic similarity) to the model was an important factor in the generalization process. Hence, although participants observed a same or different ethnicity model, there may have been other factors that affected their perceived ethnic similarity, and hence group membership, relative to the observed model. Hence, it was expected that a mediational effect of perceived (vs. physical or manipulated) similarity would be found such that participants would display heightened generalization if they perceived themselves to be similar to the observed model, regardless of whether they watched the ingroup or outgroup model. Moreover, in the mediation analyses, this study assessed the individual contribution to generalization of perceived age, gender and ethnicity similarity to the model. As in Study 1, this study measured generalization along a gradient and generalization to a new exemplar.

Method

Participants

One hundred and twenty-seven students from a large regional Australian University (43 males; 84 females) participated in the study for either course credit or AU$20 as compensation for their participation. Of this, 64 were White and 63 were

Asian (M = 22.48 years, SD = 3.31). The study had a 2 Participant Ethnicity (White/Asian) x 2 Model Ethnicity (White/Asian) x 2 Stimulus (CS+/CS-) x 2 Time (Pre/Post) design, with Stimulus and Time as repeated measures (between 31 and 32 participants per cell).

Apparatus and Stimulus Materials

The apparatus and materials were identical to those used in Study 1 except for a few minor changes. Study 2 included a second training video, which depicted an Asian, rather than a White, model displaying anxious behavior towards the CS+ and relaxation responses to the CS- (see Appendix I). White (N = 15) and Asian (N = 11) participants completed a pilot test aimed to ensure that the Asian video was the most convincing among four available versions, and to ensure the video was comparable to the White video from Study 1. Both White and Asian participants rated the videos on model believability, model anxiety, and model reliability. The selected video was the most believable, reliable and anxiety inducing. Moreover, paired samples t-tests revealed no differences between the ratings of the Asian model and the White model used in Study 1 (for more details, see Chapter 2).

Procedure

The learning task procedure was identical to Study 1 except that half of the participants watched the Study 1 video, displaying the White model, whereas the other half watched the newly developed video of an Asian model. This meant that half of the participants observed a video displaying a model with the same ethnicity as themselves; while the other half observed a model of a different ethnicity.

Once all psychophysiological measurements had been completed, the equipment was removed to allow participants to complete a brief questionnaire about the video, which included items from Study 1 assessing perceived overall similarity (1 item), model anxiety (3 items, $\alpha = .76$; see Appendix L), and participant anxiety (1 item); additional items for model believability (6 items, 1 new, $\alpha = .83$; see Appendix H), but also new items assessing perceived gender similarity (1 item, "I see the research participant as having a similar gender to me"), perceived age similarity (1 item "I see the research participant as being a similar age to me"), and perceived ethnic similarity (1 item, "I think the research participant has a similar ethnicity to me"). All items were again answered on a 7 point Likert-type scale (1 = *not at all*; 7 = *very much*). Participants reported average self-model similarity ($M = 3.58$, $SD = 1.75$), self-model age similarity ($M = 3.77$, $SD = 1.65$), self-model ethnic similarity ($M = 3.64$, $SD = 1.97$), participant anxiety ($M = 3.37$, $SD = 1.55$), and model believability ($M = 3.08$, $SD = .93$), and high model anxiety ($M = 5.31$, $SD = 1.33$), and self-model gender similarity ($M = 5.97$, $SD = 1.66$). These variables were predictably related (*r*s ranging between .017 and .466, median .137).

As in Study 1, participants were reconnected to the physiological equipment so that they could undergo extinction. Participants' physiological responses to the CS stimuli were extinguished before they left the laboratory by repeatedly presenting the CS+ and CS- until they no longer evoked any skin conductance response (mean number of face presentations until responses extinguished: 12.54, $SD = 2.93$; range: 10-21 trials). As in Study 1, all participants watched a five minute video clip portraying Black people in a positive light. These procedures ensured that individuals left the laboratory without any heightened arousal and with positive emotions to the outgroup. As for Study 1, all research procedures complied with the APA's human ethics guidelines, with the relevant approval provided by the local institutional review board for human research ethics (see Appendices B and C for ethics approvals, and Appendices M, N, O, and P for participant forms).

Results and Discussion

As in Study 1, skin conductance levels were analyzed using two different methods to investigate generalization along a gradient and generalization to a new exemplar, respectively. A 2 Stimulus (CS+, CS-) x 2 Time (pre-test, post-test) x 3 Similarity Gradient (training faces, 75%, 50%) x 2 Model Ethnicity (White, Asian) x 2 Participant Ethnicity (White, Asian) mixed model ANOVA, with Stimulus, Time, and Similarity Gradient as repeated measures, was used to analyze generalization along a gradient.

As in Study 1, the ANOVA revealed a significant 3-way interaction between Stimulus, Time and Similarity Gradient, F (2, 246) = 35.901, p < .001, η_p^2 = .23; see Figure 7. When followed up along Similarity Gradient as in Study 1, the Stimulus x Time interaction was significant for the training faces, F (1, 123) = 89.02, p < .001, η_p^2 = .42, and the 75% similar variations, F (1, 123) = 13.72, p < .001, η_p^2 = .10, but not the 50% similar variations, F (1, 123) < 1, p = .425, η_p^2 = .005. Paired samples t-tests revealed no significant differences between the training faces or their variations at pre-test, all *t*s < 1, indicating that the CS+ and CS- faces and their variations evoked similar levels of arousal before training. As predicted, however, the CS+ evoked a significantly greater skin conductance response relative to the CS- after training, t (126) = 8.58, p < .001, as did the 75% similar variation relative to its CS- equivalent, t (126) = 7.01, p < .001, but not the 50% similar variation relative to its CS- equivalent, t (126) < 1, p = .363. These findings show that, as in Study1, participants

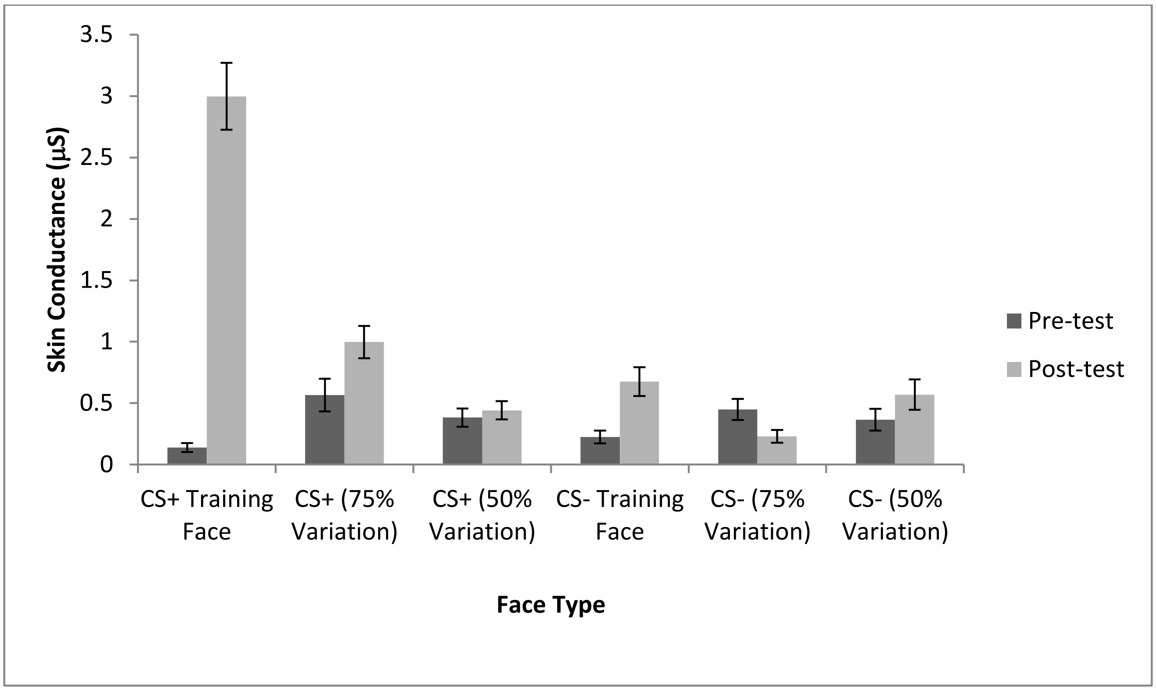


Figure 7. Three-way interaction between stimulus, time and variation (Study 2).

displayed generalization of observationally learned anxiety from the trained CS+ face to its closest untrained variation, consistent with generalization along a similarity gradient.

This basic generalization effect was qualified by two significant 4-way interactions: 1. a Participant Ethnicity x Stimulus x Time x Similarity Gradient, F (2, 246) = 7.82, p = .001, η_p^2 = .06; and 2. a Model Ethnicity x Stimulus x Time x Similarity Gradient, F (2, 246) = 6.08, p = .003, η_p^2 = .05. The two 4-way interactions reflected the fact that the 3-way interaction between Stimulus, Time and Similarity Gradient, while significant for both ethnic groups and both models, was stronger for Asian (vs. White) participants, F (2, 124) = 27.72, p < .001, η_p^2 = .31 vs. F (2, 126) = 7.33, p < .001, η_p^2 = .10 and for participants who observed the White (vs. Asian) model, F (2, 124) = 25.24, p < .001, η_p^2 = .30; vs. F (2, 126) = 9.26, p < .001, η_p^2 = .13. Contrary to predictions, however, the higher order 5-way interaction was not significant, $F < 1$. Power analysis confirmed that this was not due to insufficient power (see footnote 12).

Following up the 4-way interaction involving Participant Ethnicity, paired samples *t*-tests comparing each CS+ (training face, 75% similar variation, 50% similar variation) with its CS- equivalent (training face, 75% similar variation, 50% similar variation) revealed that both White and Asian participants generalized their acquired arousal responses towards the CS+, White: t (63) = 5.61, $p < .001$; Asian: t (62) = 7.10, $p < .001$, to the 75% similar variant, White: t (63) = 4.62, $p < .001$; Asian: t (62) = 5.26, $p < .001$, but not to the 50% similar variant, White and Asian: *t*s < 1, *p*s > .300.

Following up the 4-way interaction involving Model Ethnicity, paired samples *t*-tests comparing each CS+ (training face, 75% similar variation, 50% similar variation) with its CS- equivalent (training face, 75% similar variation, 50% similar variation) revealed that both White-model and Asian-model mediated responses to the CS+, White: t (62) = 7.26, $p < .001$; Asian: t (63) = 5.13, $p < .001$, generalized to the 75% similar variation, White: t (62) = 5.28, $p < .001$; Asian: t (63) = 4.76, $p < .001$, but not to the 50% similar variation, White and Asian, *t*s < 1, *p*s > .300.

To explore whether the 3-way interaction between Stimulus, Time, and Similarity Gradient was mediated by subjective dimensions of observational learning, each subjective dimension (perceived self-model age, ethnic, gender and overall similarity, model anxiety, participant anxiety and perceived model believability) was included in turn as a covariate within the Stimulus x Time x Similarity Gradient x Model Ethnicity x Participant Ethnicity ANOVA (Judd et al., 2001). Perceived model believability nullified the 3-way interaction, while perceived age similarity, perceived ethnicity similarity, perceived gender similarity, perceived overall similarity, model anxiety, and participant anxiety all reduced the size of the 3-way interaction substantially (see Table 4).

In order to verify that the effect of similarity on generalization was in the expected direction, each of the covariates included above were correlated with the generalization index used in Study 1. Correlations between each of the indices, including observer-model similarity, model believability, and model anxiety, and the

Table 4

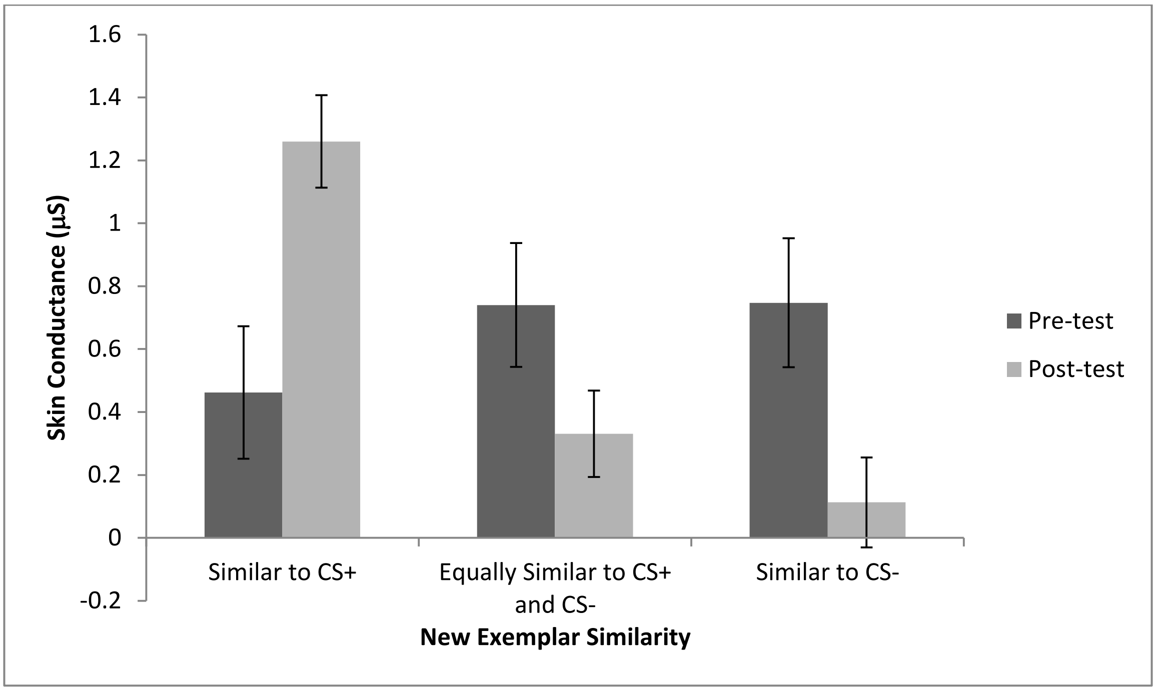
Mediation results and correlations between mediators and generalization (Study 2)

	F	df	p	η_p^2	Generalization from CS+ to 75% Variation		Generalization from CS- to 75% Variation	
					r	p	r	p
Original Effect	35.901	2, 246	< .001	.23				
Perceived Model Believability	< 1	2, 200	.707	< .01	.403	< .001	.009	.929
Perceived Age Similarity	4.11	2, 242	.018	.03	.219	.014	.126	.160
Perceived Ethnic Similarity	8.85	2, 200	< .001	.07	.182	.041	.040	.654
Perceived Gender Similarity	< 1	2, 242	.403	< .01	.155	.084	.001	.991
Perceived Overall Similarity	6.69	2, 200	.001	.06	.200	.041	.045	.618
Model Anxiety	< 1	2, 202	.934	< .01	.169	.083	.109	.267
Participant Anxiety	3.90	2, 202	.022	.04	.262	.007	.020	.841

generalization index calculated using the skin conductance responses evoked by the trained CS+ and its 75% similar variation were all in the expected positive direction (Table 4). In contrast, correlations between each of the mediators and the generalization index calculated using the skin conductance responses evoked by the trained CS- and its 75% similar variation revealed no significant correlations (Table 4). These results demonstrate that subjective dimensions of observational learning, including perceived model believability, perceived similarity, participant anxiety, and model anxiety, were all associated with increased generalization.

As in Study 1, the role of perceived stimulus similarity in generalization to a new exemplar was assessed using participants' self-reported ratings of how similar they perceived each of the two new Black outgroup faces to be to the CS+, and to the CS-, respectively. For each of the two new Black faces, a 3 New Face Similarity (similar to CS+, similar to CS-, equally similar to CS+ and CS-) x 2 Time (pre-test, post-test) x 2 Model Ethnicity (White, Asian) x 2 Participant Ethnicity (White, Asian) mixed model ANOVA was performed on skin conductance levels. As expected, a significant two-way interaction was found between Similarity and Time, F (2, 110) = 10.21, $p < .001$, $\eta_p^2 = .16$; see Figure 8 (top pane) for the first new face, as well as for the second new face, F (2, 112) = 12.60, $p < .001$, $\eta_p^2 = .18$; see Figure 8 (bottom pane). The two-way interaction was not qualified by any higher order three or four way interactions with Participant or Model Ethnicity for either the first, all *F*s < 1, all *p*s > .25, or second new face, all *F*s < 1.90, all *p*s > .17, meaning that the manipulated ethnic similarity with the model did not qualify generalization of anxiety.

For the first new face, paired samples *t*-tests revealed marginally significant reductions in anxiety over time when the new Black face was perceived to be similar to the CS- or equally similar to the CS+ and CS-; similar to CS-, $t = 1.89$, $p = .066$; equally



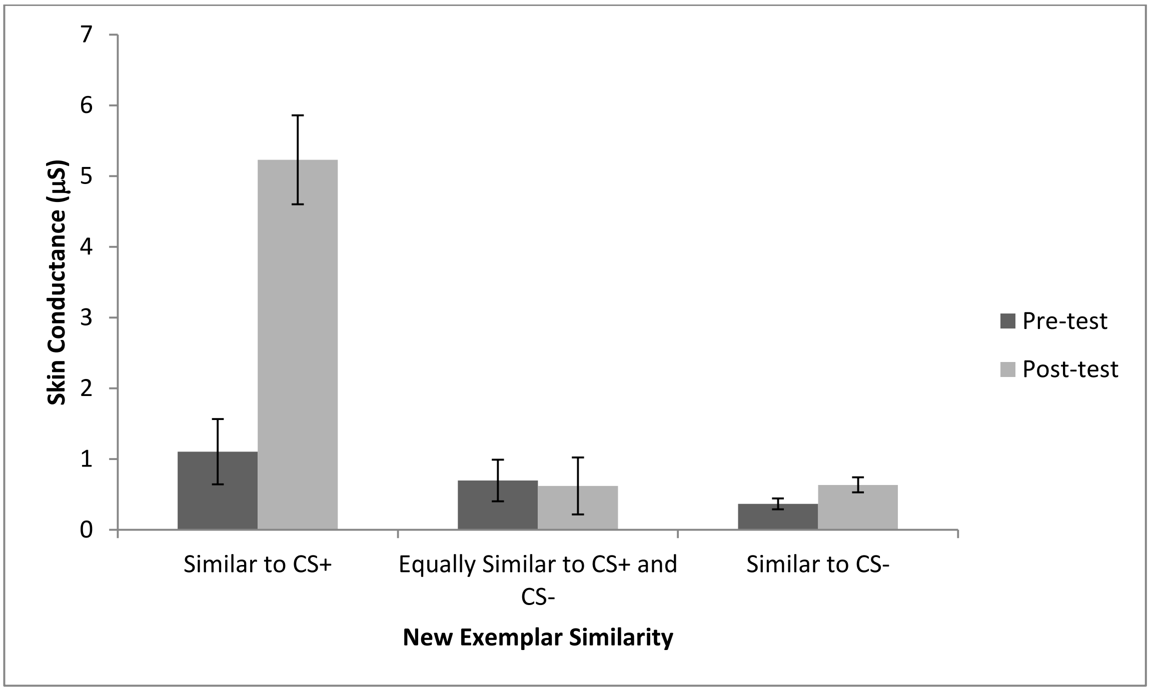


Figure 8. Two-way interaction between similarity and time for the first (top pane) and second (bottom pane) new exemplar faces (Study 2).

similar, $t = 1.98$, $p = .055$. Importantly, there was a significant increase from pre- to post-training in participant responses to the new face when the new Black face was perceived to be more similar to the CS+, $t = 2.80$, $p = .008$, demonstrating that participants displayed significantly more generalization of physiological arousal to the new face if it was perceived as being more similar to the CS+ face. For the second new face, paired samples *t*-tests revealed no significant differences over time in participants' responses to these new face when the new Black face was perceived as equally similar to the CS+ and CS-, $t < 1$, $p = .603$. However, while there was a significant increase from pre- to post-training in skin conductance levels when the new Black face was perceived as more similar to the CS-, increases in anxiety over time were more robust when the new Black face was perceived as more similar to the CS+, more similar to CS-, $t = 2.26$, $p = .026$; more similar to CS+, $t = 6.67$, $p = .007$. These data suggest that participants displayed generalization of physiological arousal to the new face if it was perceived as similar to the CS+ and, to some effect, if it was perceived as similar to the CS-.

These results replicate Study 1's findings that anxiety learning generalizes along a similarity gradient, from the trained CS+ stimulus to the most similar-looking stimuli, and when new outgroup members are perceived as similar in appearance to the outgroup member directly involved in the aversive observational experience. Generalization occurs because participants regard the model as being anxious and believable, which makes themselves feel anxious. These results extend Study 1's findings by demonstrating that generalization within the context of observational learning is all the greater that participants perceive themselves to be similar overall, as well as on specific dimensions, to the model.

General Discussion

Aims

These two studies aimed to investigate the mechanisms involved in the generalization of intergroup anxiety. Even though social psychology typically encourages positive intergroup experiences, which improves attitudes not only towards that individual but also towards the entire outgroup, indicative of individual-to-group generalization (e.g., Joyce & Harwood, 2012; Pettigrew & Tropp, 2006), this study is the first to investigate the mechanisms of generalization of negative experiences with outgroup members using an observational learning paradigm, as opposed to the more commonly investigated direct learning paradigm. In particular, this chapter assessed the influential role of similarity within the generalization process.

Key Results

Both studies presented here provide converging evidence that similarity plays a determining role in determining whether and how much generalization occurs. While both studies measured and manipulated similarity in a variety of ways, similarity always contributed to generalization. This is despite the fact that similarity is a difficult construct to measure because it varies along so many dimensions.

First, the two studies provided evidence of generalization to a new exemplar (Lissek, et al., 2010; Pettigrew, 2008). In particular, the physiological arousal experienced to the CS+ generalized to new outgroup faces if and when that new face was perceived as being more similar to the CS+ than the CS- face. However, no such generalization was evident when the new face was perceived as either more similar to the CS- or as equally similar to the CS+ and CS- face. Second, both studies provided evidence of generalization along a similarity gradient. This was demonstrated via the use of morphed versions of the initial CS+ and CS- stimuli. Physiological arousal generalized from the CS+ to its closest approximation relative to the CS- and its closest approximation. However, no such generalization occurred in response to the furthest approximations of the CS+ and CS-. Hence, generalization was determined by the degree of visual similarity between the CSs and morphed versions of the original faces. This means that after an aversive experience with an outgroup member, any acquired anxiety is more likely to generalize to further outgroup members if the latter are perceived as similar in specific stimulus features such as group membership or if they have similar characteristics but appear slightly less outgroup like.

The third key finding was that the perceived similarity to the model played an additional determining role in the generalization process (Bandura, 1969, 1977; Bandura et al., 1963a; Barry & Overman, 1977; Pratt, et al., 2007; Schunk, 1987; Weeks, et al., 2005). This research provided support for the extensive research conducted by Bandura (Bandura, 1969, 1977; Bandura et al., 1963a, 1963b, 1963c), whose seminal work on observational learning demonstrated the powerful nature of observing an individual’s reactions to stimuli. The present research extended Bandura’s research to the realm of generalization. Participants displayed greater levels of generalization from the CS+ to its closest approximation if the participant perceived themselves to be similar to the model that they observed during the observational learning task. This held true for specific characteristics such as age, gender and ethnicity, as well as for overall impressions of similarity with the model. In terms of perceived self-model similarity, results suggested that age and gender were more influential than ethnicity. Although this may appear somewhat surprising, perhaps this was a result of the participant pool being recruited from a population that engages in inter-ethnic contact on a daily basis due to the mixed university population.

Summary and Implications

Across two studies, this chapter was the first to demonstrate, using an aversive observational learning paradigm, the contributing role of self-model similarity, as well as the influential nature of various subjective dimensions of observational learning, for generalization of intergroup anxiety. The effects provide a more complete understanding of intergroup relations and suggest that observational experiences of outgroups may be a critical technique for not only developing anxiety, but also for generalization beyond the originally experienced stimuli. Understanding how intergroup anxiety develops and generalizes will no doubt assist in the development of strategies to prevent and reduce intergroup tension and improve intergroup relations (Wright, et al., 1997). These two studies have significant implications for providing a more complete understanding of generalization and some of the factors that appear to be influential for generalization, focusing in particular on applications for intergroup relations.

These findings are consistent with previous work indicating that similarity may be important for generalization. For instance, Mallet and Wilson (2010) assigned participants to view either an intergroup or an intragroup friendship interaction. Participants were then asked to write about a similar experience that they'd had. They found that participants in the intergroup condition and who wrote about a similar experience had more positive interracial interactions and initiated more interracial friendships in subsequent weeks than in the other conditions. Hence, Mallet and Wilson (2010) emphasize the role of outgroup salience and vicarious observation for boosting generalization. More recently, Dunsmoor White and Labar (2011) have shown that conceptual similarity is important for the generalization of direct fear learning. They found that generalization was enhanced to stimuli that were considered conceptually similar to the CS+, compared to unrelated or mismatched stimuli. For example, if the CS+ was a spider, generalization was enhanced to a spider web (conceptually similar), compared to a hospital corridor (unrelated) or a wasp nest (mismatched). Hence, this chapter's data map nicely onto Dunsmoor and colleagues by extending their research into vicarious fear learning and by demonstrating that the perceived conceptual similarity to the CS+ impacts generalization of outgroup anxiety learning.

This chapter's findings may have significant theoretical and practical implications. The fact that perceived similarity to the observed model facilitated generalization suggests that in the real world, an individual whom you perceive to be similar to yourself can have a huge impact on your anxiety levels towards other outgroup members. Hence, the data reinforce the powerful nature of observational experiences and identifies the critical role that perceived similarity to the model plays in the generalization process, as well as intergroup relations.

The influence of similarity did not hold up in every instance, however. While the perceived self-model similarity ratings did mediate generalization in both studies, the manipulation in Study 2 of the model's ethnicity with that of the participant (i.e., match vs. mismatch) did not appear to affect generalization. This may be because it is not the physical similarity defined in objective ways to the model's characteristics that matter, but rather subjective or *perceived* similarity. Moreover, manipulation of similarity is rather difficult because each individual's perception and definition of an outgroup is rather divergent. In particular, one's definition of an outgroup does not necessarily depend solely on the face's pigmentation. Hence, varying features may have, and did, affect the participant's perceived similarity with the model, clarifying why the manipulation of the model's ethnic match (vs. mismatch) with the participant did not operate as predicted.

Self-model similarity can be manipulated along a number of levels and warrants further investigation. In particular, whereas this chapter manipulated self-model similarity purely on the basis of ethnicity (White v Asian model), self-model similarity also operates on other levels such as age (old v young) and gender (male v female). There is potential that one or more of these factors is more influential in the observational learning and generalization process. Future research should investigate these factors by manipulating each one separately and determining their relative influence on observational learning and generalization.

This chapter also identified a number of observational learning variables that performed an important role in the generalization process. In particular, model believability, and model anxiety affected generalization such that higher values on these variables (i.e., higher believability, and higher anxiety) increased the generalization of anxiety displayed by participants. Hence, as predicted by Bandura (Bandura, 1969, 1977; Bandura, et al., 1963a, 1963b, 1963c), these studies highlight the critical role that the model plays in observational designs. These results extend those of Bandura, however, by pointing towards the important role that the model plays not only in the learning process, but also in generalization. Therefore, these data demonstrate that the individual we learn from (the model) is just as important as the stimuli (or people) we are learning about.

The finding that similarity determines generalization is consistent with the secondary transfer literature. Secondary transfer involves the generalization of responses from one outgroup to other, seemingly similar, groups (Pettigrew, 2009). For example Harwood and colleagues demonstrated that participants generalized their positive attitudes following positive contact with illegal immigrants to other outgroups that were classified by participants as being similar to illegal immigrants, including Mexican-Americans, and political refugees. The same secondary transfer effects were not found from illegal immigrants to outgroups that participants identified as being dissimilar to illegal immigrants, including graduate students, and Americans (Harwood, Paolini, Joyce, Rubin, & Arroyo, 2011). These findings were substantiated by Tausch and colleagues (2010), who found across four studies that the effects of positive intergroup contact on outgroup attitudes generalized from the initial outgroup involved in the contact to similar outgroups. Hence, previous research has implicated the role of similarity between different outgroups for the generalization of attitudinal responses across groups. However, this research involved positive contact, did not measure intergroup anxiety, and looked at generalization across outgroups (vs. generalization from individuals to new individuals).

In sum, perceptions of similarity drive generalization processes in observational methods of learning. Future research may want to investigate whether similarity plays a comparable role in other forms of generalization, such as secondary transfer (Pettigrew, 2009), as hinted by previous research in the area (Harwood, Paolini, Joyce, Rubin, & Arroyo, 2011).

Limitations and Future Research

It is suggested that one fruitful avenue for future research would be to investigate in more depth the mediators and moderators of generalization within the context of observational intergroup experiences. The present research utilized a ‘moderation-of-process design’ *plus* a ‘measurement-of-process design’ (Spencer, Zanna & Fong, 2005) for the focal process variable of interest, self-model similarity. A within-subjects adaptation of the ‘measurement-of-process design’ procedure originally advanced by Baron and Kenny (Judd & Kenny, 1981; Yzerbyt, Muller & Judd, 2004) was used to assess the contributing role of various subjective dimensions of observational learning. Future work investigating the mechanisms underpinning generalization could extend the more stringent approach that was adopted for self-model similarity to include these and other process variables, so to impart additional support for their influential role.

Although research into intergroup anxiety is key to improving intergroup relations, a recent review outlines that intergroup anxiety encompasses an affective, cognitive and physiological component (Stephan, 2014). While this research focused on the physiological component, via measurement of skin conductance, other aspects of intergroup anxiety include feeling states (affective component) and thoughts about the outgroup (cognitive component). More specifically, different outgroups have been shown to elicit different emotions (Cottrell & Neuberg, 2005). For instance, participants displayed higher levels of disgust towards gay men compared to African Americans, yet they displayed higher levels of fear towards African Americans than gay men. Hence, future research may want to investigate the dynamic interplay between the affective, cognitive and physiological components of intergroup contact.

It will also be important for future research to investigate to what extent the generalization effects found here hold across different contexts. For example, after White individuals fought with Black soldiers during World War II, the White soldiers’ attitudes towards Black individuals was improved whilst their role in the conflict was ongoing (Stouffer, Suchman, DeVinney, Star, & Williams, 1949). However, once the White soldiers returned home after the war, their attitudes did not generalize to Black people in their neighborhood or indeed Black people in general. Other studies also point towards limited generalization across different contexts (Deutsch & Collins, 1951; Hughes, 2007; Minard, 1952; Reitzes, 1953). Hence, it will be important for future work to investigate whether generalization is maintained or diminished across different contexts within both direct and observational learning contexts.

Taken together, these studies demonstrate the powerful nature of generalization following observational aversive learning of anxiety responses to unsafe outgroup targets, and suggest that the observer’s similarity with the model underpins generalization, such that the more similar an observer perceives themselves to the model, the more likely they are to generalize their aversive responses from the outgroup targets originally involved in the learning experience to novel outgroup targets. Moreover, for the first time, these studies confirm the key role of targets’ similarity to the training stimuli for generalization processes in the intergroup domain. The data show that the more similar observers perceive a new outgroup face to be to the original unsafe face, the greater the generalization. Overall, these results highlight the proclivity of observers to generalize their learned responses through social modelling, on the basis of similarity.

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Footnotes

10. Responses to the two training faces (i.e., acquisition effects) and psychological underpinnings of these responses in the two studies are discussed elsewhere (Chapter 2).
11. We used participants' pre-laboratory and pre-training self-reported similarity ratings between the new outgroup face and the CS+ and CS- using the formula New Face Similarity = ([similarity with CS+] – [similarity with CS-]). If this number was positive, the new Black face was perceived to be more similar to the CS+; if negative then the new Black face was perceived to be more similar to the CS-; while zero indicated that the new face was perceived to be equally similar to the CS+ and CS-.
12. Both studies have sufficient power when comparing the sample size to aversive conditioning research using a similar design and methodology. Olsson et al. (2005) had an n of 35 per cell; Olsson et al. (2007) had an n of 11 per cell; and Olsson and Phelps (2004) had an n of 29 per cell. Power calculations using PASS for a 2 x 2 x 2 (Study 1) and a 2 x 2 x 2 x 2 (Study 2) mixed model design aimed at detecting a Cohen's moderate effect size of .25 with an alpha value of .05 indicated that this study needed a total n of 70 participants in Study 1 and a total n of 1000 in Study 2. Hence, Study 1 had adequate power and Study 2 was underpowered.

Chapter 4.

Order Up: The Effects of Direct and Vicarious Aversive Outgroup Experiences on Learning and Generalization

Recall the last time that you had a conversation with someone from another ethnic group. Now recall the last time you had a discussion with a friend who told you about an interaction they had had with a person from a different ethnic group. These two forms of intergroup contact are known as direct and vicarious contact respectively.

The literature to date has demonstrated that there are clear similarities between direct and vicarious contact experiences. One similarity is that direct and vicarious experiences result in comparable learning outcomes (Harris, Griffin, & Paolini, 2015a; Chapter 2; Olsson & Phelps, 2004). For example, Olsson and Phelps (2004) presented participants with an aversive learning paradigm where angry male faces were presented, and anxiety was measured using skin conductance responses. Participants allocated to a direct learning condition experienced an angry face paired with an aversive electrical stimulation (conditioned excitor, or CS+), and a second angry face that was never paired with the electrical stimulation (conditioned inhibitor, or CS-). Participants in a vicarious learning condition observed a movie depicting a person participating in an experiment, which, they were told, they themselves would later undergo. They found that observing the model, who received electrical stimulations paired with the CS+ presentation, in the vicarious condition generated comparable acquired anxiety responses to those in the direct condition, who received the stimulations first hand. This finding has been extended by Harris, Griffin and Paolini (2015a; Chapter 2). Harris and colleagues presented participants in a direct condition with one Black outgroup face paired with an electrical stimulation (CS+) and one Black outgroup face never paired with electrical stimulation (CS-). Those in the vicarious condition were shown a movie of a White female model that simulated receiving electrical stimulations when presented with the Black CS+ and simulated expressions of relaxation towards the Black CS-. Similar to Olsson and Phelps (2004), Harris and colleagues (2015a; Chapter 2) found that the magnitude of anxiety learning, as measured via pre- to post-conditioning changes in skin conductance evoked by the CS+, was comparable across both the direct and vicarious conditions. Hence, psychophysiological research suggests that both direct and vicarious experiences instigate a similar magnitude of stimulus-specific/contingency bound learning, such that direct and vicarious experiences produce a comparable magnitude of learning, in both experiences (Harris et al., 2015a; Olsson & Phelps, 2004). That direct and vicarious learning show some degree of commonality is supported by neuroscience research. Brain-imaging studies have shown that the neural circuitry and brain regions activated during instances of direct learning share some degree of overlap with those activated during vicarious learning (Olsson, Nearing, & Phelps, 2007).

On the other hand, direct experiences are considered by some researchers to be more powerful than vicarious ones in instigating individual-level effects. In a seminal discussion of the literature, Fazio and Zanna (1981) highlighted the differential effect of direct vs. vicarious experiences. They underlined that there is evidence that direct experiences result in stronger attitudes, ones that are held more confidently, and are clearer (Fazio & Zanna, 1981). This is because direct experiences provide multisensory inputs that provide broader recall cues for the individual. Hence, Fazio and Zanna (1981) stress the importance of the information being more readily accessible, a different mode of information processing, and greater attitude accessibility. This is supported by Paolini, Hewstone and Cairns (2007) who, across three correlational studies, found that intimate direct contact produces a larger attitude change than intimate vicarious contact, but only when the outgroup was considered affective (e.g., elderly people) rather than cognitive (e.g., engineering students). Hence, direct experiences are considered to be more stable and potentially influential.

Further support for differences in direct and vicarious experiences has been provided by Lolliot and colleagues (2014). They found that vicarious intergroup contact affects group-level attitudes more when in a segregated environment. In diverse settings, however, they found that people rely on direct outgroup experiences. Hence, they suggested that vicarious experiences are only used when direct experiences are not available. Moreover, Christ and colleagues (2010) investigated the effects of vicarious contact in areas of high and low segregation in Northern Ireland. This allowed them to explore the effect of direct experiences on vicarious contact. Across two cross-sectional and longitudinal studies, they found that intimate vicarious contact is more likely to influence group-level attitudes when individuals are segregated and thus have limited or no opportunities for direct outgroup contact. The results hint towards the fact that direct experiences are more powerful than vicarious ones. Importantly, they also included a measure of attitude certainty as a proxy for attitude strength. Christ and colleagues found that direct contact was associated with higher levels of attitude certainty than vicarious contact immediately following contact experiences. Across time, however, both forms of intergroup contact have similar effects on attitude certainty.

In contrast, the powerful nature of vicarious intergroup contact has been shown by Christ and colleagues (2014), who found a contextual effect of intergroup contact. Specifically, across seven large-scale cross-sectional and longitudinal studies, they found that vicarious intergroup contact is more powerful than direct intergroup contact in affecting group-level attitudes. More generally, Wright and colleagues (1997) were instrumental in highlighting and demonstrating the effects of vicarious intergroup contact. In their seminal paper, Wright and colleagues demonstrated that vicarious intergroup contact influences outgroup attitudes, even when direct intergroup contact was controlled for. Hence, they suggested that vicarious interactions are a powerful form of intergroup contact.

Turner and colleagues (2007b) have expanded on Wright and colleagues' (1997) findings. In their review, Turner and colleagues discuss the key advantages of vicarious forms of intergroup contact: The applicability of vicarious intergroup contact in isolated or segregated societies without the opportunity for direct contact (Christ et al., 2010; Turner, Hewstone, & Voci, 2007a; Turner et al., 2007b); the potential to be implemented on a larger scale (Wright et al., 1997); and, the simplicity of applying vicarious contact as a prejudice-reduction intervention. The real advantage of vicarious experiences, compared to direct experiences, is that they pose less personal risk to the observer since they are not at risk of threat themselves (Bandura, 1977; Hoover et al., 2012; Whitmarsh, 2005). Put differently, personal experience with an aversive stimulus is hazardous, since one potential error could lead to lethal consequences (Bandura, 1977). Instead, vicarious experiences do not expose an individual to potentially harmful situations directly because inherent dangers (e.g., uncertainty, fear of appraisal, fear of rejection, etc.) are removed from the contact situation (Whitmarsh, 2005). Furthermore, the advantage of vicarious forms of intergroup contact is reinforced by the fact that even hearing about intergroup friendships in stories read in school can reduce prejudice (Cameron & Rutland, 2006).

Despite the evidence of similarities, and the hint towards disparity suggested by some research outcomes (Christ et al., 2014; Fazio & Zanna, 1981; Lolliot et al., 2014; Paolini et al., 2007), studies to date have concentrated on isolated experiences of either direct or vicarious contact. In the real world these modes of contact are rarely experienced in isolation, however. Hence, to investigate direct and vicarious contact in a more biologically meaningful way, research should acknowledge that peoples' experiences are rarely limited to an isolated experience of one of these forms of contact. Rather, contact is constituted of multiple episodes of both direct and vicarious contact, the effects of which are likely to interact. For example, the two types of experience might act synergistically producing a larger effect than each type of experience in isolation. Furthermore, the net outcome of this interaction might depend upon the order in which these two types of experience occur. For example, the effects of indirect experience might be amplified when preceded by prior direct experience, but the effects of an individual experience might take precedence over a prior indirect experience. Quantifying how direct and indirect experiences interact as a consequence of these ecologically more meaningful scenarios is an essential step in predicting which real-life contexts are most prone to generating intergroup anxiety and will inform the design of intergroup anxiety reduction interventions.

The suggestion that direct and vicarious experiences not only interact, but also interact in a manner dependent upon the order in which the two kinds of experiences occur has some precedent in the non-human animal learning literature. Galef and Whiskin (2001, Study 4) exposed observer Norway rats (*Rattus norvegicus*) to a demonstrator rat that had been previously trained to eat one of two foods preferentially. At the time of the vicarious experience, observer rats were either naïve (i.e., they had had no prior experience of the two foods consumed by the demonstrator; V-D learning) or they had already experienced five days of free access to both diets (D-V learning). The food choice of both groups of observers was measured once again either at the end of an additional five days of free access to both foods (V-D learning) or immediately after the vicarious experience (D-V learning). Hence, at the time of testing, the observer treatments differed only with respect to whether the vicarious experience occurred before (V-D) or after (D-V) their own direct experience of the diets. Results showed that although both treatments preferred the food eaten by their demonstrator, observers that learnt about the diets through their own experience first and then from interacting with the demonstrators (D-V learning) copied their demonstrators to a significantly greater extent than those rats that had experienced direct and vicarious experiences in the opposite order (V-D learning). Hence, a direct experience followed by a vicarious one caused a significantly greater change in behavior than a vicarious experience followed by a direct one. Galef and Whiskin (2001) explained the differences between D-V learning and V-D learning by suggesting that it might be functionally adaptive to retain information acquired vicariously only if those experiences confirm direct experience.

An aversive conditioning paradigm provides the unique opportunity to investigate the interaction between direct and vicarious contact experiences experimentally. One outgroup face is paired with an electrical stimulation (CS+), whereas another outgroup face is never paired with an electrical stimulation (CS-; e.g., Harris et al., 2015a, 2015b; Mallan, Sax, & Lipp, 2009; Navarrete et al., 2009, 2012; Olsson et al., 2005; see Chapter 2 and 3 for more detail). The advantage of using this experimental paradigm in investigations of intergroup contact, as opposed to the traditionally used cross-sectional correlational design (e.g., Paolini et al., 2007) is that it allows the researcher to manipulate key processes underpinning the development of intergroup anxiety and to identify those that influence its maintenance and generalization (see Chapter 2 and 3).

A further advantage of a conditioning paradigm is that it can be adapted to study vicarious forms of contact (see Chapter 2 and 3). By incorporating a model from which participants learn, this modification has the consequence that vicarious paradigms involve additional influencing variables compared to direct learning paradigms. For example, the model might influence participant behavior in a manner predicted by social learning theory (Bandura, 1977), which claims that a higher level of observer-model similarity should facilitate vicarious learning through increased identification with the model (Chapter 3). This prediction has found support in recent work, demonstrating the influential effect of observer-model ethnic similarity, model believability and model anxiety on vicarious learning of anxiety (Harris, Griffin & Paolini, 2015b; Chapter 3).

Conditioning paradigms involve multiple contingencies that can be learned by individuals. For instance, participants can learn that the CS+ predicts the aversive outcome (Unconditioned stimulus; US), that the CS- predicts the absence of the US, and that the CS+ and CS- are unrelated (i.e., have different outcomes). This concept of contingency awareness has been shown to be important for learning (Clark & Squire, 1998). In particular, participants typically show greater differential learning effects (i.e., larger fear responses to CS+ vs. CS-) when they are able to self-report correctly the respective signal values of the CS+ and CS-. Given the importance of this factor for conditioning, it might also help explain any interactions between direct and vicarious experiences.

Generalization

Understanding how learning about an individual outgroup member spreads, or generalizes, to the entire outgroup as a whole is paramount to understanding outgroup perceptions and attitudes, and therefore, for the designing of real-world interventions. This transfer, known as generalization, can shed light on how intergroup anxiety can spread from a single outgroup member and lead to overall impressions of all members of that group as demonstrated by several existing studies (Herek & Capitanio, 1996; Paolini, Crisp & McIntyre, 2009; Paolini, Hewstone, Rubin & Pay, 2004; Voci & Hewstone, 2003; Wright et al., 1997).

Generalization has typically been measured in social psychology using generalization to a new exemplar, rather than along a gradient. Generalization to a new exemplar occurs when acquired responses transfer from the original stimulus to a new outgroup face that differs in individual features (Pettigrew, 2008). For example, Harris, Paolini and Griffin (2015b; Chapter 3) used an aversive vicarious learning paradigm in which participants watched a movie of a model acting as if she was receiving an electrical stimulation in the presence of one Black face (CS+), and as if she was relieved to receive no electrical stimulation in the presence of a second Black face (CS-). After conditioning, participants were shown several other Black faces. They found that generalization of learned anxiety from the CS+ to a new exemplar was dependent on the new stimuli being perceived as more similar to the face that had evoked anxiety in the model (CS+) than to the face that had evoked relief (CS-) (Harris et al., 2015b; Chapter 3).

Generalization, however, can also be measured along a gradient (Honig & Urcuioli, 1981). Quantifying generalization along a gradient requires morphing the original stimulus so that each new morph is gradually less like the original stimulus. For example, Harris, Paolini and Griffin (2015b; Chapter 3) morphed the Blackness of the skin (i.e., group membership) and the facial features (i.e., physiognomy) were manipulated towards a more Eurocentric (vs. Afrocentric) appearance. The results demonstrated generalization along a gradient such that fear towards the CS+ was generalized to the morph most similar to the CS+, but not the morph most different to the CS+. Hence, generalization can be measured to new exemplar outgroup faces, or via morphing faces to measure generalization along a gradient.

Expectations, Hypotheses and General Design

Research has verified that direct and vicarious learning are effective experimental paradigms for quantifying how behavior changes to both a particular stimulus and towards similar stimuli. This study will extend the use of these paradigms by quantifying how engaging in combinations of direct and vicarious experiences affect behavior.

To investigate the cumulative effects of direct and vicarious intergroup contact on both the acquisition and generalization of intergroup anxiety, this study adopted a classical conditioning paradigm. Participants experienced two sets of six trials in which one outgroup face (CS+) was paired with an aversive outcome and another outgroup face (CS-) was never paired with an aversive outcome. In one set of trials, the participant experienced the aversive outcome first-hand (electrical stimulation to his/her finger; direct learning), while in the other set of trials, the aversive outcome was experienced second-hand (the participant observed a model receiving an electrical to her finger; vicarious learning). To determine whether the interaction between direct and vicarious experiences differed depending on which (direct vs. vicarious) was experienced first, half the participants underwent the set of six direct trials first, while the other half underwent the set of six vicarious trials first. To quantify generalization from experienced faces to new ones (generalization to a new exemplar), participants were shown new outgroup faces both before and after conditioning. Generalization along a gradient was quantified by including morphed variations of the original CS+ and CS-. Following conditioning, participants completed a questionnaire in which they provided self-reported ratings of the perceived level of the model's anxiety to investigate the influence of social and intergroup dimensions of the vicarious learning experience on conditioning and generalization.

This study quantified psychophysiological arousal elicited by the faces prior to conditioning and after both the first and second set of conditioning trials. Considering the similarities between direct and vicarious learning, and in particular the research pointing towards their comparable levels of anxiety learning (Harris et al., 2015a; Olsson & Phelps, 2004), it was expected that participants would display similar levels of anxiety learning by the end of their first set of conditioning trials independently of whether they had learnt through direct experience or vicariously. Following from Galef and Whiskin's (2001) findings, it was expected that a second set of vicarious trials (D-V learning) would produce stronger learning effects than a second set of direct trials (V-D learning). Based upon classic learning theories in which the breadth of generalization is directly related to the strength of learning (Rescorla, 1976), it was expected that broader generalization would follow stronger conditioning effects. It was also expected that both model anxiety and contingency awareness would facilitate the acquisition and generalization of anxiety.

Method

Participants and Design

Seventy-eight (19 male; 59 female) self-identified White Australians (mean age of 20.27 years, *SD* = 3.01, range 18-29) were recruited from a large regional university in Australia and provided course credit for their participation. The design was a 2 Order

(Direct-Vicarious learning, Vicarious-Direct learning) x 2 Stimulus (CS+/CS-) x 3 Time (Time 1, Time 2, Time 3) mixed model design with Stimulus and Time as within subjects factors and Order as a between subjects factor. A power analysis confirms the study had sufficient power (see footnote 13).

Apparatus

FaceGen, a face morphing software (Singular Inversions, 2004), was used to generate eight standardized faces of Black-African appearance (see Appendix Q). The eight faces were of 25 year-old males with a neutral expression. Of the eight faces, two acted as the training faces (see Appendix R): one of which would be paired with an aversive outcome (CS+) and one which would not (CS-). Of the remaining six faces, two morphs of each of the CS+ and CS- (i.e., 4 faces) were created along the ethnicity factor. This was done such that the original training face appeared less Black (75% similar) and even less Black (50% similar) and instead was more like the average of the four available ethnic groups within FaceGen (Asian, Black-African, Middle Eastern and White). The final two faces were novel outgroup faces that appeared typically Black (i.e., 100% on the ethnicity factor). The variation faces were included to test generalization along a gradient; whilst the two new Black faces were included to test generalization to a new exemplar.

Procedure

Participants were asked to complete a two-part study investigating “how people become anxious”. The first part consisted of an online questionnaire, which asked participants to use a 7-point Likert-type scale (1 = *not at all*, 7 = *very much)* to rate the perceived similarity of each pair combination of the eight faces (see above) that would be shown in the laboratory testing session. Participants were also asked to indicate "how prototypical each face is of Black people in general", as a measure of typicality (see Appendix S). They used the same 7-point Likert-type scale as the similarity ratings.

During the laboratory testing session, participants were seated in a comfortable chair in front of a 17-in. flat screen Dell computer monitor that projected stimuli synchronized with a 60-Hz vertical refresh rate. Once seated, participants were asked to clean their fingers with a humidified wipe. They were then fitted with the physiological recording equipment. This included an electrical stimulation electrode on the distal phalange of the left index finger, and a skin conductance electrode on the distal phalanges of the left middle and ring fingers, as well as a respiration belt around their chest to account for any breathing artefacts (Greco & Baenninger, 1991). The skin conductance electrodes (stainless steel; AD Instruments) were prepared with an isotonic gel to improve skin contact and recording quality. Once fitted with the skin conductance electrodes, participants were provided with a demonstration of the equipment and then asked to self-select their level of electrical stimulation (range 1-20 mA) that they found "uncomfortable but not painful" (Lovibond et al., 2008) using a standard work-up procedure. This level of electrical stimulation was then used throughout the experiment. Similar to Lovibond and colleagues (2008), participants were then shown the contingency dial that was on the arm of their chair. This dial was described as a "measurement of how much you think you will receive an electric stimulation at any given moment". The participants made their judgment by using a spring-loaded dial, which rotated 180 degrees, and returned to the midpoint when participants released it. From the midpoint, 90 degrees to the left was labelled as 'low expectancy' and 90 degrees to the right was labelled as 'high expectancy'. Participants were asked to use the dial continuously throughout face presentations during the experiment. The participants' ratings provided a measurement of awareness of the contingent relationship between viewing certain faces and the likelihood of receiving an electric stimulation. Participants were classified as 'aware' if their dial ratings indicated increased expectancy that an electrical stimulation would be received while observing CS+ (i.e., a rating closer to the 'high expectancy' endpoint) and reduced expectancy that an electrical stimulation would be received while observing the CS- (i.e., a rating closer to the 'low expectancy' endpoint). Participants were 'unaware' if they did not predict either of the two contingencies (i.e., expectancy rating for the CS+ was closer to the 'low expectancy' endpoint and expectancy rating for the CS- was closer to the 'high expectancy' endpoint). Participants were classified as 'partially aware' if their dial ratings demonstrated that they correctly predicted one of the two contingencies.

Approximately 10 minutes after the work-up procedure had been completed, participants then underwent the learning component of the study. All participants were first presented with each of the eight stimuli, once each, to measure baseline skin conductance levels (SCLs). This time point is referred to as Time 1. Each face was presented for 10 seconds, with an average inter-stimulus-interval of 15 seconds (range 10-20 seconds). Participants were then randomly allocated to undergo a direct followed by vicarious conditioning (D-V learning) (N = 38), or a vicarious followed by direct conditioning (V-D learning) (N = 40). The time point coinciding with the end of the first conditioning experience is referred to as Time 2 and the time point coinciding with the end of the second conditioning experience is referred to as Time 3.

Olsson and Phelps' (2004) direct and vicarious learning paradigms were adapted for this study. During direct learning, participants were presented with a Black face, known as the CS+, which co-terminated with the presentation of a 2 ms electrical stimulation delivered at the level selected in the work-up procedure. The CS- was never paired with electrical stimulation. When undergoing vicarious learning, no electrical stimulations were administered to participants. Instead, participants watched a video displaying a young female actor (the ‘model’) simulating responses to face stimuli presented on a computer monitor in front of her (see Appendix G). The model was connected to the same physiological equipment as the participant, including the electrical stimulation electrode. All participants were told that the stimuli the model was purportedly observing on her monitor were displayed on the right hand side of the monitor in front of them. On the left hand side they viewed the model simulating anxiety reactions towards the CS+ and receiving an electrical stimulation, and expressions of relief towards the CS- and receiving no stimulations. Participants were asked to “pay attention to both sides of the monitor. That is, pay attention to both the behaviour of the participant, and also to what she is seeing on her screen.”

Participants were informed that the video was an illustration of the experiment they were about to undergo. The video was selected from a pool of four potential video sequences that contained four different models. The selected video was selected on the basis of tests indicating that White Australian students had found it to be the most believable, reliable and anxiety inducing sequence of the four potential videos (for more information, see Chapter 2).

During both direct and vicarious learning, participants were shown the CS+ and CS- six times each. This meant that during direct learning, participants received six CS+/electrical stimulation pairings and six CS-/no electrical stimulation pairings. During vicarious learning, participants observed the anxiety responses of the model elicited by six CS+/electrical stimulation pairings, and the relief responses evoked by six CS-/no electrical stimulations pairings. Hence, in total each participant experienced 12 CS+/aversive outcome pairings and 12 CS-/no aversive outcome pairings.

At Time 2, the two training faces (CS+ and CS-) were shown once each, without electrical stimulations for participants who underwent direct learning first, and without the model's responses for participants who underwent vicarious learning first. The additional six faces (i.e., the generalization stimuli) were not presented at Time 2 to minimize extinction.

At Time 3, the training stimuli and the six additional faces were displayed once each without electrical stimulations or model responses. All participants then completed a short questionnaire related to the vicarious learning experience. Participants used a 7 point Likert-type response scale to indicate their level of perceived model anxiety (1 item, "in the segments of the video in which the research participant looked anxious or apprehensive, how anxious or apprehensive did she appear?"). Perceived model anxiety was positively correlated with contingency awareness (r = .48). Finally, participants were asked to complete a post-test measure of typicality, which was identical to the pre-test measure.

For ethical purposes, participants underwent extinction before leaving the lab. Participants were presented with the CS+ and CS- repeatedly without any electrical stimulation pairings, so that any acquired negativity was extinguished (mean number of face presentations until responses extinguished: 14, SD = 6.2; range: 10-41 presentations). Following extinction, participants were asked to watch a short video clip that portrayed Black people in a positive manner. Participants were then debriefed and thanked for their time.

All research procedures complied with the APA's human ethics guidelines, with the relevant approval provided by the local institutional review board for human research ethics (see Appendices B and C for ethics approval and Appendices M, N, O and P for participant forms).

Scoring of Skin Conductance Levels

Skin conductance levels (SCLs) were scored when the baseline to peak amplitude difference commenced within the 1-4 s latency window following stimulus onset (Mallan, Sax, & Lipp, 2009). If no upwards inflection commenced within this period, the response was scored as 0. The minimum response criterion was 0.02 μS. SCLs were screened for breathing artefacts, including coughs, sneezes and yawns (Greco & Baenninger, 1991), which were removed from data analysis.

Results

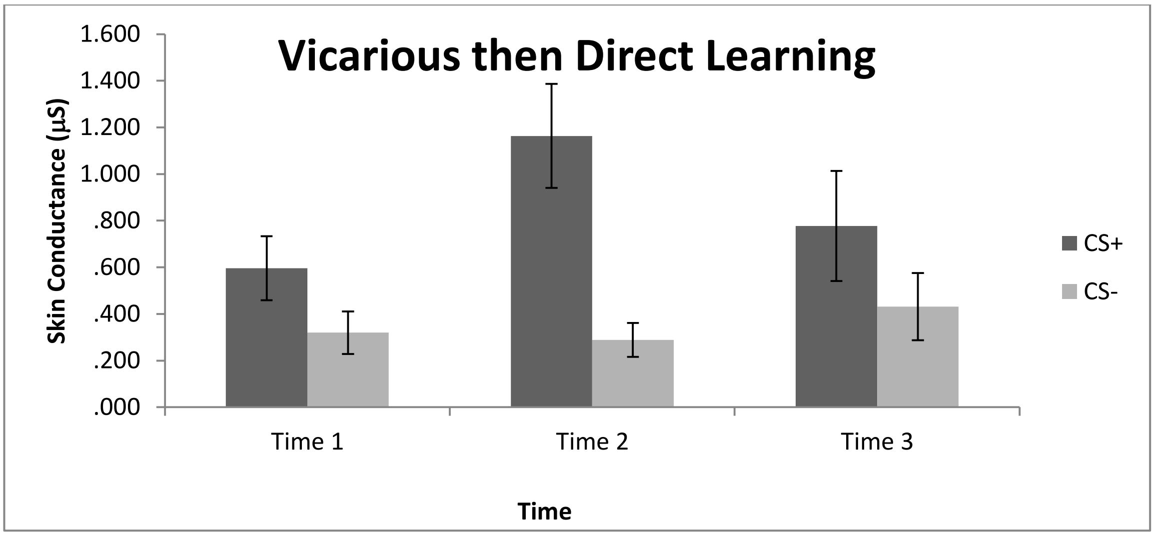
Learning

First, SCLs to the training faces (CS+ and CS-) were analyzed in order to determine whether differential learning of the CS+ vs. CS- had occurred using three separate 2 Order (Direct-Vicarious learning/Vicarious-Direct learning) x 2 Time x 2 Stimulus (CS+/CS-) mixed model ANOVA's, with Time and Stimulus as repeated measures.

The first ANOVA compared Time 1 SCLs with Time 2 SCLs to determine whether participants demonstrated learning following the first learning experience. The ANOVA revealed an interaction between Time and Stimulus, F (1, 76) = 10.95, p = .001, η_p^2 = .126, reflecting the fact that participants displayed a greater increase in SCLs towards the CS+ relative to the CS- over time. More specifically, participants displayed significantly higher SCLs to the CS+ at Time 2 (M = .1.20, SD = 1.55), relative to the CS- (M = .46, SD = .76), t (77) = 4.120, p < .001. In contrast, participants displayed no significant difference in SCLs towards the CS+ and CS- at Time 1 CS+: M = .57, SD = .98; CS-: M = .65, SD = 1.39, t (77) = -.369, p = .713. Importantly, this two-way interaction was not qualified by Order (*F* < 1, *p* = .392), suggesting that participants displayed this pattern of contingency learning regardless of which type of learning experience, direct of vicarious, they underwent first.

The second ANOVA compared SCLs collected at Time 2 with those collected at Time 3. The ANOVA revealed a main effect of Stimulus, F (1, 75) = 21.06, $p < .001$, $\eta_p^2 = .219$. This was expected because participants already discriminated the CS+ from the CS- at Time 2 following their first learning experience. As expected, SCL's showed that at Time 3, the CS+ displayed higher SCLs relative to the CS-, CS+: *M* = 1.06, *SD* = 1.57; CS-: *M* = .46, *SD* = .96. However, the ANOVA revealed no evidence of a two-way interaction between Time and Stimulus (*p* = .294) or three-way interaction between Time, Stimulus and Order (*p* = .237), indicating that further learning did not further amplify the ability of participants of either treatment to discriminate the CS+ from the CS-.

The third ANOVA compared SCLs measured at Time 1 with those measured at Time 3 to determine whether the combined effect of two types of learning experiences differed depending on the order in which they were experienced. The ANOVA found a two-way interaction between Time and Stimulus, F (1, 75) = 5.573, $p = .021$, $\eta_p^2 = .069$. Specifically, participants displayed higher Time 3 SCLs to the CS+ relative to the CS-, CS+: *M* = .93, *SD* = 1.61; CS-: *M* = .46, *SD* = 1.17, t (76) = 2.767, $p = .007$, demonstrating that participants displayed contingency learning following the combined learning experiences. As mentioned above, there was no difference in Time 1 SCLs to the CS+ and CS- (see above for means and SDs). This two-way interaction between Time (Time 1 vs. Time 3) and Stimulus (CS+ vs. CS-) was qualified by Order, F (1,75) = 4.255, $p = .043$, $\eta_p^2 = .054$. When analyzed separately by Order, those participants who underwent D-V learning displayed greater discriminative learning, as evidenced by a significant Time x Stimulus interaction, F (1,36) = 7.685, p = .009, η_p^2 = .176, relative to those who underwent V-D learning, F (1,39) = .058, p



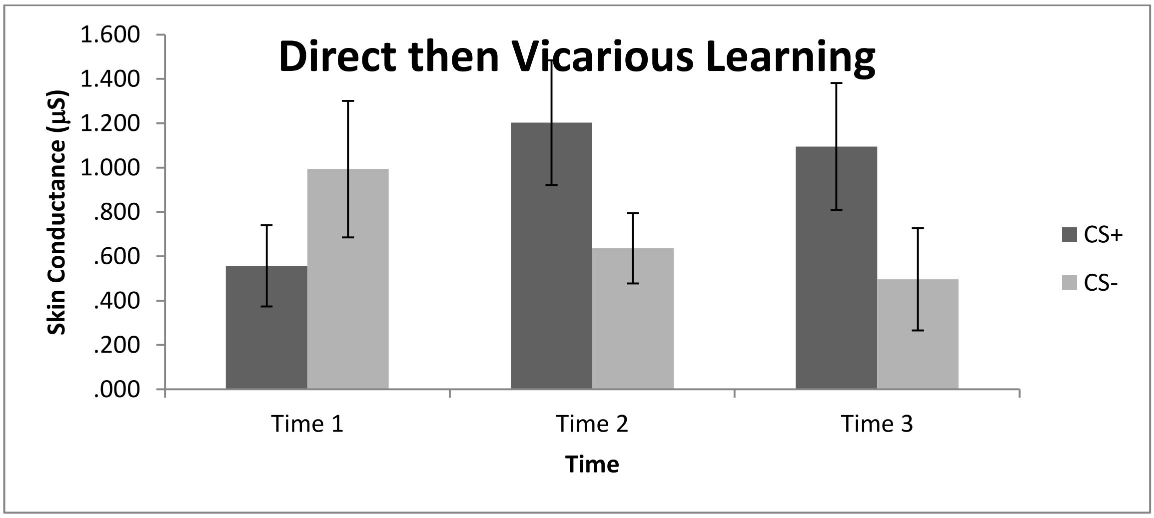


Figure 9. Decomposition of the three-way time x stimulus x order interaction, separated by order. The top panel shows the time x stimulus interaction for those who underwent V-D learning; the bottom panel represents participants who underwent D-V learning. Time 1 refers to baseline SCL measurements; time 2 refers to SCLs recorded following the first conditioning experience; and time 3 refers to SCLs recorded following the second conditioning experience.

= .810, η_p^2 = .001 (see Figure 9). Hence, D-V learning resulted in discrimination of the CS+ and CS- whereas V-D learning did not.

To explore whether the two-way interaction between Time and Stimulus, and the three-way interaction between Time, Stimulus and Order, were mediated by perceived model anxiety and contingency awareness, these variables were included separately as a covariate in a Time (Time 1, Time 3) x Stimulus (CS+, CS-), and in a Time (Time 1, Time 3) x Stimulus (CS+, CS-) x Order (D-V, V-D) ANCOVA (refer to Judd, Kenny, & McClelland, 2001; Yzerbyt, Muller & Judd, 2004 for mediation tests for within-subject designs). Both perceived model anxiety and contingency awareness mediated the two and three-way interactions, Time x Stimulus, *from F* (1, 75) = 5.573, *p* = .021, η_p^2 = .069, to perceived model anxiety: *F* (1, 73) = .386, *p* = .537, η_p^2 = .005; contingency awareness: *F* (1, 74) = 2.172, *p* = .145, η_p^2 = .029; Time x Stimulus x Order, *from F* (1,75) = 4.255, *p* = .043, η_p^2 = .054, to perceived model anxiety: *F* (1, 73)= 2.80, *p* = .099, η_p^2 = .037; contingency awareness: *F* (1, 74) = .882, *p* = .351, η_p^2 = .012. To check that perceived model anxiety and contingency awareness mediated the two- and three-way interactions in the predicted direction, that is, to ensure that perceived model anxiety and contingency awareness facilitated discriminative learning, a correlation was conducted between the covariates and an index of learning calculated using the formula:

> Learning index = ([Time 3 SCL for CS+] – [Time 1 SCL for CS+]) – ([Time 3 SCL for CS-] – [Time 1 SCL CS-]), whereby larger positive values indicated greater discriminative learning.

The results demonstrated that perceived model anxiety and contingency awareness acted as a mediator in the predicted direction; perceived model anxiety and contingency awareness both facilitated discriminative learning (see Table 5). More specifically, model anxiety and contingency awareness were both positively associated with higher SCL's towards the CS+, and negatively correlated with high SCL's towards the CS-.

Generalization Along a Gradient

As SCL responses to the generalization faces were only measured at Time 1 and Time 3, generalization was analyzed using a single ANOVA. To test for generalization along a gradient, that is to test for the transfer of acquired anxiety from the training faces to the manipulated variations, a 2 Time (Pre-test/Post-test) x 2 Stimulus (CS+/CS-) x 3 Similarity (CS/75%/50%) x 2 Order (Direct-Vicarious learning/Vicarious-Direct learning) mixed model ANOVA was conducted with Time, Stimulus and Similarity as repeated factors.

The results revealed a three-way interaction between Time, Stimulus and Similarity, F (2,150) = 3.873, p = .023, η_p^2 = .049, Figure 10. Paired Samples *t*-tests demonstrated that there was no difference in SCLs towards the CS+ and CS- at Time 1 for either the 75% similar variations, t (37) = .158, p = .875, the 50% similar variations, t (37) = -.238, p = .813, or the training faces, t (77) = -.369, p = .713. At Time 3, there was no difference in SCLs towards the CS+ and CS- for the 50% similar variations, t (37) = .033, p = .974, but there was a significant difference in SCLs towards the CS+ and CS- for the 75% similar variations, t (37) = 4.113, p <.001, showing evidence of generalization of SCLs from the training stimuli

Table 5

Mediation results and correlations between mediators and generalization

	Learning		Generalization to CS+ Variations		Generalization to CS- variations	
	r	p	r	p	r	p
Perceived Model Anxiety	.129	.454	.092	.426	-.014	.903
Dial Ratings	.061	.600	.036	.755	-.008	.947

to the most similar variations, but not the least similar variations (Figure 10). This three-way interaction was not qualified by Order, indicating that participants from both treatments displayed generalization of SCLs from the training faces to the 75% similar variations, but not the 50% similar variations. In other words, the extent to which participants generalized their acquired SCL response from the faces involved in the conditioning experience to new similar looking faces was independent of the order in which they had undergone the vicarious and direct conditioning.

When included separately as covariates in the ANOVA (see Judd et al., 2001), the dial ratings of contingency awareness nullified the three-way interaction, *from* F (2,150) = 3.873, p = .023, η_p^2 = .049, to F (2, 148) = .367, p = .694, η_p^2 = .005, as did perceived model anxiety, *from* F (2,150) = 3.873, p = .023, η_p^2 = .049, to F (2, 146) = 2.539, p = .082, η_p^2 = .034, suggesting that both factors mediated generalization along a gradient. To establish whether these mediators operated on generalization in the expected direction (i.e., contingency awareness increases the breadth of generalization), each of the covariates were correlated with an index of generalization to the most

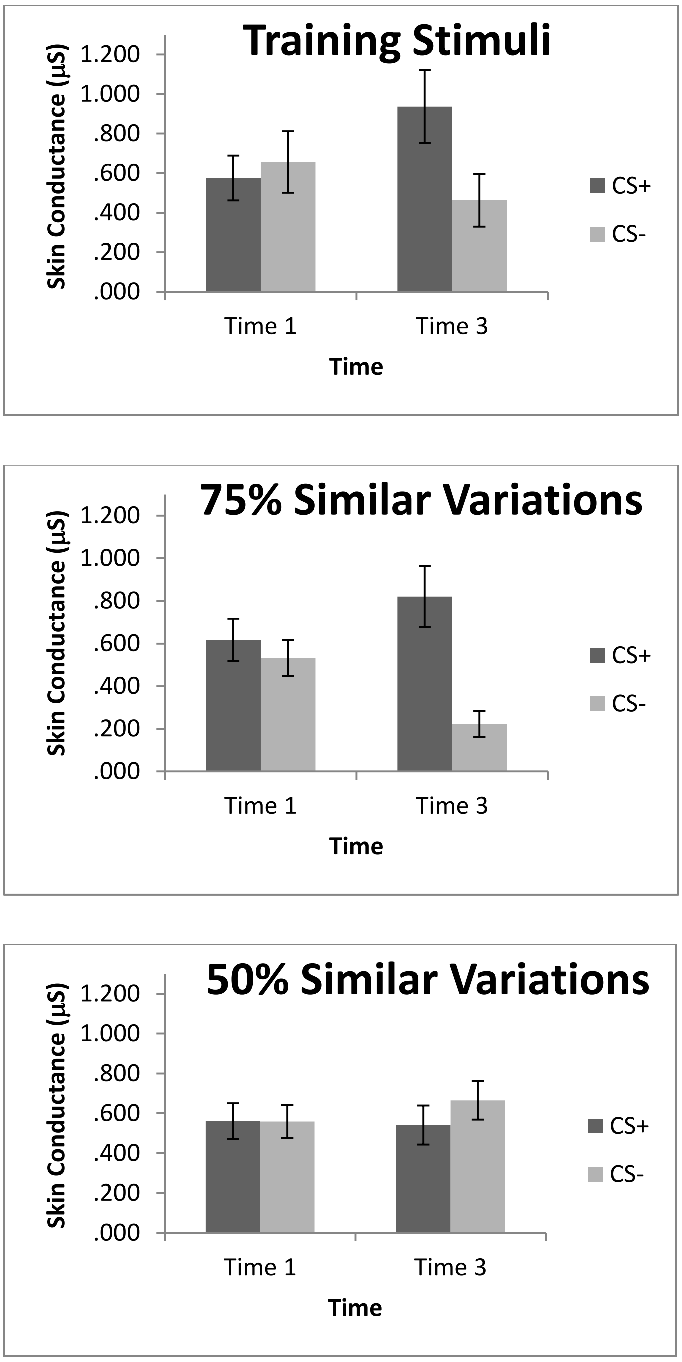


Figure 10. Three-way interaction between time, stimulus and similarity for the ANOVA comparing baseline SCLs (time 1) with SCLs following both learning experiences (time 3) for the two training stimuli and their 75% and 50% similar variations.

similar face. The index was calculated as follows:

Generalization Index =- ([post SCL for CS+] – [pre SCL for CS+]) – ([post SCL for 75% CS+ similarity variation] – [pre SCL for 75% CS+ similarity variation]).

An identical formula was created for generalization towards the CS-, except CS- was substituted in where CS+ appears in the above formula. This generalization index encompasses a difference of two differences. The first difference reflects the acquired response to the CS+; larger difference scores indicate greater levels of anxiety learning. The second difference reflects the acquired response to the CS+ 75% variation; larger difference scores indicate greater levels of generalization to the non-trained 75% CS+ similar variant. Hence, large negative values between these two difference scores indicate lower levels of generalization, while smaller negative values between these two difference scores indicate broader generalization. If generalization is complete, the index should equal zero.

The results demonstrated that both mediators operated in the predicted direction; perceived model anxiety and contingency awareness both facilitated generalization along a gradient as evidenced by positive correlations, albeit non-significant, with the generalization index for the CS+ and a general trend for negative correlations, albeit non-significant, with the generalization index for the CS- (see Table 5). Hence, high levels of perceived model anxiety and high levels of contingency awareness were associated with greater transfer, or generalization, of acquired anxiety from the CS+ to its 75% variation; and less transfer, or generalization, of acquired anxiety from the CS- to its 75% variation.

Generalization to a New Exemplar

To test for generalization to a new exemplar, participants' pre-training similarity ratings were analyzed and the moderating role of perceived similarity between the training stimuli (CS+ and CS-) and the new Black faces was investigated. For each of the two new Black faces, a between subjects variable was created, which categorized participants into one of three groups: Similar to CS+, where participants perceived the new Black face as being most similar to the CS+; Similar to CS-, where participants perceived the new Black face as being most similar to the CS-; and Equally similar to the CS+ and CS-, where participants perceived the new Black face as equally similar to both training faces (see footnote 14).

A 2 Time (Time 1, Time 3) x 3 Similarity (most similar to CS+/equally similar to CS+ and CS-/most similar to CS-) x 2 Order (Direct-Vicarious learning/Vicarious-Direct learning) mixed model ANOVA was conducted on SCL's to the new exemplar face, with Time as a repeated factor. Results revealed a two-way interaction between Time and Similarity, F (2, 71) = 12.401, $p < .001$, $\eta_p^2 = .259$. When analyzed separately by similarity to the CS+, the data revealed a significant main effect of Time for participants who perceived the new exemplar face as most similar to the CS+, F (1, 23) = 10.073, $p = .004$, $\eta_p^2 = .305$, and for those who perceived the new exemplar face as most similar to the CS-, F (1, 31) = 7.949, $p = .008$, $\eta_p^2 = .204$, whereas there was no main effect of Time for those participants who perceived the new outgroup face as equally similar to the CS+ and CS-, F (1, 17) = 2.945, $p = .104$, $\eta_p^2 = .148$ (Figure 11). More specifically, those who perceived the new outgroup face as most similar to the CS+ showed an increase in SCLs from Time 1 to Time 3, t (24) = -2.96, $p = .007$, whereas those who perceived the new outgroup face as equally similar to the CS+ and CS-, did not, t (18) = 1.73, $p = .100$, and those who perceived the new outgroup face as most similar to the CS- showed a significant decrease in SCLs from Time 1 to Time 3, t (32) = 2.51, p = .017 (Figure 11).

The two-way interaction between Time and Similarity was marginally qualified by Order, F (2, 71) = 2.309, p = .061, η_p^2 = .062. Specifically, participants who underwent V-D learning demonstrated a larger two-way interaction between Time and Similarity, F (2, 37) = 9.967, p < .001, η_p^2 = .350, compared to those who underwent D-V learning, F (2, 34) = 3.368, p = .046, η_p^2 = .165.

When analyzed separately by Order, V-D participants displayed higher SCLs to the new exemplar at Time 3 relative to Time 1 when the new exemplar was perceived as most similar to the CS+, t (11) = -2.782, p = .018 (Figure 12). V-D participants did not show differential responding to the new exemplar at Time 3 relative to Time 1 when it was

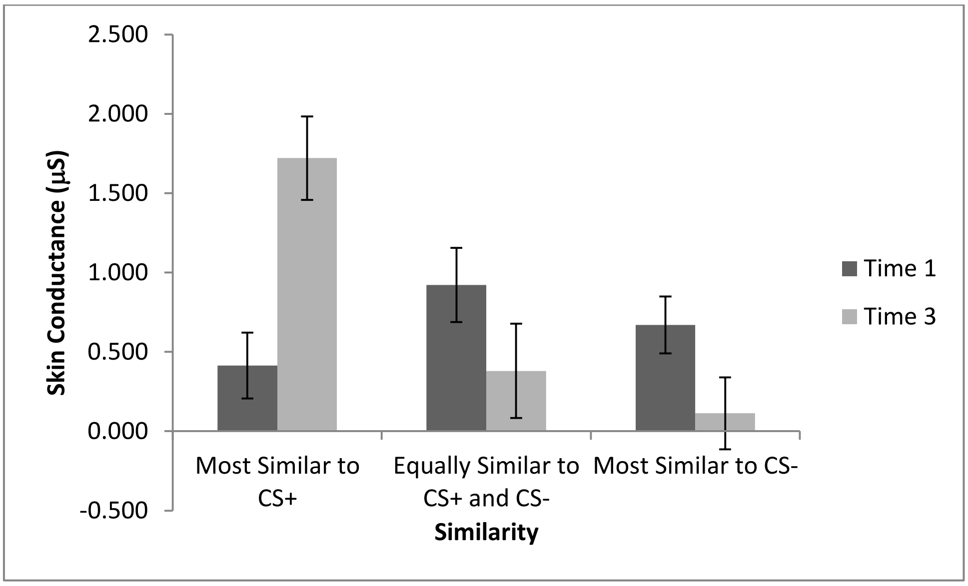


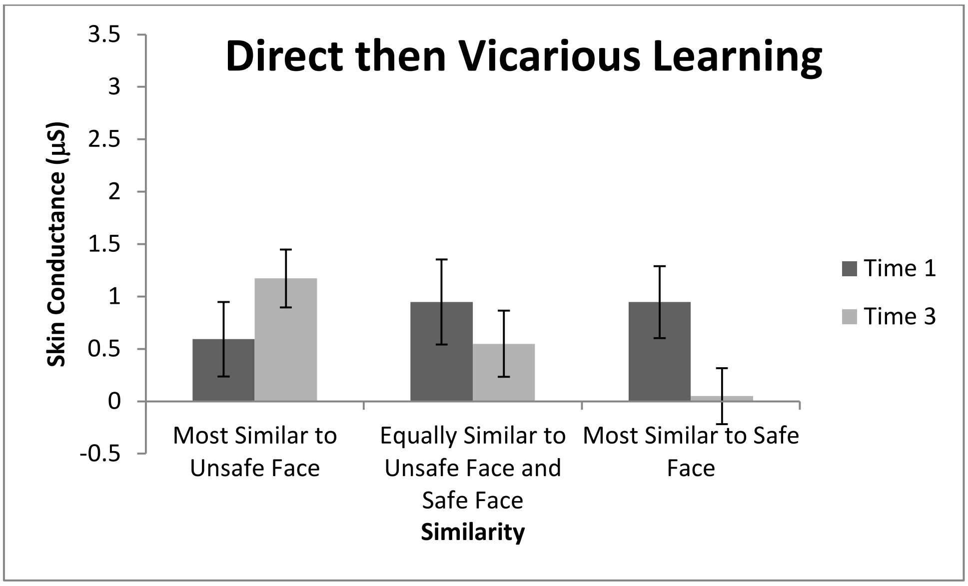
Figure 11. Two-way interaction between time (baseline, or time 1, and following both learning experiences, or time 3) and perceived similarity of the first new exemplar outgroup face to the CS+ and CS-.

perceived as equally similar to the CS+ and CS-, nor when it was perceived as most similar to the CS-, *t*s > .139 (Figure 12).

In contrast, D-V participants showed no evidence of generalization to the new exemplar whether it was perceived as most similar to the CS+, or whether it was perceived as equally similar to the CS+ and CS-, *t*s > .193 (Figure 12). However, D-V participants showed a significant decrease in SCL's from Time 1 to Time 3 for the new exemplar when it was perceived as most similar to the CS-, t (13) = 2.258, p = .042 (Figure 12). This pattern of acquired SCL's suggests that D-V participants generalize the relative 'safety' of the CS- to the new exemplar faces when the new exemplar faces were perceived as most similar to the original CS-.

Taken together, these findings suggest that generalization of anxiety responding occurred towards the new exemplar face for V-D participants and for D-V participants; however this was conditional upon whether the new exemplar face being perceived was considered as similar to the CS+ (for V-D participants), or similar to the CS- (for D-V participants).

For the second new outgroup face, the Time x Similarity x Order ANOVA revealed a two-way interaction between Time and Similarity, F (2, 71) = 12.602, p < .001, η_p^2 = .262. When broken down by similarity to the CS+, a significant main effect of Time was found for participants who perceived the new exemplar face as most similar to the CS+, F (1, 32) = 10.968, p = .002, η_p^2 = .255, and for those who perceived the new exemplar face as most similar to the CS-, F (1, 34) = 12.444, p = .001, η_p^2 = .268, whereas those who perceived the new outgroup face as equally similar to the CS+ and CS-, F (1, 5) = 2.235, p = .195, η_p^2 = .309, did not (Figure 13). More specifically,



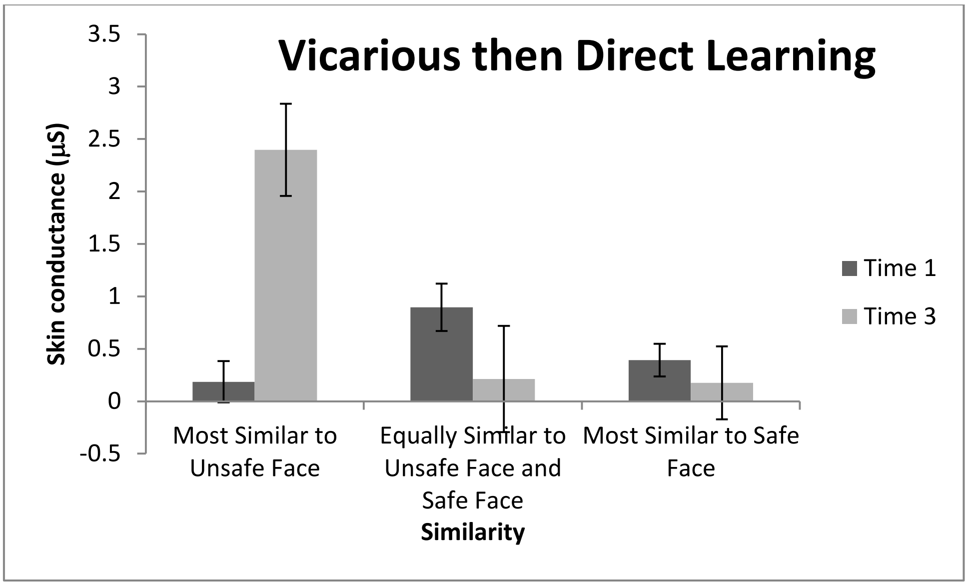


Figure 12. Three-way interactions between time, perceived similarity of the first new exemplar outgroup face to the CS+/CS-, and order for those who underwent D-V learning (top panel) and V-D learning (bottom panel).

those who perceived the new outgroup face as most similar to the CS+ showed an increase in SCLs from Time 1 to Time 3, t (33) = -3.33, p = .002, whereas those who

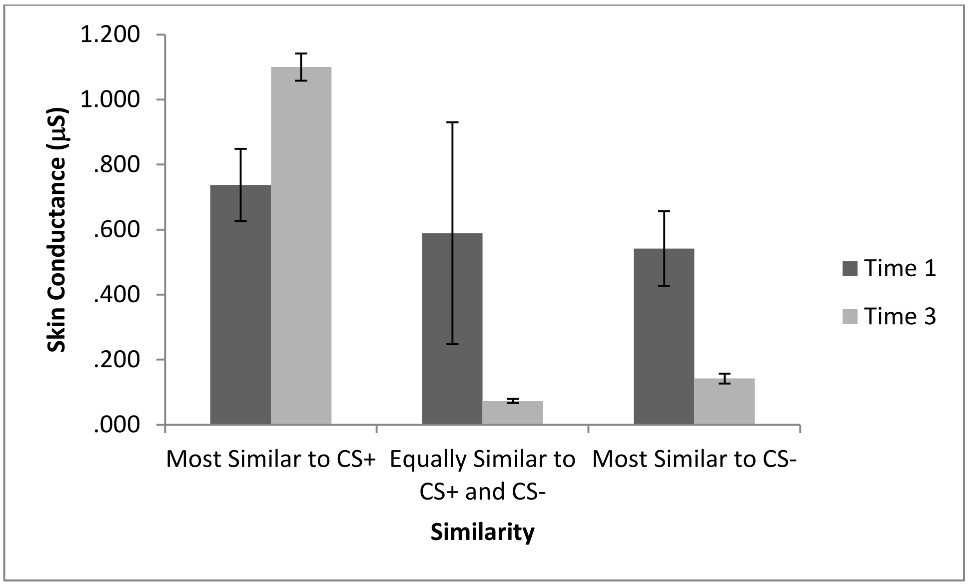


Figure 13. Two-way interaction between time (baseline, or time 1, and following both learning experiences, or time 3) and perceived similarity of the second new exemplar outgroup face to the CS+ and CS-.

perceived the new outgroup face as equally similar to the CS+ and CS-, did not, t (6) = 1.65, p = .150, and those who perceived the new outgroup face as most similar to the CS- showed a significant decrease in SCLs from Time 1 to Time 3, t (35) = 3.59, p = .001 (Figure 13). The two-way interaction between Time and Similarity was not qualified by Order, p > .490. This pattern of results suggests that generalization occurred towards the new exemplar face, but only when the new exemplar face was perceived as similar to the CS+.

Discussion

The purpose of this study was to investigate potential cumulative effects resulting from experiencing direct *and* vicarious intergroup anxiety learning *in different orders*. The results showed that participants who were given the opportunity to learn about an outgroup face through their own experience first and then vicariously (D-V learning) acquired an overall fear response towards the face, whereas participants who leant vicariously and then directly (V-D learning) did not. This differential effect was solely attributable to the effect of the second experience on the first as both participant groups exhibited anxiety responses towards the faces by the end of their first experience independent of whether it was a direct or indirect one. Specifically, participants whose second experience was a vicarious one appeared to retain their learnt response whereas those participants for whom the second experience was a direct one appeared to extinguish their initial learning (Figure 9). These results are in line with previous work examining the interaction between direct and social learning in rodents (Galef & Whiskin, 2001), which showed that individuals that learnt about two distinctly tasting foods through their own experience and then from interacting with a demonstrator acquired the taste preference of their demonstrator far more than individuals that were exposed to the food choice of their demonstrator and then learnt about them individually. These interactions were explained by suggesting that direct experience effectively extinguishes previous unconfirmed vicarious experiences.

These results further revealed that participants displayed generalized anxiety responses to a new face whose individual and group-defining features were 25% less like those of the face experienced during conditioning, as well as towards a new group member they perceived to be similar to the face experienced during conditioning. In both these cases, the level of generalization did not differ between the two participant groups.

Patterns of generalization to a second new group member were more complex and varied across the two participant groups. Those participants that had learnt vicariously and then directly (V-D learning) showed a very high generalized anxiety response to a new group member, whom they perceived to be similar to the original face experienced during training. In contrast, those participants that had learnt directly and then vicariously (D-V learning) generalized their relaxation responses to the new group member if they perceived it to be similar to the face that had never been paired with electrical stimulation during conditioning (CS-). Hence, although both groups showed generalization, this effect was expressed with respect to the unsafe face in V-D participants and with respect to the safe face in D-V participants.

These results reveal an inherent contradiction between learning and generalization. Classic learning theory (Rescorla, 1976) predicts that the breadth of generalization should increase with the level of conditioning to the conditioned stimuli. In other words, participants who show high conditioned responses should show larger generalization responses. Here, it was found that anxiety acquired as a consequence of vicarious learning appeared to extinguish during subsequent first-hand learning, yet these very same participants expressed a very high generalized anxiety response towards a new group member whom they rated to be similar to the face they experienced together with the electrical stimulation, as well as generalized anxiety towards both a face with slightly different individual and group defining features and an additional a new group member.

One way to reconcile the learning and generalization data draws upon the peak shift effect. A peak shift is a learning phenomenon in which the peak of the generalization gradient is modified from the stimuli originally presented within a discrimination learning task, and instead moves towards a more extreme exemplar (Livesey, & McLaren, 2009; McLaren, & Mackintosh, 2002; Terrace, 1968). This phenomenon has been demonstrated in a multitude of species, including bees (Lynn, Cnaani, & Papaj, 2005), horses (Dougherty & Lewis, 1991), rats (Weiss & Schindler, 1981), goldfish (Ames & Yarczower, 1965), chickens (Gamberale & Tullberg, 1996), pigeons (Cheng, Spetch, & Johnston, 1997), and humans (Purtle, 1973). A peak shift effect would explain why participants who learnt about the outgroup faces vicariously and then directly showed no overall conditioned response to the target face, but strong generalization to a new face. Rather than extinction, as thought to be the case in non-human animals, these participants, for some reason, showed a displacement of the generalization peak away from the original training stimulus towards a new group member they perceived as similar to the original target face.

As a post-hoc test to determine why these peak shifts occurred only in the V-D learning condition and not just the D-V learning condition, analyses were conducted on the typicality data. In particular, the pre-test and post-test typicality data was analyzed separately for the D-V and the V-D learning conditions. The results revealed that the new group member was perceived to be more outgroup-like compared to the originally trained CS+, but only at post-test and only in the V-D learning condition (see footnote 15). That is, despite no pre-existing differences in typicality judgments at pre-test between the CS+ and the new outgroup faces, the increase in typicality after undergoing V-D learning was larger towards the new outgroup exemplar face compared to the CS+. In contrast, the D-V learning condition found no difference in typicality ratings at post-test between the CS+ and the new outgroup faces. Hence, those in the V-D learning condition displayed broader generalization from the CS+ to similar outgroup members, and also rated this new outgroup member to be more typical of the outgroup. In contrast, those in the D-V learning condition displayed generalization from the CS- to similar outgroup members, and did not display a significant difference in ratings of typicality towards the new outgroup stimulus relative to the CS+.

When combined, the typicality and the anxiety data suggest that individuals engaged in peak shift during the V-D learning, but not the D-V learning, condition.

According to this interpretation, the most important difference between V-D and D-V experiences is in the capacity of one to produce robust learning of a target group member and of the other to produce robust generalization towards new more extreme group members mediated by a peak shift effect. What remains to be explained is why V-D experiences produce movements of acquired responses towards presumably more extreme members of the outgroup. Some insight might be gained from the peak shift literature.

Peak shifts are thought to provide a mechanism that protects against making potential errors, and in particular, mistaking the CS+ and CS- (Lynn et al., 2005). For example, in an aversive discriminative learning task, the peak of the generalization gradient will shift from the CS+ to a stimulus that is further removed from the CS-, in a direction opposite to the CS- (Terrace, 1966, 1968). The literature suggests that participants become more conservative; they reduce the likelihood that they would respond erroneously towards a presented face that was actually a safety signal. For illustrative purposes, if the CS+ was a 2000-Hz tone and the CS- was a 1200-Hz tone, tests for generalization across a range of tones will show that the generalization peak (i.e., the largest acquired fear response) is elicited by a 2200-Hz tone. To date, the peak shift literature does not contain any evidence that peak shifts occur following vicarious learning paradigms.

Although the results were not predicted by a functional perspective, the generalization results can also be explained by Fazio and Zanna's theory of attitude formation (1981). Research by Fazio and Zanna (1981) suggests that direct experiences, relative to vicarious ones, generate responses that are more stable, more resistant to change, and are held more confidently. Hence, since anxiety responses were comparable after isolated experiences of direct and vicarious fear learning, Fazio and Zanna's research would predict that subsequent direct experiences would 'reinforce' or confirm the associations between an anxiety inducing stimulus and aversiveness, relative to subsequent vicarious experiences. Following this notion, these data found that participants displayed broader levels of generalization when they experienced V-D learning. That is, aversive first-hand experiences, when experienced most recently, encouraged a change towards members of the outgroup, which included associating similar outgroup members with the original target stimuli. This process of association is representative of generalization. Hence, the generalization of intergroup anxiety was consistent with Fazio and Zanna's (1981) predictions. However, unlike the peak shift explanation, this cannot explain why there the learning data did not display the same pattern of results as generalization.

It was also expected that model anxiety, as well as contingency awareness, would mediate learning and generalization, respectively. Consistent with predictions, the data demonstrated the mediating role of model anxiety, on anxiety learning. These mediation effects reinforce the significance of the model during vicarious learning experiences that have been found within this thesis (Chapter 3). In particular, this study has substantiated that participants learn and generalize to a greater degree if the model is perceived to be more anxious, more believable and more similar to them (Harris et al., 2015b; Chapter 3). However, this study did not find an effect of order, suggesting that the model's anxiety played a key role in the development of anxiety responses, regardless of when participants underwent vicarious learning. Thus, this chapter has demonstrated the robustness of the findings from this thesis that suggested the importance of the model's anxiety, and this reinforces that the model's anxiety is a significant driver of vicarious learning and generalization.

Consistent with predictions, contingency awareness was also found to be an influential factor that mediated both learning and generalization along a gradient. More specifically, this study found that participants who were classified as contingency aware showed greater differential learning and broader generalization gradients compared to those who were classified as contingency unaware, with no associated order effects. That is, contingency awareness facilitated the heightened anxiety to the aversive stimulus compared to the safe stimulus, and also made this acquired anxiety spread to the most related or similar stimuli, regardless of whether participants underwent D-V or V-D learning. While contingency awareness has been shown to be important for learning and acquisition (Lovibond et al., 2008), these results also implicate the importance of contingency awareness for generalization. The fact that generalization was mediated by contingency awareness adds weight to the fact that generalization drew upon the participant's ability to learn. However, since this study did not find an effect of order for this mediating role of contingency awareness on the generalization of intergroup anxiety, this suggests that contingency awareness is a significant facilitator of the generalization of anxiety responses, regardless of the order in which direct and vicarious learning are experienced. Hence, stimulus-specific or contingency-bound generalization is facilitated by knowledge of the CS and outcome, and the social and intergroup dimensions of the vicarious learning experience, including model anxiety.

Implications, Limitations and Directions for Future Research

The different effects that emerged on both acquisition and generalization when participants experienced direct and vicarious learning in different orders have important implications for intervention strategies. In particular, these effects suggest that intervention strategies should adopt a multifaceted approach to reduce intergroup anxiety. More specifically, the data point towards the importance of both first-hand and vicarious intergroup experiences for the acquisition and spread of intergroup anxiety. Although vicarious experiences following direct ones are more effective for individual level learning, to ensure generalization to other outgroup members, the order of experiences should be reversed. Therefore, if an intervention is aiming to change anxiety towards a single outgroup member (i.e., episodic anxiety), then the recommended order of experiences should be D-V learning. However, if the aim is to change anxiety towards the outgroup as a whole (i.e., chronic anxiety), then the recommended order of experiences should be V-D learning.

Although these data imply intervention strategies should take heed of the order in which participants undergo direct and vicarious experiences with outgroup members, policy makers must be wary about such recommendations being adapted and adopted too readily. This is because this study has investigated *increases* in intergroup anxiety. To confirm such order effects are applicable for intervention strategies, and thus, to reduce intergroup anxiety, future research should investigate *decreases* in intergroup anxiety. It would be interesting to investigate whether positive experiences do work in much the same way, such that the positive effects of individual-level contact are reinforced and more pronounced if participants undergo direct then vicarious intergroup experiences, whereas group-level perceptions are reinforced and more pronounced if participants undergo vicarious then direct experiences.

One potential limitation of this study is the differential levels of cognitive load between the two learning types. On the surface, this issue seems to be problematic, since it is a key difference between the two contact types that cannot be controlled for. In particular, when engaging in direct learning, participants are simply presented with a facial stimulus on their computer screen. However, during vicarious learning, participants' attention is split between observing the facial stimuli and the video of the model on the other half of their computer screen. Therefore, an argument could be made that during vicarious learning, participant attention, or cognitive load, is being split across two different sources of information. However, this maps onto the ecology of vicarious learning experiences. Hence, although a key difference in direct vs. vicarious learning experiences, this differential cognitive load is exactly how this form of contact occurs in everyday contact scenarios, meaning the apparent discrepancy actually strengthens the ecological validity of this paradigm.

Moreover, it may potentially be a limiting factor that the generalization stimuli were presented only after both learning types had been experienced (vs. presented after each learning type had been experienced). However, as stated in the methods, presenting too many generalization stimuli, which would have occurred if they were presented after each learning type, can reduce any resulting learning effects, via habituation, or reduction, of the learned response (Rankin et al., 2009). With diminished acquisition, you are less likely to obtain generalization effects. Hence, while it would have been ideal to have the capability to compare generalization after the first and then second learning type to investigate whether generalization is comparable after the first type of aversive experience, this was unfeasible. Moreover, it should be noted that the differences that were found in acquisition (i.e., order effects) emerged only after both learning types (vs. isolated experiences) had been experienced, which suggests that the generalization effects may not have been different after isolated experiences of direct or vicarious learning. This supports previous research that has shown that learning effects are comparable after isolated direct or vicarious experiences (Harris et al., 2015a; Olsson & Phelps, 2004).

Therefore, these data show that although intergroup anxiety learning is comparable after independent experiences of direct and vicarious learning, these experiences have differing effects on the acquisition and generalization of intergroup anxiety when experienced consecutively. Importantly, these data demonstrate that experiencing contact vicariously and then directly might make us *learn* to be anxious of a *particular* individual, whereas experiencing contact directly and then vicariously helps us to make *generalizations* about that person's group.

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Footnotes

13. Power estimates were based on conditioning research using similar methods, as well as a power analysis. Previous research investigating intergroup anxiety via a learning paradigm has used 35 participants per cell (Olsson et al., 2005); 11 per cell (Olsson et al., 2007) and 29 per cell (Olsson & Phelps, 2004). Power estimates computed with G*Power for a 2 x 2 x 2 mixed model design aimed at detecting a Cohen's moderate effect size of .25 with an alpha value of .05 indicated that this study needed a total of 66 participants. Hence this study had adequate power.
14. We used participants' pre-training self-reported similarity ratings between the new outgroup face and the CS+ and CS- using the formula New Face Similarity = ([similarity with CS+] – [similarity with CS-]). If this number was positive, the new Black face was perceived to be more similar to the CS+; if negative then the new Black face was perceived to be more similar to the CS-; while zero indicated that the new face was perceived to be equally similar to the CS+ and CS-.
15. To determine whether the pattern of generalization that differed between conditions was in part explainable by changes in typicality judgments, two separate 2 Time (Time 1, Time 3) x 2 Stimulus (CS+, New Exemplar) within-subjects ANOVA's were run, using the typicality data as the dependent variable. For the V-D learning participants, there was a significant Time x Stimulus interaction, F (1, 36) = 4.747, p = .036, η_p^2 = .116, suggesting that participants displayed a larger increase in typicality towards the new exemplar from pre-test to post-test compared to the change in typicality towards the CS+, Pre-test CS+: M = 2.70, SD = .1.52; Post-test CS+: M = 5.60, SD = 1.28; Pre-test New

Exemplar: *M* = 2.85, *SD* = 1.46; Post-test New Exemplar: *M* = 6.35, *SD* = .73. Paired Samples *t*-tests confirmed that there were no differences in typicality ratings at pre-test between the CS+ and new exemplar faces ($t < 1$, $p > .90$), however, there was a significant difference at post-test, t (36) = 2.391, p = .022. For the D-V learning condition, the ANOVA did not demonstrate a significant Time x Stimulus interaction F (1, 39) = 1.229, p = .274, η_p^2 = .031, suggesting that there was no significant difference between the CS+ and the new exemplar typicality rating changes from pre-test to post-test, Pre-test CS+: *M* = 2.70, *SD* = .1.57; Post-test CS+: *M* = 5.60, *SD* = 1.35; Pre-test New Exemplar: *M* = 2.70, *SD* = 1.54; Post-test New Exemplar: *M* = 5.88, *SD* = .89. Paired Samples *t*-tests confirmed that there were no pre-existing differences in typicality ratings of the CS+ and new exemplar at pre-test ($t < 1$, $p > .99$), nor was there a significant post-test difference ($t < 1.3$, $p > .21$). Hence, typicality ratings of the CS+ and new exemplar were comparable at pre-test for both D-V and V-D learning participants. At post-test, these typicality ratings were comparable for D-V learning participants, whereas for V-D learning participants, typicality ratings for the new exemplar were significantly higher than those for the CS+. That is, the new exemplar face became more typical of the outgroup compared to the CS+ for V-D learning participants.

Chapter 5.

No Prior Experience Necessary: The Acquisition and Generalization of Intergroup Anxiety Towards Minimal Groups

Evolutionary theory suggests that threats from our evolutionary past are perceived as more threatening than stimuli that were not perceived as threatening in our evolutionary past (Tooby & Cosmides, 1990). In visual search tasks, individuals are much quicker to detect fear-relevant stimuli such as snakes and spiders, which were threatening in our ancestral past, than non-fear-relevant stimuli such as birds and butterflies, since they were not threatening in our ancestral past (Öhman, Flykt, & Esteves, 2001).

This logic of differential response patterns to fear-relevant and non-fear-relevant stimuli has recently been applied to the intergroup domain. Öhman and Mineka (2001) claim that outgroup members can equate to fear-relevant stimuli, since they have been historically threatening in our ancestral past; whereas ingroup members can equate to non-fear-relevant stimuli, since they were not historically threatening in our ancestral past. Applying evolutionary theory to intergroup relations helps to advance specific hypotheses regarding the development of *intergroup anxiety*. From this stance, individuals will develop anxiety *faster* and be *slower* to extinguish acquired anxiety towards outgroup, relative to ingroup, members.

Olsson and colleagues (Olsson, Ebert, Banaji, & Phelps, 2005) used two studies to investigate differences in the extinction of acquired anxiety responses between outgroup members (i.e., intergroup condition) and ingroup members (i.e., intragroup condition). The first study established that participants found it difficult to extinguish acquired fear (i.e., reduce anxiety) towards snakes or spiders; whereas they readily extinguished acquired fear towards birds or butterflies. The second study used human stimuli (White and Black faces). The results were that (White and Black) participants found it difficult to extinguish acquired fear towards outgroup faces (Black or White, respectively), whereas they readily extinguished acquired fear towards ingroup faces (White or Black, respectively). This line of research has been extended by Navarrete and colleagues (2009), who demonstrated that acquired *intergroup* anxiety resists extinction only when the outgroup faces are male (vs. female). These results for the moderating effect of gender are consistent with an evolutionary perspective, since in our ancestral past, it was typical for males to be the aggressors, and for females to be nurturers (Daly & Wilson, 1988; Keeley, 1996; Kelly, 2005; Wrangham & Peterson, 1996). Taken together, the Olsson and Navarrete studies support an evolutionary account that outgroups, originating in our ancestral past and continuing in contemporary society, are 'threats', or competitors, for resources such as land, mates, and food (McDonald, Navarrete & Van Vugt, 2012), and therefore, like snakes and spiders, are more difficult to dissociate from fear learning.

While ground-breaking, the investigation of anxiety for real social groups (i.e., Black and White faces) in the Olsson and Navarrete studies introduces complexities and natural confounds that are potentially problematic for interpretation. Real social groups bring with them the influence of individuals' group membership (e.g., categorizing a face as being an ingroup or an outgroup member), *and* their cumulative past experiences with members of those groups. Cumulative past experiences with members of social groups revolve around two key dimensions. The first is the amount of contact, or contact quantity. Typically, individuals have a vastly greater number of contact experiences with ingroup members, and relatively fewer contact experiences with outgroup members. This difference in contact quantity can affect future contact experiences, and the resulting development of intergroup anxiety. Research on latent inhibition (Lubow, 1973), for example, posits that a more familiar stimulus (in this case, ingroup members) would take longer to generate new meaning (e.g., negativity or anxiety), relative to an unfamiliar stimulus (i.e., outgroup members). This means that experiments focusing on established ingroups and outgroups are naturally biased towards finding ingroup-outgroup asymmetries as a result of differential familiarity with these groups.

The second key problem inherent when assessing anxiety developments with established social groups is that of differences in contact valence, or quality. The contact literature indicates that individuals typically perceive the ingroup as being more positive, and the outgroup as more negative (Hewstone, Rubin, & Willis, 2002), which in natural settings is likely to reflect differences in prior contact quality. The influential role of contact history in shaping anxiety learning has been documented in a number of studies (Page-Gould, 2012; Page-Gould, Mendoza-Denton, & Tropp, 2008). These studies demonstrate that a history of positive contact reduces intergroup anxiety and buffers against the acquisition of aversiveness towards the outgroup (see Chapter 2). Alternatively, studies have shown that negative contact is associated with increased intergroup anxiety (see evidence reviewed in Paolini, Harwood, & Rubin, 2010). Hence, due to the differential amounts of prior contact experiences and the differential quality of prior contact experiences with ingroup and outgroup members, anxiety learning should be naturally biased towards the acquisition of anxiety towards outgroup members, relative to ingroup members. These background factors, rather than *group membership per se* as Olsson and Navarette would argue, could be the key drivers of their ingroup-outgroup anxiety effects.

One way to investigate group membership without the confounding influence of past contact experience, is to use a minimal group paradigm (Tajfel, Billig, Bundy & Flament, 1971). Minimal group paradigms allocate participants to an arbitrary group, which the participant thinks is a real group and was simply unaware of prior to taking part in the research. While group assignment is random, it is framed to the participant as allegedly reflecting genuine and meaningful group –related individual differences, like artwork preferences (Harmon-Jones, Greenberg, Solomon & Simon, 1996), or chronic differences in stimuli estimation (i.e., over- or under-estimation; Mussweiler, Gabriel & Bodenhausen, 2000). Since participants are unaware that they belonged to such groups prior to their group assignment, they do not have a prior history of contact with the ingroup and/or outgroup and they are unaware of typical characteristics of these groups (e.g., stereotypes of underestimators/overestimators). This means that a minimal group paradigm allows for the assessment of 'pure' group membership, without the influence of differential contact experiences and associated stereotyping.

Evolutionary theory would claim that, regardless of contact experiences, individuals should display heightened levels of anxiety towards outgroup (vs. ingroup) members and would be slower to extinguish such anxiety (Navarrete et al., 2009; Olsson et al. 2005). That is, according to an evolutionary perspective, the ingroup-outgroup asymmetries in anxiety that are detected with established social groups should hold unchanged within a minimal group paradigm. This is because dating back to our ancestral past, individuals have been biologically hardwired to perceive outgroup members negatively, as competitors for key survival resources. Therefore, any ingroup-outgroup differences in anxiety that emerge within a minimal group paradigm should be the result of group membership, without the influence of contact history; as those with established groups, they would support an evolutionary explanation.

Navarrete and colleagues (2012) recently used a minimal group paradigm to investigate the ‘pure’ effects of ingroup and outgroup membership on intergroup anxiety. In this study, Navarrete and colleagues assigned White participants to a group, distinguishable by color (red, yellow or blue). Participants then completed an aversive learning task, in which they were presented with four White faces. Two faces were identifiable as ingroup members, since the color of the shirt the ingroup members were wearing matched the participants’ group membership color (red, yellow or blue); two other faces were identifiable as outgroup members, since their shirt color was different to the participant’s’ group membership color. Of these four faces, one ingroup and one outgroup face were paired with an aversive outcome (electric shock; CS+, Conditioned excitor), whereas the other ingroup and outgroup faces were not (CS-, Conditioned inhibitor). Their results indicated that participants were faster to acquire fear, as measured physiologically via Skin Conductance Levels (SCLs), towards minimal outgroup faces relative to minimal ingroup faces, despite participants not having any prior history or knowledge with these groups. Hence, this study shows that even without the extensive history of contact associated with established social groups, group membership is influential and moderates intergroup anxiety in ways consistent with evolutionary theory.

Although research by Olsson and Navarrete has shown that intergroup anxiety develops and endures towards specific outgroup members (i.e., episodic anxiety) more than towards specific ingroup members, research to date has not investigated the generalization or spread of anxiety from specific outgroup members to similar members (i.e., individual-to-individual generalization). In the next section, I will argue that generalization of anxiety from an individual outgroup member is an important component of evolutionary theory and deserves direct empirical investigation.

Generalization, Evolutionary Theory, and Past Research

It is imperative for survival that individuals are able to quickly and accurately detect stimuli that are threatening to their well-being. To require direct experience with each individual threatening stimulus to make such threat appraisals is inefficient and would mean that an individual is at more risk of injury or death (Bolles, 1970; Öhman & Mineka, 2001). Thus, the generalization or spread of expectations of threat following an aversive experience is an efficient way of processing information and should lead to more defensive strategies and therefore stronger chances of survival (Öhman, Dimberg, & Ost, 1985). This spread of anxiety is traditionally measured in one of two ways. The first involves the spread or generalization of individual-level experiences with a single outgroup member to the entire outgroup (i.e., individual-to-group generalization). The second involves the use of cumulative past contact experiences with members of a group to inform the appropriate course of action when encountering a new individual member from that group (i.e., group-to-individual generalization). However, the literature has to date, largely neglected a third type of generalization; the transfer or spread of anxiety from an individual outgroup member to other individual outgroup members (i.e., individual-to-individual generalization). Hence, investigations of generalization, since they represent efficiency and can boost chances of survival, are central to assessing an evolutionary framework of intergroup anxiety.

To date, social psychological investigations of intergroup contact in the field have focused on generalized (or group-level) anxiety responses, have been retrospective, self-reported, and typically have assessed anxiety around a hypothetical intergroup encounter (e.g., Greenland & Brown, 1999; Voci & Hewstone, 2003). These investigations of anxiety generalization are potentially problematic for several reasons, 1) individuals have a bias to remember negative events (Ito, Larsen, Smith, & Cacioppo, 1998), meaning that the group-level anxiety measures are likely to be negatively skewed; 2) self-reported measures are not always reflective of attitudes and/or behaviors (e.g., La Pierre, 1934); and 3) retrospective accounts typically require individuals to report on accumulated intergroup contact experiences, which can, similar to eyewitness memory, highlight potential recall problems (i.e., different outgroup contact experiences become merged, conflicting memories from positive vs. negative experiences, etc.) or issues remembering details (e.g., Zaragoza & Lane, 1994). Very few studies incorporate both episodic and chronic anxiety in a single design (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001; for a review, see Paolini, Harris, & Griffin, 2015). Moreover, several social psychological studies of anxiety towards outgroups do not include an ingroup-outgroup design (Harris et al., 2015a, 2015b; Voci & Hewstone, 2003), as a result, these studies do not compare anxiety towards the ingroup and outgroup and therefore fall short of providing evidence for and/or against the evolutionary perspective.

To resolve these key issues associated with past tests of anxiety generalization, this study used an adaptation of the aversive conditioning paradigms used by Olsson and Navarette. Participants will have direct (vs. imagined) aversive experience with both ingroup and outgroup target faces. Moreover, the dependent measure of anxiety will be psychophysiological (vs. self-reported), and online (vs. retrospective), thus capturing anxiety continuously at the time that participants observe each stimulus. Hence, the dependent variable will be tapping into unconscious bodily processes that are less able to be controlled or suppressed, and therefore, are less susceptible to social desirability (Nederhof, 1985) or memory distortions. Furthermore, this paradigm will incorporate measures of individual-level anxiety responses. This will be done by collecting physiological responses to specific ingroup and outgroup stimuli involved in an aversive learning paradigm, as well as to morphed variations of these individuals to measure individual-to-individual generalization. .

Besides cancelling out the influence of past contact with the groups, the use of a minimal group paradigm has an additional advantage in the investigation of generalization processes: It can assist in the disentanglement of physiognomy and global cues of group membership that afflict tests with established real groups (Harris et al., 2015a, 2015b; Mallan, Sax, & Lipp, 2009; Navarrete et al., 2009; Olsson et al., 2005).

Global cues of group membership are gross visual cues such as clothing, body structure and physique for gender groups, shirt color for minimal groups, or skin color for ethnic groups. Physiognomy markers of group membership instead involve the analysis of specific local facial features (e.g., nose, eyes, mouth etc.). These cues have been conflated in the analysis of anxiety generalization with real social groups. That is, in the studies reported in the earlier sections, researchers have not separated the influence of physiognomy with global cues. The problem that then arises is whether group membership related global cues, or physiognomy related facial features are driving generalization effects. Hence, it is uncertain which of global cues and physiognomy is the key driver of the generalization effects that emerge. This study aims to address this and ascertain the relative influence of global cues and physiognomy on the generalization of anxiety.

In an aversive learning paradigm using minimal groups, like the one used by Navarette and colleagues and adapted here, global cues are used to mark group memberships, and physiognomy can be used by the participant to discriminate between the CS+ and CS-. In this research set up, group membership is identifiable only by global cues, typically via the t-shirt color or background color of the target outgroup faces (e.g., Navarrete et al., 2012). As a result, contrary to what happens in real group studies, manipulations of global cues of group membership do not alter the physiognomy of the target outgroup face. This means that global cues are subjective predictors, since group membership on its own is not a predictor of the outcome, such as an electrical stimulation. In contrast, physiognomy cues are objective predictors, since the facial features are the key discriminating factor that assists in the prediction of the outcome, such as an electrical stimulation. Hence, in a minimal group paradigm, global cues provide a subjective predictor of threat, whereas physiognomy cues provide an objective predictor of threat. Physiognomy markers, instead, are—across both ingroup and outgroup—the only way to discriminate between a CS+ and a CS- (Mallan et al., 2009; Navarrete et al., 2009, 2012; Olsson et al., 2005). Hence, a key advantage of a minimal group paradigm is that, unlike investigations of generalization within ethnicities or race, it allows researchers to manipulate in isolation (and conjunction) global cues (t-shirt or background color, which indicates group membership) and physiognomy (facial features, which allow for discrimination between safe and unsafe stimuli). With regards to generalization, this means that variations of the original CS+ and CS- can manipulate in isolation, or conjunction, the global cues (i.e., just background color) and physiognomy cues (i.e., just facial features) and then measure the transfer or spread of anxiety to that new stimulus. As a result, this allows for the study of generalization effects by dissecting the contribution of mere group membership from that of stimulus contingency. These desirable properties were actively recruited in this study to obtain a deeper analysis of the generalization processes by providing an insight into the relative importance of global cues relative to physiognomy.

The ability of individuals to distinguish the contingency between a stimulus and outcome is imperative for learning to occur (Lovibond, Saunders, Weidemann &

Mitchell, 2008), and this may also extend to generalization. A high level of contingency awareness reflects the conscious knowledge of three important relationships in a learning paradigm: that the CS+ predicts the aversive outcome (Unconditioned Stimulus; US), that the CS- predicts the absence of the US, and that the CS+ and CS- are unrelated (Clark & Squire, 2002). Learning studies have shown that contingency awareness facilitates the acquisition of anxiety responses (Lovibond et al., 2008). Hence, the knowledge of particular relationships or contingencies between the CS+, CS- and US influences the acquisition of anxiety responses.

However, for generalization to occur to similar stimuli to the CS+, but not the CS- (i.e., generalization along a gradient, Harris, Paolini, & Griffin, 2015b; Pettigrew, 2008), individuals must first display differential learning towards the CS+ and CS-. That is, in anxiety learning research, heightened anxiety responses to the CS+ and lower levels of anxiety towards the CS-. The merit of a minimal group design is that it frees these physiognomy markers from their group membership content, meaning that group membership can be manipulated separately from contingency. This allows for the assessment of the contribution of physiognomy and global cues on generalization effects in ways that is not possible in studies that use established social groups. If acquisition is dependent on the participants' ability to learn these contingencies, then generalization might also be dependent on learning these contingencies. While contingency awareness has been shown to facilitate acquisition of anxiety, to the best of my knowledge, contingency awareness has not been shown to be a facilitating factor in the generalization of such anxiety responses.

To date, only research investigating group-to-individual generalization (vs. individual-to-individual generalization) has examined global cues and physiognomy. Since research has established that global cues and physiognomy both affect group judgments, it is important to investigate the relative impact of both types of cues for generalization. However, research investigating intergroup anxiety currently confounds the manipulation of global cues with manipulations of physiognomy cues.

While research to date has explored the comparative impact that global cues and physiognomy cues have on categorization of ingroup-outgroup members (Stepanova & Strube 2012a), and affect towards ingroup-outgroup members (Hagiwara, Kashy & Cesario, 2012; Stepanova & Strube, 2012b), assessments of anxiety have been neglected. Despite this, research has attempted to delineate which of the global and physiognomy cues are more influential. Research suggests that since skin color is in general more salient, or immediately obvious, it should be more influential than physiognomy (Stepanova & Strube, 2012b). This conclusion is reinforced by the emerging literature, which has demonstrated that race categorization decisions are determined almost exclusively by global cues (Dunham, Stepanova, Dotsch, & Todorov, 2014). For example, Caucasians perceive African American faces with darker skin tones more negatively (Maddox & Gray, 2002), more stereotypically, and with more discrimination (Klonoff & Landrine, 2000), when compared to African American faces with lighter skin tones (for a review, see Blair, Judd, Sadler & Jenkins, 2002; Maddox, 2004). However, outgroup members with more Afrocentric *facial features* (i.e., varying of the nose, eyes, and lips, but not the skin color) are evaluated more negatively (Livingston & Brewer, 2002), perceived as more stereotypical (Blair, Chapleau & Judd, 2005; Blair et al., 2002), and are discriminated against (Blair, Judd, & Chapleau, 2004) more than outgroup members with Eurocentric facial features. For example, Blair and colleagues (2004) found that although Black and White (global cues) inmates who committed similar crimes and had similar criminal histories received comparable sentences (i.e., no ingroup-outgroup asymmetry), those with more

Afrocentric (vs. Eurocentric) features (i.e., physiognomy) received harsher sentences. Hence, research is at odds as to which of global cues and physiognomy cues are more influential.

Design, Aims and Hypotheses

The present study was designed to extend both Olsson and colleagues (2005) and Navarrete and colleagues (2012) by investigating the generalization of intergroup anxiety using an aversive learning procedure. This study adopted a minimal group paradigm, similar to Navarrete and colleagues (2012), to investigate the influence of group membership, while excluding the impact of prior experiences with the ingroup and outgroup. Extending on Navarrete and colleagues, this study investigated the generalization of anxiety responses to outgroup members not involved in the aversive learning procedure, and also sought to separate the contribution that group membership and contingency have on generalization (i.e., identify the contribution of global cues and physiognomy in the generalization process).

To do this, participants first completed a dot estimation task (Brown, Collins, & Schmidt, 1988; Mussweiler et al., 2000; Rubin, Hewstone, & Voci, 2001), after which they were told they were an overestimator or an underestimator of physical stimuli. Their allocation to a group was in actual fact completely random. Participants were informed that individuals from each group were associated with specific colors and therefore, could be identifiable via those colors (green underestimators and blue overestimators). This was done to provide participants with a visual global cue to quickly determine group membership of the target faces during the learning procedure, comparable to using skin color to quickly categorize a target face in other minimal group studies.

As part of the learning procedure, participants were then presented with four White male faces; with the background color identifying two of these faces as ingroup members and the other two as outgroup members (blue or green, depending on participant group allocation). One ingroup face and one outgroup face were paired, during the acquisition phase of the experiment, with a mild electric stimulation (CS+), whereas the other ingroup and outgroup face were never paired with electrical stimulation (CS-).

To measure generalization, before and after the acquisition phase, participants were shown the same four faces but with morphed backgrounds (i.e., background looked less blue and more green, or less green and more blue; global cue faces) to investigate generalization along the *sole* global cue/group membership factor. They were also presented with faces that had both the morphed background and morphed individual facial features (physiognomy faces) in order to investigate the *additional* effect of physiognomy/contingency on generalization. Throughout the study, participants used a contingency dial (Lovibond et al., 2008), to indicate their level of expectancy at any given moment. While contingency awareness has been shown to facilitate acquisition of anxiety (Lovibond et al., 2008), to the best of my knowledge, contingency awareness has not been shown to be a facilitating factor in the generalization of such anxiety responses.

Following Navarrete and colleagues (2012), it was expected that participants would display more pronounced acquisition of anxiety towards outgroup members, relative to ingroup members, after experiencing an aversive learning procedure and that generalization would occur towards ingroup and outgroup members even in the absence of prior contact history. That is, it was anticipated that greater increases in physiological responses would be found at post-test, relative to pre-test, towards outgroup members compared to ingroup members. It was also anticipated that the generalization data would demonstrate broader generalization, through heightened physiological responses at post-test relative to pre-test, for both ingroup and outgroup members. Although the study predicted that generalization would be evident towards both ingroup and outgroup members, it was expected that an ingroup-outgroup asymmetry would be found, such that physiological responses towards outgroup members (vs. ingroup members) would display a larger transfer or spread of physiological arousal. That is, this study expected learning and generalization to occur towards both ingroup and outgroup members, however, learning and generalization was expected to be more pronounced towards outgroup (vs. ingroup) members.

Moreover, this study expected to find support for research demonstrating the independent influence of global cues and physiognomy (Hagiwara et al., 2012; Stepanova & Strube, 2009; 2012b), but to do so on anxiety generalization. Specifically, it was expected that generalization would be broader, with higher levels of anxiety towards outgroup faces similar to the CS+. The study was also expected to find relatively lower levels of anxiety generalization towards outgroup faces similar to the CS-. Drawing from evolutionary theory, it was predicted that global cues would be stronger predictors of anxiety since they are more obvious than physiognomy cues. While physiognomy should be more important for distinguishing apart particular individuals, since outgroup members are difficult to differentiate, a phenomenon known as the outgroup homogeneity effect (Ostrom & Sedikides, 1992; Park & Rothart, 1982), it is uncertain whether physiognomy would have the desired effect on facilitating the acquisition of anxiety. Finally, similar to Lovibond and colleagues (2008), it was expected that contingency awareness would facilitate the acquisition and generalization of anxiety.

Method

Participants and Design

Participants were 68 students (27 males; 41 females; mean age of 23.03 years, *SD* = 6.78 years) from a large regional Australian university, who were provided partial course credit or reimbursed AU$25 for their participation. Participants were randomly assigned to the Blue Overestimator (*N* = 34) or to the Green Underestimator (*N* = 34) condition in a 2 Target Group (Ingroup/Outgroup) x 2 Target Stimulus (CS+/CS-) x 2 Time (Pre/Post-Learning) repeated measures design. A power analysis confirms the study had sufficient power (see footnote 16).

Apparatus and Stimulus Materials

Eight faces were selected from the Radboud Faces Database (Langner et al., 2010). All faces were young, male, Caucasian faces with a neutral expression. To indicate group membership (underestimator vs. overestimator), the background color of the eight faces was manipulated using Adobe Photoshop, such that two versions were created of each target face: one with a green background to indicate understimator group membership, and one with a blue background to indicate overestimator group membership. For simplicity, these faces will henceforth be referred to as the ‘target faces’. See Column A in Figure 14 for examples of target faces.

In order to investigate the influence of global cues on generalization, the background color of the target blue overestimator and green underestimator faces was manipulated to appear more

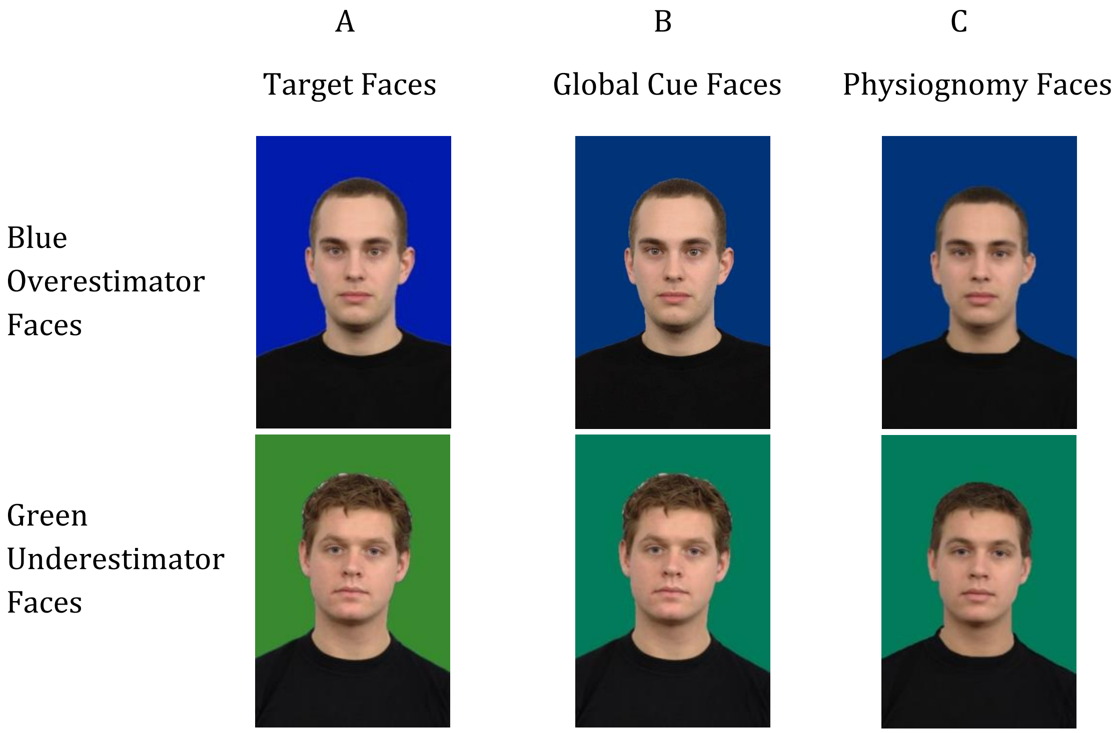

Figure 14. Sample of a blue overestimator and green underestimator target face, global cue face, and physiognomy face.

ambiguous of the original color. This meant that the original blue background target faces were manipulated so that the background appeared less blue (and more green), whilst the original green background target faces were manipulated so that the background appeared less green (and more blue) . For simplicity, these faces will be referred to hereafter as the ‘global cue faces’. For examples of global cue faces, see Column B in Figure 14.

To investigate the influence of physiognomy on generalization *over and above* the influence of global cues, each of the global cues faces was morphed, using FaceGen, such that the facial features appeared less Eurocentric, and instead appeared more like the average of the available ethnic groups (Asian, Black-African, Middle Eastern, and White). Hence, compared to the original, target faces, these morphs had both the background color *and* the facial features manipulated *simultaneously*. For simplicity, these faces will be referred to as the 'physiognomy faces'. For examples of physiognomy faces, see Column C in Figure 14.

Procedure

Participants were invited to attend a laboratory testing session investigating "how people become anxious". Upon entering the lab, participants were seated in a comfortable chair in front of a 17-in. flat screen computer monitor that projected stimuli synchronized with a 60-Hz vertical refresh rate. Once seated, participants were asked to complete a dot estimation task, in which they estimated the number of dots on a series of slides (see Figure 15, for an example), that they were ostensibly told would determine whether they were an 'overestimator' or an 'underestimator' of physical stimuli. To reinforce this cover story, participants were also told that each group (overestimator vs. underestimator) had different personality characteristics, but they were not explicitly provided with specific examples or traits nor were they provided information about group status differences (i.e., the majority/minority status of either group). In reality, participants were randomly allocated to either the blue overestimator or green underestimator group and 'identified' as either an overestimator or an underestimator. To maintain participants' group allocation sufficiently salient over time, participants were fitted with colored wrist bands that helped remind them of the color associated with their ingroup (blue or green).

At this point, participants were asked to complete a short online survey in which they were asked to respond to a feeling thermometer towards the ingroup (i.e., the group to which they belonged) and outgroup (the group to which they did not belong; Wilcox, Sigelman, & Cook, 1989). This measure was included as a manipulation check; social

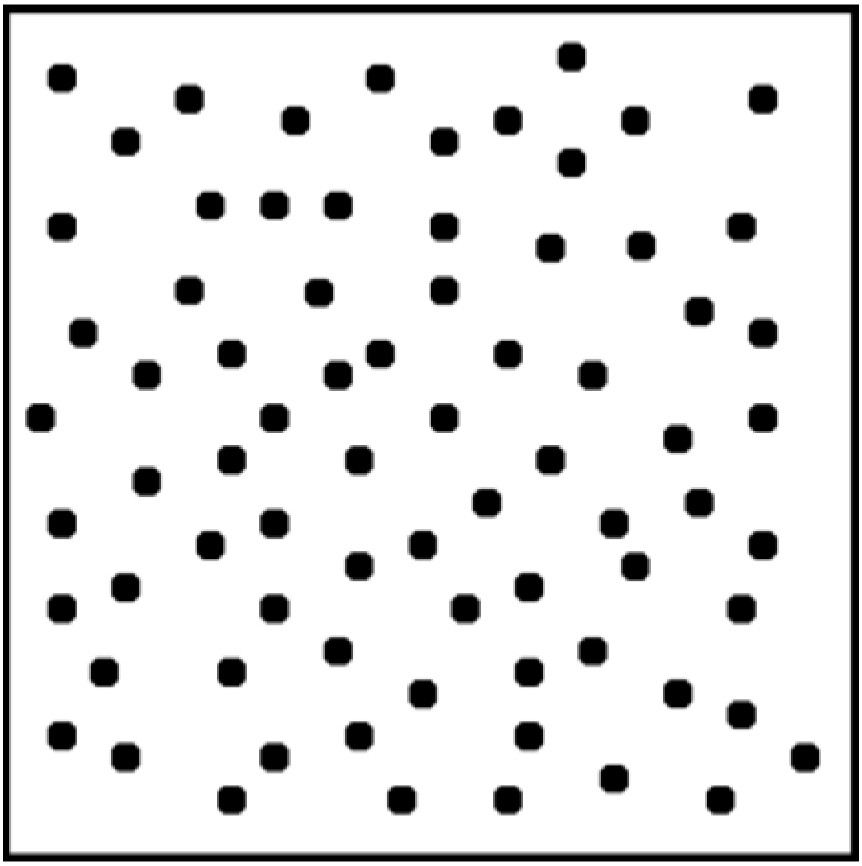

Figure 15. Sample image from the dot estimation task.

psychological research demonstrates that group allocation leads to positive ingroup perceptions and negative outgroup perceptions (Brewer, 1999). Participants were asked to use a 100 point scale to indicate their overall feelings towards each group. The survey also asked participants to indicate how similar they perceived each pair of faces that were to be presented during the learning task (see Appendix K). These similarity ratings were included to determine if participants could distinguish between the CS+ and CS- target faces, global cue faces, and physiognomy faces. The similarity ratings were answered using a 7-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*). The faces were presented without any group membership cues; the background color was a standardized grey.

At this point, participants were asked to clean their fingers with a humidified wipe before being connected to the physiological equipment. This included the shock electrode on the distal phalange of the left index finger and skin conductance electrodes on the distal phalanges of the left middle and ring fingers. A respiration belt was then fitted around participants' chest to account for any breathing abnormalities and artefacts (Greco & Baenninger, 1991). The skin conductance electrodes (stainless steel; AD Instruments) were first prepared with an isotonic gel to maximize skin-electrode contact and improve recording quality. Prior to recording skin conductance, participants were connected to the equipment for approximately 20 minutes to allow for accurate baseline measurements. During this time, the participant engaged in reading some magazines whilst the researcher set-up and calibrated the recording equipment. Participants were then provided with a brief demonstration of how all equipment worked and asked to self-select their level of electrical stimulation for the rest of the experiment, within the stimulating bar electrode's (AD Instruments) range of 1-20 mA, using the work-up procedure where they chose a level that they found "uncomfortable but not painful" (Lovibond, Saunders, Weidemann, & Mitchell, 2007). A respiration belt was then fitted around participants' chest to account for breathing abnormalities such as yawns (Greco & Baenninger, 1991). Before the commencement of the learning task, participants were shown the custom-made contingency awareness dial, which was used similarly to Lovibond, Saunders, Weidemann and Mitchell (2008). Participants completed a "measurement of how much you think you will receive an electric stimulation at any given moment". The dial was spring loaded, and rotated 180 degrees. Following its release (i.e., between trials), the dial returned to the midpoint. The dial had labels of 'low expectancy' at 90 degrees to the left of the midpoint, and 'high expectancy' at 90 degrees to the right of the midpoint. Participants were instructed to use the dial continuously during the portion of the experiment when faces were presented.

Participants then underwent a learning procedure. During the learning task, all stimuli were presented for 10 seconds, with an average inter-stimulus interval of 17.5 seconds (range 15-20 seconds). During the task, the four original stimuli (out of the pool of eight) that participants were exposed to were counterbalanced so that each face was equally likely to be a CS+ or CS-, and an ingroup or an outgroup member. Participants were assigned to either the blue overestimator or green underestimator group and were all exposed to faces from both groups. Hence, from here the stimuli will be referred to on the basis of the relationship between the participant's assigned group (blue vs. green) and the target face's group (blue or green). In this context, *ingroup* members were faces that matched the participant's color group, whereas *outgroup* members were faces that did not match the participant's group. Of the four stimuli participants were presented with, one served as an ingroup CS+, one as an ingroup CS-, one as an outgroup CS+ and the last as an outgroup CS-. Therefore, two had a blue background indicative of the blue overestimator group, whilst two had a green background signaling membership to the green understimator group. The faces were counterbalanced among all participants such that they were just as likely to be presented as ingroup or outgroup stimuli, or act as CS+ or CS- stimuli. During this baseline, or pre-test phase, the four global cue faces and four physiognomy faces were also presented to obtain pre-test measurements of participants' physiological responses. Hence, participants were presented with a total of 12 faces during pre-test: the four target faces, the four global cue variations, and the four physiognomy variations.

Participants then underwent training, during which participants were presented only the four target faces. During training, one ingroup face and one outgroup face co-terminated with an electric shock (unsafe stimuli, CS+) at the level chosen during the work-up procedure. The other ingroup and outgroup faces were never paired with shock (safe stimuli, CS-). Each of the CS+ and CS- faces were presented six times each. Following training, participants were presented with all of the target faces (*N* = 4), global cue faces (*N* = 4), and physiognomy faces (*N* = 4), once each, to measure post-test physiological responses.

Following the learning procedure, participants completed a self-reported survey, in which they recorded their post-test feeling thermometer ratings, their willingness to engage in future outgroup contact, and their self-reported contingency awareness. The feeling thermometer ratings were the same items as in pre-test and again measured overall attitudes towards the two groups as a whole on a 100 point scale. The willingness to engage in future contact items asked participants about whether they "would be happy to personally get to know more" ingroup or outgroup members, and whether they "would not hesitate to attend a cultural event organized by" ingroup or outgroup members using a 7 point Likert type response scale (1 = *not at all*, 7 = *very much*). In the contingency awareness section (see Appendix T), participants were presented with the four target faces, without the blue or green colored background, and asked to determine which face(s) they believed were paired with electrical stimulation, and how confident they were, using a 7 point Likert type response scale (1 = *not at all confident*, 7 = *very confident*).

Consistent with ethical requirements, next all participants underwent extinction. During extinction, participants were repeatedly presented with the CS+ and CS- stimuli without any shock pairings until their physiological responses indicated the absence of any increases in anxiety (mean number of face presentations until responses extinguished: 21.86, *SD* = 2.32; range: 20-32 trials). Following extinction, participants were debriefed and thanked for their time. All research procedures complied with the APA's human ethics guidelines, with the relevant approval provided by the local institutional review board for human research ethics (see Appendices B and C for ethics approval, and Appendices M, N, O and P for participant forms).

Data Preparation and Scoring

The participants' dial ratings and the self-reported contingency awareness questionnaire provided two separate measures of contingency awareness. Both measures reflected participants' expectation of the relationship between viewing the CS+ and CS- faces and the likelihood of receiving an electric stimulation. Participants were classified as 'contingency aware' if their dial ratings indicated increased shock expectancy to the CS+ (i.e., a rating closer to the 'high expectancy' endpoint) and reduced shock expectancy to the CS- (i.e., a rating closer to the 'low expectancy' endpoint). Participants were classified as 'partially aware' if their dial ratings demonstrated that they correctly predicted at least one of the two contingencies. Participants were 'contingency unaware' if they did not predict any of the above contingencies (i.e., shock expectancy rating for the CS+ was closer to the 'low expectancy' endpoint and shock expectancy rating for the CS- was closer to the 'high expectancy' endpoint). With regards to the responses to the self-reported contingency awareness questionnaire, participants were categorized as contingency aware when they indicated that the CS+ was paired with the electrical stimulation and also reported a confidence rating of this relationship of above four (i.e., indicating awareness of the CS+/stimulation contingency) and an indication that the CS- was not associated with the electrical stimulation with a confidence rating of above four (i.e., indicating awareness of the CS-/no shock contingency). Participants were classified as 'unaware' if they did not correctly select the CS+ as being paired with the stimulation and the CS- as not being associated with stimulation, or if they chose the correct stimuli but were not confident with their choice (indicating a guess). They were classified as ‘partially aware’ if their responses demonstrated that they correctly predicted only one of the two contingencies with confidence.

Skin conductance levels (SCLs) were analyzed using the baseline to peak response from the first four seconds after the stimulus presentation (Mallan et al., 2009). This incorporates any upwards inflection that commences within the 1-4 second interval post face presentation. If this inflection is less than 0.02 μS or commences more than 4 seconds after the face presentation, SCLs were scored as 0.

Results

Manipulation Check

As a manipulation check to determine if there were any pre-existing differences between the facial stimuli in the perceived level of similarity between the Ingroup and Outgroup CS+ and CS-, paired samples *t*-tests were conducted to compare the pre-test similarity ratings between face *pairs* (without colored background), separately for the Target Faces, the Global Cue Faces, and the Physiognomy Faces. This single similarity rating between the Ingroup CS+ and CS- (one score) was compared with the similarity rating between the Outgroup CS+ and CS- (one score) using three separate *t*-tests; one for the Target Faces, one for the Global Cue Faces, and the third for the Physiognomy Faces. These results are summarized in Table 6.

A 2 Target Group (Ingroup vs. Outgroup) x 3 Variation (Target Faces, Global Cue Faces, Physiognomy Faces) repeated measures ANOVA found no main effect of

Table 6

Paired samples t-tests comparing the similarity ratings between the ingroup CS+ and CS- with the outgroup CS+ and CS- across target faces, global cue faces and physiognomy faces

	Ingroup		Outgroup		Paired Samples *t*-test		
	M	*SD*	*M*	*SD*	*t*	*df*	*p*
Target Faces	3.32	2.15	3.12	2.17	.804	67	.425
Global Cue Faces	3.07	2.08	3.72	2.30	1.61	67	.112
Physiognomy Faces	4.34	2.22	4.94	2.08	1.404	67	.165

Target Group, nor an interaction between Target Group and Variation, $F < 2.20$, $p > .145$. The ANOVA however revealed a main effect of Variation, F (2, 134) = 24.086, $p < .001$, $\eta_p^2 = .264$. Pairwise comparisons confirmed that the similarity ratings for the physiognomy faces were higher than those for the other faces ($p < .001$), suggesting that, as intended, those faces blurred any CS+ and CS- differences. However, the pairwise comparisons demonstrated no difference between the Target Faces and Global Cue Faces, $p > .836$. All three *t*-tests revealed non-significant p-values, suggesting comparable similarity levels between the Ingroup and Outgroup for the CS+ and CS-, and thus, any Ingroup-Outgroup asymmetry that arises for the Global Cue Faces and Physiognomy Faces in the SCL data is not due to objective differences in discriminability between the CS+ and CS- for the two levels of Target Group.

Learning

A 2 Time (pre-test vs. post-test) x 2 Target Stimulus (CS+ vs. CS-) x 2 Target Group (Ingroup vs. Outgroup) three-way repeated measures ANOVA was conducted on the skin conductance data toward the Target Faces to determine if anxiety acquisition had occurred towards the ingroup and outgroup CS+ relative to their CS- counterparts. The ANOVA revealed a three-way interaction between Time, Target Stimulus and Target Group, F (1, 66) = 9.270, p = .003, η_p^2 = .123. This interaction is displayed in Figure 16. Contrary to predictions, when separated by Target Group in a 2 Time (pre-test vs. post-test) x 2 Target Stimulus (CS+ vs. CS-) ANOVA, participants did not exhibit a Time x Target Stimulus interaction towards Ingroup members, F (1, 66) = .397, p = .531, η_p^2 = .006, suggesting that there was no difference in SCLs towards the Ingroup CS+, relative to the Ingroup CS-, from before to after the learning task (Figure 16's top pane). Yet, a check was conducted to determine whether there was differential learning towards the Ingroup CS+ and CS- at post-test. A paired samples t-test revealed that participants displayed marginally higher SCLs to the Ingroup CS+, relative to the CS-, for Target Faces, t (66) = 1.748, p = .085. Consistent with predictions, the Time x Target Stimulus interaction was significant towards Outgroup members, F (1, 66) = 10.893, p = .002, η_p^2 = .142 (Figure 16's bottom pane). Paired samples t-tests confirm that there was no difference in SCLs towards the Outgroup CS+ and CS- at pre-test, t (66) = .031, p = .975, whereas at post-test, participants displayed significantly higher SCLs to the Outgroup CS+ relative to the Outgroup CS-, t (66) = 3.162, p = .002. Overall, these results indicate that while participants displayed anxiety acquisition towards Outgroup faces, there was only a trend towards an increase in anxiety towards Ingroup faces across time. Hence, participants displayed elevated anxiety towards the CS+ relative to the CS- at post-test, and this increase in anxiety was more pronounced towards Outgroup targets.

Next, the measures of contingency awareness were included as potential mediators of anxiety learning towards the outgroup. When included as covariates within the 2 Time x 2 Target Stimulus x 2 Target Group three-way repeated measures ANOVA to test for mediation with within-subject designs (Judd, Kenny, & McClelland, 2001), self-reported contingency awareness, as well as the dial ratings, both cancelled out the three-way interaction, dial: from F (1, 66) = 9.270, p = .003, η_p^2 = .123, to F (1, 65) = .338, p = .563, η_p^2 = .005; self-reported: from F (1, 66) = 9.270, p = .003, η_p^2 = .123, to F (1, 64) = .057, p = .812, η_p^2 = .001. When the outgroup data were analyzed separately in a 2 Time (pre-test vs. post-test) x 2 Target Stimulus (CS+ vs. CS-) ANOVA, with Contingency Awareness as a covariate, self-reported contingency awareness, as well as the dial ratings, both cancelled out the two-way interaction between Time and Target Stimulus, dial: from F (1, 66) = 10.893, p = .002, η_p^2 = .142, to F (1,65) = .741, p = .392, η_p^2 = .011; self-reported: from F (1, 66) = 10.893, p = .002, η_p^2 = .142, to F(1,64) = 3.349, p = .072, η_p^2 =.050. Hence, differential ingroup-outgroup discriminative increases in physiological arousal towards the CS+ (vs. the within-subject control CS-), as well as the magnitude of differential learning between the CS+ vs. CS-, were driven by higher levels of contingency awareness as self-reported by participants and via the dial ratings. To check that this mediation occurred in the predicted direction (higher contingency awareness facilitates differential learning), self-reported contingency awareness and the dial ratings were corrected by creating an index of learning. To create this index, the following formula was used:

{[((PostOutgroupCS+) – (PreOutgroupCS+)] + [(PostOutgroupCS+) – (PreOutgroupCS+))] –[((PostOutgroupCS-) – (PreOutgroupCS-)] + [(PostIngroupCS-) – (PreIngroupCS-))]}

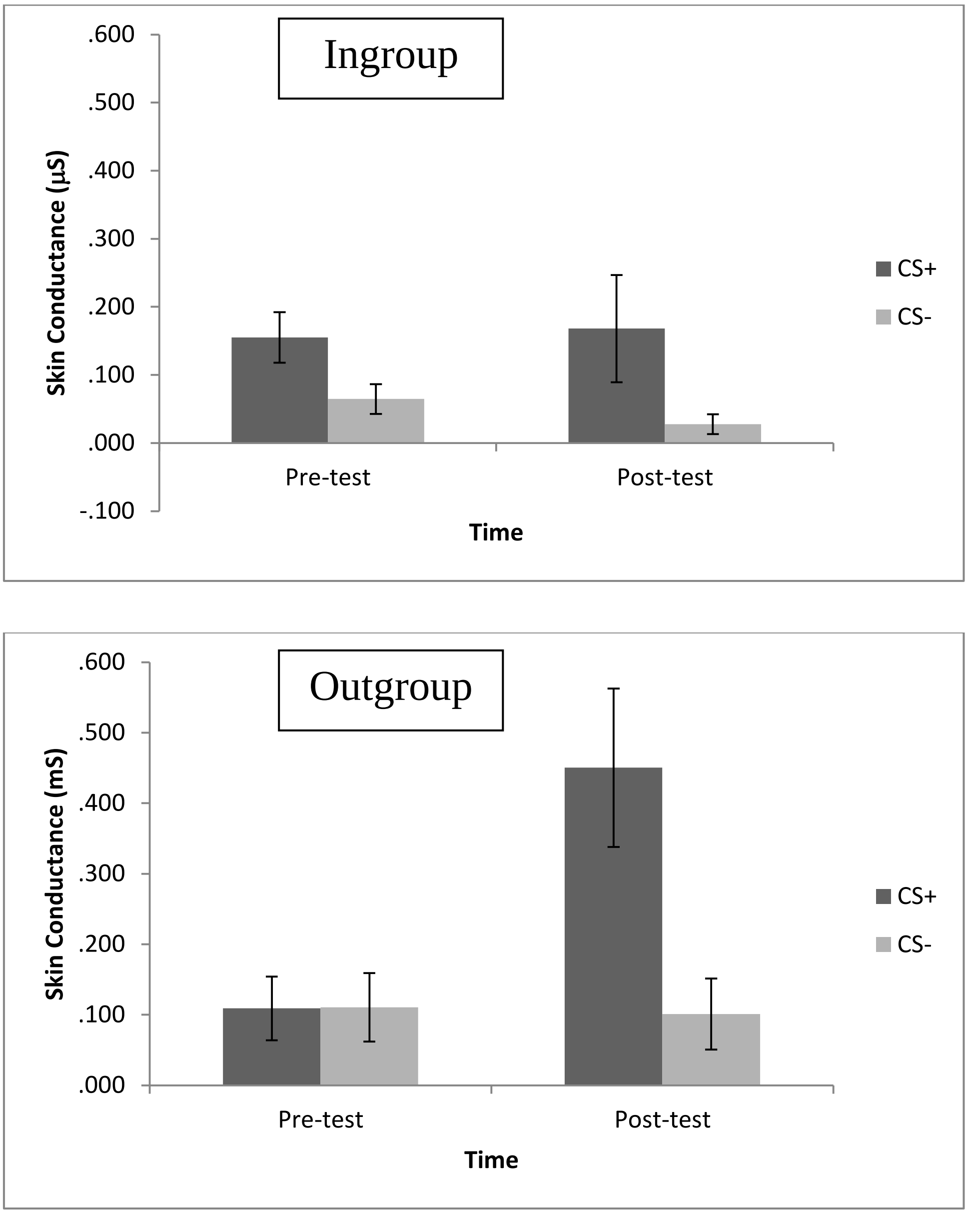

Figure 16. Three-way interaction between time, target stimulus, and target group on the skin conductance data collected during acquisition, shown separately for target ingroup (top panel) and target outgroup (bottom panel) faces.

Using this index, higher scores indicate greater differential learning. Correlations revealed that mediation was in the predicted direction, with positive correlations between the index of learning and self-reported contingency awareness (r = .164, p = .185), and dial ratings (r = .250, p = .043) respectively.

Generalization

Next, a 2 Time (pre-test vs. post-test) x 2 Target Stimulus (CS+ vs. CS) x 2 Target Group (Ingroup vs. Outgroup) x 3 Variation (Target Faces, Global Cue Faces, Physiognomy Faces) four-way repeated measures ANOVA was conducted to test for generalization using the SCL data. The ANOVA found a significant four-way interaction between Time, Target Stimulus, Variation and Target Group, F (2, 132) = 3.355, p = .038, η_p^2 = .048, suggesting that generalization occurred and was affected by whether the face observed was purportedly part of participants' Ingroup or Outgroup. This interaction is displayed in Figures 17a and 17b. When separated by Time, a 2 Target Stimulus (CS+ vs. CS-) x 2 Target Group (Ingroup vs. Outgroup) x 3 Variation (Target Faces, Global Cue Faces, Physiognomy Faces) ANOVA at pre-test revealed no three-way interaction between Target Stimulus, Target Group and Variation (F <1, p =.825), suggesting participants displayed similar SCLs towards the Ingroup and Outgroup CS+ and CS- and their Variations (All F's < 1, ps > .490). At post-test however, the three-way interaction between Target Stimulus, Target Group and Variation was significant, F (2, 132) = 3.597, p = .030, η_p^2 = .052, suggesting that at post-test, participants did display different SCLs towards the Ingroup and Outgroup CS+ and CS- and their Variations.

To determine whether there were differences in SCLs towards the CS+ and the CS- at each level of the Variation factor (Global Cue and Physiognomy), a series of paired samples t-tests were first conducted on the post-test SCL data. The paired samples t-tests confirmed that, towards the Ingroup faces, participants displayed marginally higher SCLs to the Ingroup CS+, relative to the CS-, for the Global Cue Faces, t (66) = 1.795, p = .077. Participants displayed significantly higher SCLs towards the CS+ relative to the CS- for Ingroup Physiognomy Faces, t (66) = 2.284, p = .026.

Paired samples *t*-tests also revealed that, towards the Outgroup faces, participants displayed higher SCLs to the CS+, relative to the CS-, for the Global Cue Faces, and the Physiognomy Faces, Global Cue Faces: t (66) = 2.316, p = .024; Physiognomy Faces: t (66) = 3.000, p = .004. Hence, participants generalized their acquired anxiety to the CS+ and its variants when responding to both Outgroup and Ingroup stimuli (see Figures 17a and 17b).

To delve more into the significant three-way interaction between Target Stimulus, Target Group and Variation, and to determine the *unique* effects of physiognomy and global cues on generalization, three separate 2 Target Stimulus (CS+ vs. CS-) x 2 Target Group (Ingroup vs. Outgroup) x 2 Variation three-way repeated measures ANOVAs were conducted on different sections of the post-test data. The first ANOVA compared the Target Faces with the Global Cue Faces at post-test. The ANOVA produced a non-significant three-way interaction between Target Stimulus, Target Group, and Variation, F (1, 66) = 2.226, p = .140, η_p^2 = .033, suggesting that there were comparable levels of generalization from the Target Stimuli towards the Global Cue Variation Faces for both the Ingroup and Outgroup. A lower-level interaction was also significant between Target Group and Variation, F (1, 66) = 7.31, p = .009, η_p^2 = .100. Hence, there was some level of Ingroup-Outgroup asymmetry in non-discriminative anxiety. To isolate the effect of Target Group, a 2 Target Stimulus (CS+ vs. CS-) x 2 Variation (Target Faces vs. Global Cue Faces) repeated measures ANOVA was conducted separately for Ingroup and Outgroup SCLs at post-test. Contrary to predictions, the ANOVA for the Ingroup data did not reveal a two-way interaction between Target Stimulus and Variation (F < 1), suggesting that participants responded similarly to the CS+ and CS- for both the Target Faces and the Global Cue

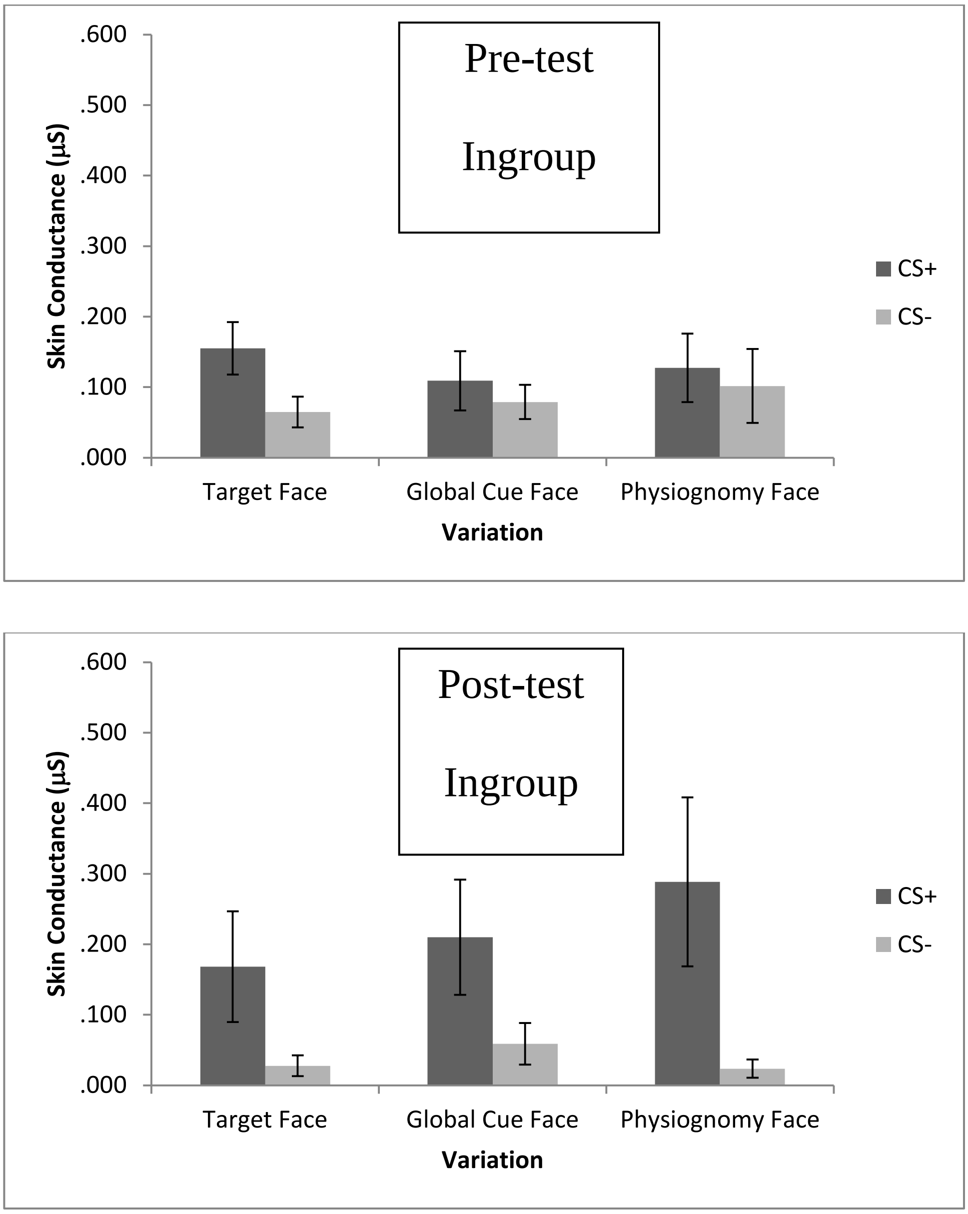

Figure 17a. Four-way interaction between time, target stimulus, target group and variation, on the skin conductance data collected during generalization, shown separately for the ingroup comparing pre-test (top panel) and post-test (bottom panel).

Faces (see Figure 17a). This non-significant interaction suggests that generalization was broad to Ingroup members along the group membership marker. Also contrary to predictions, the ANOVA for the Outgroup data did reveal a marginal two-way

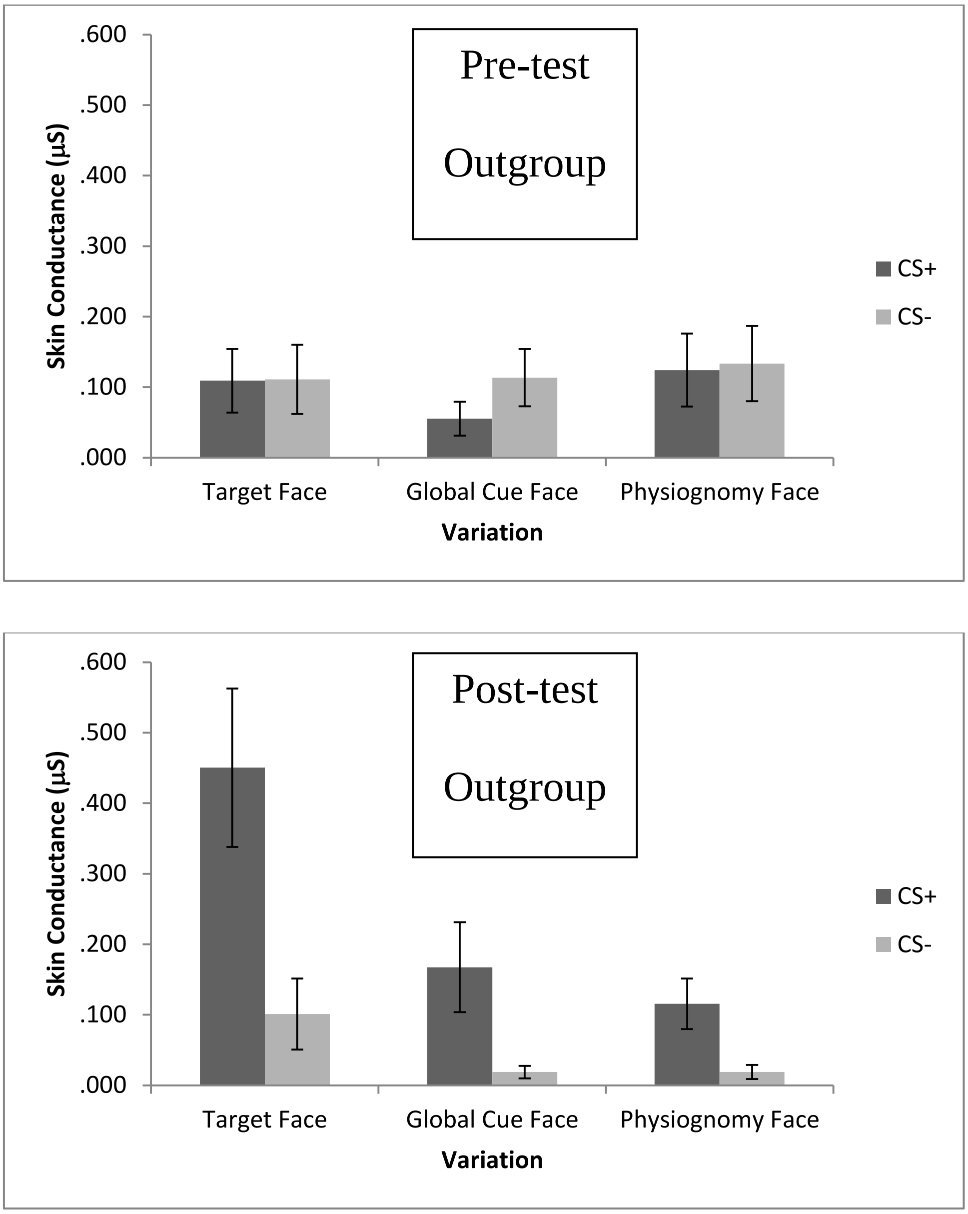

Figure 17b. Four-way interaction between time, target stimulus, target group and variation, on the skin conductance data collected during generalization, shown separately for the outgroup at pre-test (top panel) and post-test (bottom panel).

interaction between Target Stimulus and Variation, F (1, 66) = 3.885, p = .053, η_p^2 = .105, suggesting that participants responded differently to the Outgroup CS+ and CS- Target Faces and Global Cue Faces. Specifically, participants displayed lower SCLs towards the Global Cue Faces relative to the Target Faces (see t-tests above, and Figure

17b). Hence, participants displayed generalization of responding from the Outgroup Target stimuli to their Global Cue variations, and maintained discriminative responding between the CS+ and CS- Global Cue faces.

The second 2 Target Stimulus (CS+ vs. CS-) x 2 Variation (Target Faces vs. Physiognomy Faces) x 2 Target Group (Ingroup vs. Outgroup) ANOVA focused on comparing the Target Faces with the Physiognomy Faces at post-test. The ANOVA revealed a significant three-way interaction between Group, Stimulus and Variation, F (1, 66) = 5.071, p = .028, η_p^2 = .071, suggesting that participants responded differently to the CS+ and CS- stimuli depending on whether they were Ingroup or Outgroup faces, and depending on whether they were Target Faces or the Physiognomy Faces. The ANOVA also displayed again a significant Group x Variation interaction F (1, 66) = 8.476, p = .005, η_p^2 = .114, suggesting that participants responded differently to the Ingroup and Outgroup Target and Physiognomy Faces. To explore this three-way interaction, two 2 Target Stimulus (CS+ vs. CS-) x 2 Variation (Target Faces vs. Physiognomy Faces) ANOVAs were conducted, separated by Target Group on the post-test SCL data. Contrary to predictions, the ANOVA for the Ingroup data did not reveal a two-way interaction between Stimulus and Variation (F < 1.2), suggesting that again participants responded similarly to the Ingroup CS+ and CS- for both the Target Faces and the Physiognomy Faces. This non-significant interaction suggests that generalization was broad to Ingroup members along the group membership marker. Also contrary to predictions, the ANOVA for the Outgroup data did reveal a marginal two-way interaction between Stimulus and Variation, F (1, 66) = 4.682, p = .034, η_p^2 = .066, suggesting that participants responded differently to the Outgroup CS+ and CS- Target Faces and Physiognomy Faces in non-discriminative anxiety. Specifically, participants displayed lower SCLs towards the Outgroup Physiognomy Faces relative to the Target Faces (see t-tests and Figure 17b). Hence, participants displayed the generalization of anxiety responding from the Ingroup and Outgroup Target stimuli to their Physiognomy variations, however, they maintained discriminative responding between the CS+ and CS- Physiognomy faces only for Outgroup stimuli.

The third and final 2 Target Stimulus (CS+ vs. CS-) x 2 Target Group (Ingroup vs. Outgroup) x 2 Variation ANOVA compared the SCLs towards the Global Cue Faces with the Physiognomy Faces at post-test. The ANOVA revealed no significant two or three-way interactions (all *p*s > .120), suggesting *no* ingroup-outgroup asymmetry was found between SCLs for the CS+ (vs. CS-) towards the Global Cue and Physiognomy Variations. The only significant main effect was Stimulus, F (1, 66) = 12.117, p < .001, η_p^2 = .155, suggesting that participants responded with higher SCLs to the CS+ Global Cue Variation and Physiognomy Variation, compared to the CS- equivalents. For completeness, two 2 Target Stimulus (CS+ vs. CS-) x 2 Variation (Global Faces vs. Physiognomy Faces) ANOVAs were conducted, separated by Target Group on the post-test SCL data. Contrary to predictions, the ANOVA for the Ingroup data did not reveal a two-way interaction between Target Stimulus and Variation (F < 1.1), suggesting that participants responded similarly to Global Cue and Physiognomy CS+, and CS-, respectively. This non-significant interaction suggests that generalization was comparable between Ingroup members that varied along the group membership marker with Ingroup members that varied along both the group membership and facial feature marker. Consistent with predictions, the ANOVA for the Outgroup data did not reveal a two-way interaction between Stimulus and Variation (F < 1), suggesting that participants responded similarly to the Outgroup Global Cue and Physiognomy CS+ Faces, and the Outgroup Global Cue and Physiognomy CS- Faces. Hence, the Physiognomy faces (which manipulated both Global Cues and Physiognomy cues) did not demonstrate any significant differences compared to the Global Cue faces. This suggests that the Physiognomy variations provided no additional influence on generalization, over and above that already provided by the Global Cue variation faces.

In summary, the data demonstrate that generalization did occur. The data have shown that participants were able to transfer learned anxiety from the CS+ to its morphed variations, both via background color (Global Cue Face) and facial features (Physiognomy Face). Moreover, the relative safety of the CS- was also generalized or spread to its morphed variations. It is important to note that participants displayed significantly higher SCLs towards the CS+ Target Face, and its variations, relative to the CS- equivalents. This shows differential learning and generalization; participants were able to recognize the threat associated with the CS+ and the relative safety of the CS-, and their morphs.

Next, the analyses assessed whether contingency awareness was a potential mediator of generalization by including, in turn, dial ratings and self-reported contingency awareness ratings, within the ANOVA as covariates. When included in the 2 Time (pre-test vs. post-test) x 2 Target Stimulus (CS+ vs. CS-) x 3 Variation (Target Faces, Global Cue Faces, Physiognomy Faces) x 2 Target Group (Ingroup vs. Outgroup) ANOVA as a covariate to test for mediation (Judd et al., 2001), self-reported contingency awareness, as well as the dial ratings, both made the four-way interaction between Time, Target Stimulus, Variation, and Target Group, which captured differences in discriminative generalization as a function of target, non-significant, dial ratings: from F (2, 132) = 3.355, p = .038, η_p^2 = .048, to F (2, 130) = .014, p = .987, η_p^2 < .001; self-reported contingency awareness: from F (2, 132) = 3.355, p = .038, η_p^2 = .048, to F (2, 128) = .247, p = .782, η_p^2 = .004. To check that this mediation occurred in the predicted direction (higher contingency awareness facilitates generalization), self-reported contingency awareness and the dial ratings were correlated with an index of generalization. To create this index, the following formula was used:

Generalization Index to CS+'s (see footnote 17) =

{[(Posttest SCL to Outgroup CS+ Target Face - Posttest SCL to Outgroup CS+ Global Cue Face) + (Posttest SCL to Outgroup CS+ Target Face) – (Posttest SCL to Outgroup CS+ Physiognomy Face)] -

[(Posttest SCL to Ingroup CS+ Target Face - Postest SCL to Ingroup CS+ Global Cue Face) + (Posttest SCL to Ingroup CS+ Target Face - Postest SCL to Ingroup CS+ Physiognomy Face)]}

The same formula was used to create a generalization index to the CS-, except it substituted CS- where CS+ appears in the formula. Correlations revealed that mediation was in the predicted direction, with positive correlations between the index of generalization to the CS+ and self-reported contingency awareness (r = .077, p = .541), and dial ratings (r = .170, p = .170) respectively. Consistent with predictions, the correlations between the index of generalization to the CS- were also in the predicted direction with the self-reported contingency awareness (r = .007, p = .955) and the dial ratings (r = .072, p = .552). Hence, mediation was in the predicted direction, with positive correlations between the index of generalization and self-reported contingency awareness, and dial ratings respectively.

Other Measures of Group-Level Effects

Next, the analyses aimed to determine if participants displayed any differences at pre-test in the measure of perceived group attitudes, as measured via the self-reported feeling thermometer data. Using paired-samples *t*-tests, the results found that there was a significant difference the feeling thermometer ratings at pre-test towards ingroup and outgroup members, t (67) = 3.280, p = .002. This suggested that, similar to most minimal group paradigms, the ingroup (M = 60.00, SD = 19.24) was perceived more positively than the outgroup (M = 49.12, SD = 17.08). (t < 1, p > .20). This pattern was repeated at post-test, t (67) = 2.895, p = .005, outgroup: M = 56.92, SD = 17.21; Ingroup: M = 47.21, SD = 19.23, suggesting that group valence differences were subjectively superimposed as a result of ingroup-outgroup dynamics. .

To determine if participants reported any differences in their willingness to engage in contact with members of the ingroup and outgroup at post-test, paired-samples *t*-tests were conducted to compare the willingness of participants to engage in future contact with, and attend events organized by, ingroup and outgroup members. Results revealed no significant differences (*t*s < 1, *p*s > .34). These results suggest that while participants displayed generalized anxiety post-test, they did not display differences in their willingness to engage in future contact with ingroup and outgroup members as a function of conditioning.

Extinction

Finally, a 2 Target Stimulus (CS+ vs. CS-) x 2 Target Group (Ingroup vs. Outgroup) x 5 Extinction Trial (1-5) repeated measures ANOVA was conducted to test for ingroup-outgroup asymmetries in extinction. Contrary to previous findings (Navarrete et al., 2012; Olsson et al., 2005), the results did not reveal any asymmetries between the ingroup and outgroup during extinction: The three-way interaction between Target Stimulus, Target Group, and Extinction Trial was not significant, F < 1. The only marginal effect was of Target Stimulus, F (1, 64) = 3.938, p = .052, η_p^2 = .058.

This main effect demonstrates that participants displayed higher average SCLs towards the CS+ during the extinction trials (*M* = .087, *SE* = .114), compared to the CS- (*M* = .040, *SE* = .130). No other main effects or interactions approached significance (all other *p*s > .142), meaning that SCLs across the ingroup and outgroup CS's were comparable across trials.

Discussion

This study aimed to isolate the effect of 'pure' group membership on the acquisition and generalization of intergroup anxiety away from the influence of prior experiences with groups through a minimal group paradigm. The study also investigated the effects of global cues and physiognomy on the generalization of intergroup anxiety. The facilitating mediational effect of contingency awareness on both the acquisition and generalization of intergroup anxiety was also assessed. As expected, the data revealed a larger differential learning effect towards outgroup faces relative to ingroup faces: Participants displayed higher levels of anxiety towards the outgroup CS+ relative to the outgroup CS- at post-test, compared to pre-test. In contrast, participants displayed a marginal increase in anxiety over time to ingroup stimuli, where participants displayed higher levels of anxiety towards the ingroup CS+, relative to the CS-, at post-test. This ingroup-outgroup effect is consistent with earlier research (Navarrete et al, 2009; Olsson et al., 2005). This ingroup-outgroup effect is also consistent with the findings of Navarrete and colleagues' (2012) minimal group study. By demonstrating this effect using a minimal group paradigm, these results verify that the ingroup-outgroup asymmetry identified on anxiety is in fact due to group membership, and appears even when prior experiences with the groups are removed as a potential explanatory factor.

The implications of such a differential learning effect for ingroup and outgroup targets are profound. Even though all facial stimuli were Caucasian, and group allocations were assigned on an arbitrary, trivial basis, participants still displayed larger anxiety responses towards outgroup (vs. ingroup) faces. This means that, consistent with the literature on the minimal group paradigm (Harmon-Jones et al., 1996; Navarrete et al., 2012; Ostrom & Sedikides, 1992; Tajfel et al., 1971) any arbitrary based group has powerful implications on individual-level responses, and more specifically, emotions such as anxiety. It should be noted that in a traditional minimal group study, ingroup and outgroup stimuli are not usually associated with negativity (or not). Hence, this minimal group associative aversive learning paradigm has the potential to add to traditional findings of the minimal group literature, by demonstrating that individuals develop different responses to 'us' vs. 'them', even when group members have been associated objectively with the same outcome.

As argued earlier in the chapter, evidence that individuals develop aversive reactions to arbitrary outgroups faster than arbitrary ingroups can be explained using an evolutionary account. Since members from outgroups were seen as a threat in our evolutionary past (McDonald et al., 2012), it would have been natural to develop a defensive reaction, which incorporates anxiety, towards potential invaders. This is because members from other tribal groups introduced competition for survival and reproduction, which can lead to intergroup conflict in defense of group resources (Bowles, 2009; Goldstein, 2003; Van Vugt, 2009; Wrangham & Peterson, 1996). As a result, the 'us' versus 'them' distinction has been found to guide affect, behavior and cognition.

The study however, did not provide support for the expectations with regards to generalization: Participants displayed generalization of anxiety from the ingroup Target

CS+ to its Global Cue and Physiognomy variations. This anxiety was significantly lower towards the ingroup Target CS- and its Global Cue and Physiognomy variations, demonstrating generalization of safety. In contrast, the generalization of anxiety from the outgroup Target CS+ to its Global Cue and Physiognomy variations was comparatively smaller to that of the ingroup. In particular, participants seemed to transfer or generalize their anxiety from the original training face to the global cue and physiognomy variation faces. However, the global cue and physiognomy variation faces did not display a significantly different level of anxiety responding. This means that they were comparable in their level of anxiety responding. Since the physiognomy variation faces differed from the global cue variation faces only in their manipulation of facial features, this suggests that physiognomy did not affect generalization over and above that of the group membership cues. Hence, the results demonstrated that the generalization of anxiety responses were broader towards ingroup (vs. outgroup) stimuli and that global cues were more influential compared to physiognomy cues.

Although this study did not predict generalization to be broader amongst ingroup stimuli, social psychological theory can explain such a finding. Specifically, generalization would be anticipated to the entire outgroup, via a process similar to what is commonly known as an outgroup homogeneity effect (Ostrom & Sedikides, 1992; Park & Rothart, 1982). The outgroup homogeneity effect is that since outgroup members (vs. ingroup members) are perceived to be less variable and distinct (i.e., they all appear similar), they are difficult to discriminate apart. As a result, negativity towards a single member would be transferred to other similar members more readily for outgroup members than ingroup members. However, the results did not suggest any evidence of an outgroup homogeneity effect, since pre-test similarity ratings between the ingroup and outgroup stimuli were comparable, and not markedly different.

Since ingroup members facilitate survival, evolutionary theory would claim that ingroup members are 'safe' and that they should be seen positively (Brewer, 1999). That is, individuals within one's own social groups (i.e., ingroup members) were potentially more likely to assist in achieving survival goals and hence pass on their genetic value if they were trusted. However, ingroup members are still competitors for reproductive value (e.g., seeking the most genetically 'fit' mates) and resources (e.g., having the best cut of meat at a feast). Thus, ingroup members could be perceived negatively based on their non-altruistic behaviors, or behaviors that threaten the safety and best interests of the social group (Boehm, 2012). Hence, evolutionary theory would suggest that if there was one negative ingroup deviant (in this case, the ingroup CS+ Target Face), then this ingroup member would be treated with caution.

Furthermore, kin selection theory claims that individuals who look similar are likely to be from the same genetic line (Foster, Wenseleers, & Ratnieks, 2006). Hence, if an ingroup deviant has been identified and is treated with caution, then similar members are likely to be treated cautiously as well. Since the variations of the CS+ Target Face (i.e., the Global Cue Face and the Physiognomy Face) are associated with the deviant, this could explain the transfer of anxiety towards these faces. Thus, a combination of kin selection theory and the identification of ingroup deviants predict the generalization results within this study. As a result of this caution, participants displayed heightened discrimination between the CS+ and CS- physiognomy and global cue faces, as well as generalizing the anxiety from the ingroup target faces to their physiognomy and global cue variations. Hence, evolutionary theory can explain why the results revealed a larger generalization effect for ingroup (vs. outgroup) stimuli due to the preservation of biological integrity and the protection of oneself and kin from potential threats.

Taking an alternative social psychological perspective, research has shown that ingroup members are more readily associated with desirable positive qualities (Brewer, 1999). Since ingroup membership is used to enhance one's self-esteem (Rubin & Hewstone, 1998; Tajfel & Turner, 1979), once group categorization boundaries have been established, ingroup members evaluate the respective contribution that other group members make, whether positive or negative, to the group. Hence, members who deviate from the generally positive prescriptive norms for the ingroup, by displaying bad or negative behaviors (Pinto, Marques, Levine, & Abrams, 2010), are often met with derogation by fellow ingroup members—an effect called 'the black sheep effect'. Based on this reasoning, excluding deviant members who have become associated with negativity through conditioning and generalization, should serve as a protective mechanism for the integrity of the ingroup positivity (Marques & Paez, 1994). This social psychological perspective focuses on evaluations of the group and its members, with a distinct focus on ingroup enhancement (c.f. evolutionary theory discussed above, which focuses on protection from threat).

When interpreting the generalization data, it should be noted that physiognomy was used differently in the present design to past studies. Previous research that has used established social groups such as ethnicity (e.g., Olsson et al., 2005), presented real ingroup and outgroup faces to participants. The problem with these studies that use existing social groups, such as Black or White faces, is that physiognomy typically covaries with group membership (e.g., Navarrete et al., 2009; Olsson et al., 2005). The use of a minimal group paradigm, however, is advantageous since it enables researchers to isolate and manipulate physiognomy separately to group membership. That is, in this study, the background color of the face (blue/green; global cues) was indicative of group membership (ingroup/outgroup), and therefore, based on evolutionary theory, was a subjective predictor of threat. In contrast, the facial features (physiognomy) allowed participants to discriminate apart group members (CS+/CS-), and therefore was an objective predictor of threat. Put differently, in this study, global cues were the sole marker of group membership and thus marked intergroup differences, whereas physiognomy was the sole marker of distinguishing within groups who was safe and who was not and thus marked intragroup differences. Hence, in past research that has utilized established social groups, physiognomy has acted as both an intergroup and intragroup marker, whereas in this study, physiognomy was an intragroup marker and the key predictor of threat.

The fact that participants displayed discriminant fear learning on the skin conductance responses, and were contingent aware, clearly demonstrates that changes in physiognomy were significant contributors to the learning of aversive (vs. safe) stimuli. In particular, in this present design, physiognomy was the sole marker for distinguishing safe from unsafe faces. That is, differences in physiognomy between the CS+ and CS- were the only cues available to accurately predict (i.e., contingency awareness) and react (i.e., skin conductance) to the electrical stimulation.

Despite the fact that the data provides reason to believe that participants attended to the physiognomy cue information, the results inform us that the global cue variation faces were more influential for generalization. Extending previous research on other outcome variables (Stepanova & Strube, 2012a; 2012b), this chapter’s data have demonstrated that group membership cues (e.g., the equivalent of skin color in past research with established social groups), compared to physiognomy cues (e.g., morphed facial features), are more influential for the generalization of intergroup anxiety. Hence, since the physiognomy variation faces did not show any significant differences compared to the global cue variation faces, this demonstrates that physiognomy in conjunction with global cues did not facilitate generalization over and above the generalization that was evident when global cues were manipulated in isolation. This was because the physiognomy variation included manipulations of both global cues and facial features compared to the original target stimuli. The implication is that, at least in minimal group settings where the group differences are novel and made very visually prominent (via colored background), global cues are most important for the generalization of intergroup anxiety. The implication is that group membership cues, which are subjective predictors of threat, are important sources of information that should be incorporated into anxiety reduction interventions (i.e., by making global cues obvious during positive contact interventions).

A key advantage of this study's investigation into the generalization of intergroup anxiety was the incorporation of a learning paradigm. Traditional research on the generalization of intergroup anxiety has focused on generalization from an individual to an entire outgroup (individual-to-group generalization) or on generalization from cumulative past experiences to inform responses towards a specific outgroup member (individual-to-group generalization). This paper, however, was able to investigate how anxiety develops towards an individual and spreads to other similar individuals, hence investigating individual-to-individual generalization. This was done by training participants that one ingroup and one outgroup member signaled an upcoming threat (CS+), whereas another group member did not (CS-). This allowed for a unique investigation into generalization, since it established two generalization curves; one for the CS+ and one for the CS-. Moreover, having one threatening, and one safe, stimulus allows for a unique investigation into generalization; not only could this design investigate whether any acquired anxiety spread to variations of the original target stimuli, but it could also assess whether participants were able to successfully discriminate between the variations of the CS+ and CS-. That is, the use of a learning paradigm enabled for a comparison between responses to the variations of the unsafe group members (CS+) were significantly more anxiety inducing than the variations of the safe group members (CS-). Hence, this design enabled for a unique investigation of generalization by demonstrating that individuals generalize anxiety from an aversive face, and they also generalize safety from a safe face, and are able to discriminate between variations of the safe and unsafe faces.

The data also extended previous research on the influential role of contingency awareness. In particular, this study has substantiated the facilitating role of contingency awareness for the acquisition of anxiety (Lovibond et al., 2008). Moreover, this study has demonstrated the facilitating role of contingency awareness for the generalization of intergroup anxiety responses; generalization was broader when participants were able to identify the relationships of CS+/shock and CS-/no shock. Thus, awareness of the relationship between a particular stimulus and the outcome is imperative for not only the acquisition of anxiety responses, but also for the generalization of such anxiety to similar stimuli.

Although not specifically an aim of this study, it should be noted that the extinction data did not replicate the ingroup-outgroup asymmetry found within the Olsson and colleagues (2005) and Navarrete and colleagues (2009) papers. Specifically, it was expected that acquired anxiety towards outgroup members would be slower to extinguish compared to the acquired anxiety towards ingroup members. However, this chapter’s results revealed no significant difference in the extinction between ingroup and outgroup members. Despite the inconsistency with the Olsson and Navarrete papers, the results are consistent with the Navarrete and colleagues (2012) minimal group paradigm. In their study, Navarrete and colleagues also did not find any evidence of resistance to extinction towards the outgroup CS+. They explained their null results by claiming that when learning about established social groups, such as racial groups (e.g., Navarrete et al., 2009; Olsson et al., 2005), the established biases towards those groups as established through personal experience activates different neural mechanisms compared to learning about arbitrary groups, such as minimal groups. They hypothesized that if an individual has a negative bias towards a racial outgroup (e.g., Black people), and this bias is reinforced by negative outcomes (e.g., an electric stimulation), then this may activate neural processes that resist extinction of any acquired fear response. In contrast, when there is no bias towards a group (e.g., blue overestimators), no neural processes are activated to resist extinction of any acquired fear response. Hence, for arbitrary groups, no ingroup-outgroup asymmetry should exist in the resistance to extinction of acquired fear responses.

Taken together, these data point towards the critical role of contingency awareness for the exacerbation of individual-level (i.e., acquisition) and group-level (i.e., generalization) effects. Hence, the data iterate the need to ensure that individuals are aware of the positivity and/or negativity of a particular outgroup member for anxiety reduction interventions. Knowledge of negative outcomes being associated with an outgroup member means that other outgroup members, if they share group membership and/or physiognomy cues to the original outgroup member, will be associated with the negative outcome.

Limitations, Future Research and Summary

Although research has investigated the extinction of acquired anxiety responses to ingroup and outgroup faces, future research could investigate the extinction of generalized anxiety responses. Since extinction typically involves repeated presentations of the CS+ and CS- without any US pairings (Mallan et al., 2009; Navarrete et al., 2009; Navarrete et al., 2012; Olsson et al. 2005), extinction usually assesses the reduction of any acquired responding to the target stimuli. However, future research could investigate whether there are group differences, or even stimuli differences, that affect the reduction or extinction of generalization stimuli. This means that future research could assess whether physiognomy and/or global cue stimuli take different amounts of trials to extinguish responses acquired to ingroup (vs. outgroup) stimuli. The question is, how long does it take for group-level (vs. individual-level) anxiety responses to subside, and does this differ for ingroup, relative to outgroup, facial stimuli? Knowledge of the extent to which acquired group-level anxiety responses are sustained or diminished will provide a more complete picture of intergroup anxiety. More importantly, investigations into the extinction of group-level anxiety responses would inform anxiety reduction intervention strategies.

A further limitation of this study is that the design did not include a physiognomy only morph of the target faces. For completeness, future research should include target faces, physiognomy faces, global cue faces, and global cue + physiognomy faces. Thus, the individual and the combined influence of global cues and physiognomy for the acquisition and generalization of intergroup anxiety could be assessed. This line of research would then inform the current research investigating global cues and physiognomy (e.g., Balas & Nelson, 2010; Blair et al., 2004; Dunham et al., 2014; Hagiwara et al., 2012; Stepanova & Strube, 2009; 2012a; 2012b), by highlighting the relative contribution that each provides.

Future research could also delve more deeply into the role of contingency awareness during anxiety learning studies. In particular, contingency awareness has been shown to be important for contingency learning (e.g., Lovibond et al., 2008) and this study has now extended this finding to also incorporate the generalization of acquired anxiety responses. However, to date, contingency awareness has not been studied in conjunction with reductions in intergroup anxiety (i.e., extinction). Hence, it would be interesting to see if extinction of any acquired responding occurs simultaneously with changes in contingency awareness (i.e., the realization that the CS+/shock pairing is no longer in existence), before contingency awareness changes, or following changes in contingency awareness.

Final Remarks

Taken together, this study demonstrates the powerful nature of arbitrary group assignment for the acquisition and generalization of anxiety. More generally, the study suggests the extensive impact that aversive experiences with unsafe ingroup and outgroup targets has on anxiety, and suggests that awareness of the contingency between a face and aversive outcome facilitates the generalization of anxiety from an individual to similar others. Specifically, participants displayed the acquisition of intergroup anxiety such that anxiety was larger towards a threatening (CS+) stimulus relative to a non-threatening (CS-) stimulus, indicative of the importance of physiognomy within the study. Moreover, the generalization of intergroup anxiety was found when the original target face was varied in group membership, and when varied in group membership and physiognomy. In summary, the data suggest that global cues and physiognomy have important, yet distinct, roles for the acquisition and generalization of intergroup anxiety; global cues seem most important for generalization to occur, whereas physiognomy appears to be vital for acquisition, such that it aids an individual to isolate and identify a threatening stimulus. Importantly, these results highlight that the acquisition and generalization of intergroup anxiety can readily occur in the absence of prior contact experience with the ingroup or outgroup. This provides support for an evolutionary framework, since individuals are predisposed to respond cautiously to outgroup members and deviant ingroup members.

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Footnotes

16. Power estimates were based on conditioning research using similar methods, as well as a power analysis. Previous research investigating intergroup anxiety learning used 35 participants per cell (Olsson et al., 2005); 11 per cell (Olsson et al., 2007) and 29 per cell (Olsson & Phelps, 2004). Power estimates computed with PASS for a 2 x 2 x 2 repeated measures design aimed at detecting a Cohen's moderate effect size of .25 with an alpha value of .05 indicated that this study needed a total of 71 participants.
17. When broken down, this generalization index simply means the following: The generalization of acquired anxiety to the variations of the CS+ (i.e., the global cue and the physiognomy variants) is subtracted from the generalization of acquired anxiety to the variations of the CS-. Higher scores indicate higher levels of generalization.

Chapter 6.

General Discussion

The four studies reported in this thesis have clarified and verified a number of organizing principles and components of the proposed learning model of anxiety (Paolini, Harris, & Griffin, 2015; Chapter 1). Firstly, the results are recapped and are discussed with explicit reference to the five organizing principles, and within the framework of the learning model of anxiety. The findings will then be discussed in terms of their theoretical contribution and their applied value as having the potential to inform future interventions targeting the reduction of intergroup tension and improving intergroup relations. Finally, limitations of the research are discussed and suggestions are offered for future research.

Summary of Results

Chapter 2 reported anxiety learning data from two aversive outgroup learning studies. The first study randomly allocated participants to either a direct or a vicarious learning condition to investigate potential differences in acquired levels of physiological anxiety towards outgroup members. To do this, participants were assigned to observe outgroup stimuli during an aversive episodic learning experience, which was either first-hand or observational in nature, during which the dependent measure, skin conductance, was collected as a proxy for episodic anxiety. Results revealed that participants did display anxiety learning; their skin conductance levels were heightened towards the outgroup face paired with electrical stimulation relative to the outgroup face never paired with electrical stimulation. The key take home message from this study was that this episodic anxiety was comparable in magnitude after direct and vicarious learning. Moreover, model similarity and model believability both mediated episodic anxiety learning such that the more similar participants perceived themselves to be to the model and the more believable the model, the greater their episodic anxiety learning.

The second study focused on vicarious learning towards outgroup members and manipulated the ethnic match (vs. mismatch) of the observer and model. White and Asian participants viewed either a White or Asian model during an aversive learning task. Results revealed that the perceived self-reported (vs. visual/ethnic match) similarity between the observer and model mediated anxiety learning towards outgroup members. In particular, similarity facilitated anxiety learning towards outgroup members. In addition, both studies demonstrated the protective moderating effect of contact quality, and the facilitating effect of chronic anxiety. More specifically, better contact quality with the outgroup resulted in decreased anxiety learning, whereas higher levels of chronic anxiety facilitated anxiety learning.

Chapter 3 focused on the extent to which the anxiety responses acquired in the context of the two studies discussed in Chapter 2 generalized to other outgroup faces. Across both studies, episodic anxiety generalized along a gradient of similarity from the outgroup members involved in the episodic experience to variations of the original aversive face. This means that participants transferred their acquired anxiety towards variations of the originally trained CS+ and CS- faces, such that participants displayed gradually lower levels of anxiety towards the variations of the CS+, but comparatively higher levels of anxiety towards these CS+ variations compared to the respective CS- variations. Moreover, Chapter 3 provided evidence of individual-to-group generalization via the transfer of anxiety responses to new exemplar outgroup faces. Similar to Chapter 2, perceived self-model similarity and perceived similarity to the original stimuli affected generalization such that the more similar individuals perceived themselves to the model, the broader their generalization, and the more similar the variations of the original faces were perceived to be to the original aversive stimulus, the broader their generalization of anxiety to the variation faces. Hence, similarity of new stimuli to the training stimuli, and perceived similarity to the model was paramount to the successful generalization of anxiety.

Chapter 4 included a within subjects study that assigned participants to undergo direct and vicarious learning in different orders. The study found that participants displayed greater levels of anxiety learning when experiencing direct then vicarious (D-V) learning, whereas generalization was broader when experiencing vicarious followed by direct (V-D) learning. That is, episodic anxiety following episodic aversive experiences was strongest when participants experienced D-V learning, whereas individual-to-group generalization, or inductive learning, was strongest when participants underwent V-D learning. This study identified model anxiety and contingency awareness as mediators of individual-to-group generalization of anxiety, and both contingency awareness and model anxiety also mediated episodic anxiety learning.

Chapter 5 used a minimal group paradigm to isolate the basic effects of intergroup exposure on anxiety, without the influence of past contact history with ingroup and outgroup members, inherent when using real groups such as ethnic outgroups. Results revealed that participants showed stronger acquisition to outgroup, relative to ingroup, members. However, the generalization of acquired anxiety was broader to ingroup, relative to outgroup, members. Moreover, whilst on the surface both physiognomy and group membership appeared to facilitate the generalization of anxiety, it became apparent that physiognomy did not influence the generalization of anxiety over and above group membership alone. Finally, contingency awareness facilitated both the acquisition and generalization of anxiety.

Results, Organizing Learning Principles and the Learning Model of Anxiety

Overall, these four studies provide support for the five organizing principles and the learning model of anxiety (Paolini et al., 2015). To summarize, the five organizing principles state that: (1) intergroup contact with an individual outgroup member results in episodic or individual-level responses; (2) episodic responses influence group-level or chronic responses; (3) chronic responses provide feedback and influence episodic responses; (4) There is a dynamic feedback loop between episodic and chronic responses (inductive learning or individual-to-group generalization) and from chronic to episodic responses (deductive learning or group-to-individual generalization); (5) episodic and chronic responses change over time to reflect one's personal history. Thus, the five organizing principles outline the dynamic interaction between episodic and chronic experiences over time.

With regards to the organizing principles, this series of studies has demonstrated that exposure to outgroup members provide discrete learning experiences with individual outgroup members and about specific ingroup-outgroup member interactions, which result in individual-level anxiety responses (i.e., the link from episodic contact to episodic anxiety in the model, shown in Figure 18). This has been done by showing, across four chapters, that participants display physiological anxiety towards an anxiety-provoking outgroup member (unsafe CS+), but do not display this physiological anxiety towards a non-anxiety provoking outgroup member (safe CS-). Thus, individuals were able to acquire negativity towards an unsafe outgroup target, relative to a safe outgroup target. This link between episodic contact and episodic anxiety was found to be

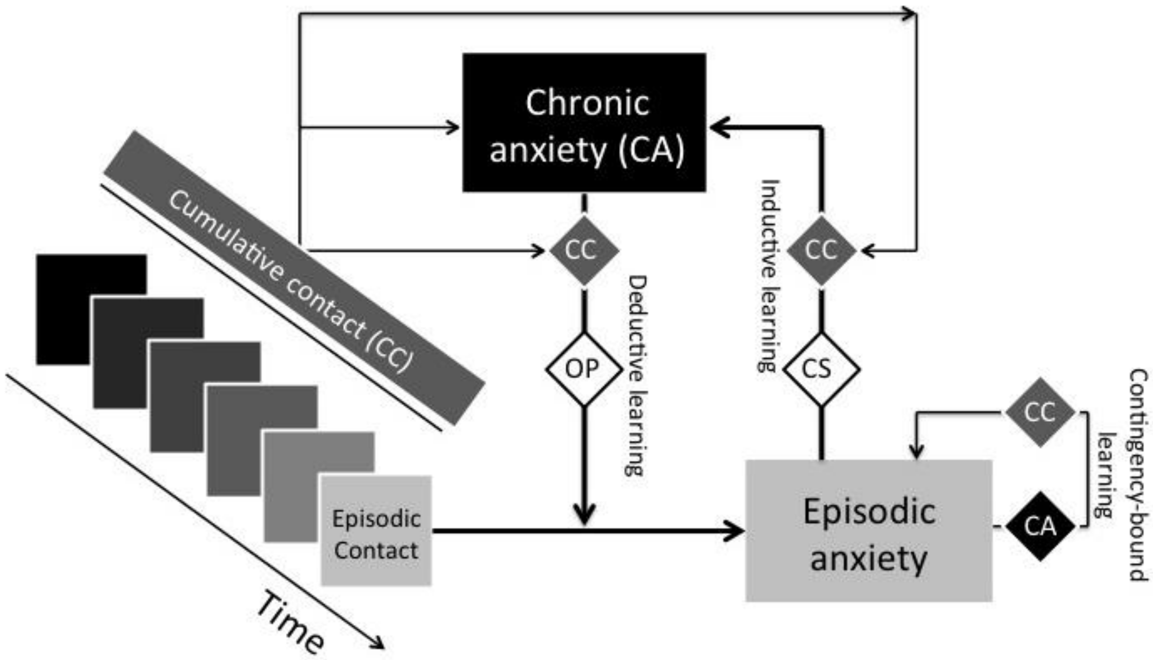

Figure 18. Learning model of intergroup anxiety.

comparable in magnitude after independent experiences of direct and vicarious learning (see Chapter 2), yet was found to have a compounding effect when experienced consecutively (see Chapter 4). Hence, the anxiety learning results demonstrate that isolated experiences with outgroup members inform specific and appropriate responses towards that individual, whilst episodic anxiety learning was significantly higher when vicarious exposure followed direct exposure, compared to when direct exposure followed vicarious exposure.

Moreover, these four studies have demonstrated that these episodic experiences inform group-level or chronic responses. This has been clearly shown via the generalization data within the series of studies via the inductive learning link (i.e., the link from episodic anxiety to chronic anxiety in Figure 18). Specifically, the data from Chapters 3, 4, and 5 demonstrated that anxiety acquired towards a specific outgroup member (the unsafe CS+), indicative of episodic anxiety learning can be generalized to other similar outgroup members. This resulted in participants displaying anxiety responses that spread from the original CS+ to variations of that face; with the most similar variation faces eliciting higher levels of anxiety compared to the least similar variation faces. Support for this inductive learning link, as proposed within in the learning model of intergroup anxiety, has been provided using direct experiences (Chapter 3, 4 and 5), as well as vicarious modes of learning (Chapter 3 and 4), has included both majority participants (Caucasian-Australians; Chapter 3, 4 and 5) and minority participants (Asian-Australians; Chapter 3), and has also been shown using a minimal group paradigm (Chapter 5). Moreover, new exemplars perceived by participants as being most similar to the unsafe CS+ stimulus also showed the strongest generalized responses. Hence, the generalization results, which encompassed both generalization along a similarity gradient, and generalization to new exemplars, illustrates that episodic experiences generalize, via the inductive learning link, towards similar outgroup members.

Thirdly, the data have also confirmed that chronic responses shape, in turn, episodic responses. Within the model, this relates to the moderating role of chronic anxiety and cumulative contact during several key processes of the learning model of anxiety (see the cumulative contact ‘CC’ and chronic anxiety ‘CA’ mediators in the contingency-bound learning link in Figure 18). In particular, the protective function of intergroup contact quality, and the facilitating function of chronic anxiety towards the outgroup, provides support for the moderating effects of cumulative contact and chronic anxiety on episodic anxiety learning and contingency-bound learning. That is, since chronic outgroup anxiety facilitated, and prior outgroup contact quality protected against, the acquisition of episodic anxiety towards outgroup members, these chronic level responses were shaping episodic responses.

Additional factors, above and beyond those anticipated by the five organizing principles and the learning model of intergroup anxiety were also found to moderate episodic anxiety learning and the inductive learning link. Specifically, perceived similarity of new outgroup exemplars to the original training stimulus (Chapter 3 and 4), perceived model anxiety (Chapter 3 and 4), contingency awareness (Chapter 4 and 5) perceived model believability (Chapter 2 and 3), participant anxiety (Chapter 3) and perceived self-model similarity (Chapter 2 and 3) were found to facilitate episodic anxiety learning (Chapter 2, 4 and 5) and the inductive learning link (Chapter 3, 4 and 5). This novel finding suggests that certain features of the model when engaging in vicarious learning experiences mediate the acquisition of episodic intergroup anxiety. That is, this thesis has successfully identified that at least some of the mediators of anxiety learning are related to attributes of the model. Hence, one's history of contact with the outgroup, as well as similarity of new stimuli to the originally trained stimuli, knowledge of contingencies, and characteristics of vicarious learning, affect if, and how much, episodic anxiety is acquired towards individual outgroup members, and towards similar outgroup members, following aversive experiences.

Moreover, the data have demonstrated various moderators of this inductive learning link. This includes that higher levels of perceived self-model similarity, perceived model believability, perceived similarity to the original stimulus, perceived model anxiety, and higher levels of contingency awareness all magnify the inductive learning loop.

Implications of Results for the Broader Literature

These data demonstrate the applicability of evolutionary, learning and contact theory with respect to intergroup relations. From an evolutionary perspective, the data contained in this thesis support and are consistent with preparedness theory, and Cottrell and Neuberg's (2005) sociofunctional approach to prejudice. Moreover, the data have the potential to inform anxiety reduction interventions aimed at improving intergroup relations.

Specifically, one implication of this thesis is that the advantage to learning vicariously has been demonstrated, and is consistent with an evolutionary perspective (Chapter 2, 3, 4). When engaging in vicarious forms of intergroup contact, individuals expose themselves to less personal risk, and therefore boost their own survival chances, if they can learn about dangerous stimuli vicariously. That is, by being able to learn through observation rather than first-hand or trial-by-trial experience, individuals can acquire social information about potential threats and therefore, learn appropriate survival responses when later faced with those stimuli.

Moreover, by demonstrating that such learning is asymmetrical with respect to the ingroup and outgroup (Chapter 5), the research within this thesis extends the findings from previous studies that demonstrate an ingroup-outgroup asymmetry (Mallan et al., 2009; Navarrete et al., 2009, 2012; Olsson et al., 2005). This idea of an ingroup-outgroup asymmetry is reflective of Seligman's (1971) preparedness theory, which has been empirically demonstrated by researchers such as Olsson and colleagues in their seminal paper in 2005, and theoretically applied to fear learning by researchers such as Öhman and Mineka (2001). Following on from the ideas of Seligman, Olsson, and Öhman, an ingroup-outgroup asymmetry was evident within the minimal group study (Chapter 5), which demonstrated that individual outgroup members are treated with more caution compared to individual ingroup members. Moreover, ingroup members were treated with more caution, compared to outgroup members, when generalizing acquired anxiety responses. This is consistent with Cottrell and Neuberg's (2005) sociofunctional approach, and hence, is in line with an evolutionary perspective.

Cottrell and Neuberg's (2005) sociofunctional approach to prejudice is based on the fundamental assumption that there is a basic human need for dealing with environmental demands by living in interdependent and cooperative groups. By engaging in interdependence and group living arrangements, an individual's chance of survival and reproductive success is maximized by improving access to essential resources, and communal assistance with time consuming and risky tasks, such as protection or child rearing. By relying on other people, this naturally leads to protective mechanisms to identify threats to group safety, as well as resources, such as territory, security, economic standard, and food. Hence, interdependent living leads to reciprocity, trust, and positivity towards cooperative ingroup members, and vigilance, defensiveness, and negativity towards outgroup members.

Empirically, by demonstrating that ingroup-outgroup asymmetries exist in the acquisition of intergroup anxiety when using a minimal group paradigm (Chapter 5), the data have confirmed this sociofunctional approach, and past empirical research that demonstrates that individuals generate anxiety differently to ingroup and outgroup members (Mallan, Sax, & Lipp, 2009; Navarrete et al., 2009, 2012; Olsson et al., 2005). More poignantly, despite no pre-existing group valence cues, or prior contact history information, individuals still displayed clear differences in anxiety responding towards a safe and unsafe outgroup, relative to an ingroup, member. Furthermore, the ingroup-outgroup asymmetry supports assumptions made within Olsson and colleagues' (2005) research and the sociofunctional approach, since differential responses towards ingroup and outgroup faces are claimed to reflect evolutionary biases. In sum, the proclivity of participants within this thesis to display a negativity bias towards individual outgroup members, and caution towards ingroup members that are reported as similar to an aversive ingroup member, is perceived by evolutionary psychology to reflect an evolved mechanism that selected for the advantages of coalition affiliation (Cosmides, Tooby, & Kurzban, 2003).

The effectiveness of vicarious learning, and in particular, its comparability in magnitude with first-hand learning also helps advance empirical work on experiences that can drive learning. Consistent with brain imaging research (for a review, see Phelps & LeDoux, 2005), and learning research using shapes as CSs (Olsson, Nearing, & Phelps, 2007; Olsson & Phelps, 2004), this thesis has shown that aversive vicarious learning is comparable in magnitude to aversive direct or first-hand learning when experienced in isolation (i.e., isolated experiences of either direct or vicarious aversive learning). Hence, not only is vicarious learning effective, it is also easy to apply in almost any context, particularly isolated or segregated societies where the opportunity for direct intergroup contact, or the willingness of individuals to engage in direct intergroup contact, is limited or non-existent. Thus, these data provide weight for Wright and colleagues' (1997) suggestion that vicarious experiences can have an impact on a wider scale than direct experiences (note that Wright's paper focused on positive experiences, which is discussed below).

This research has also made a significant contribution to the contact literature by making theoretical, empirical, and methodological advancements. For example, the contact literature to date has had a limited focus on investigating both episodic contact-anxiety effects and chronic contact-anxiety effects in a single design (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001). As a first-step in redressing this imbalance, this thesis included, in a single design, both episodic and chronic contact-anxiety effects, and investigated their interplay over time. Throughout this thesis, episodic contact-anxiety links were measured using continuous psychophysiological recordings of skin conductance, similar to previous fear-learning studies (Mallan et al., 2009; Navarrete et al., 2009, 2012; Olsson et al., 2005). This movement away from self-reported measures of anxiety advances the contact literature by removing key issues associated with self-reported data; self-reported measures do not always reflect attitudes or behaviors (La Pierre, 1934), and physiological measures are less susceptible to the controllability that self-reported measures are (Nederhof, 1985). Future research investigating intergroup contact-anxiety links should continue to use psychophysiological and behavioral measures to account for the inherent issues with self-reported data.

The series of studies contained within this thesis also introduced a unique investigation into the generalization of intergroup anxiety, or chronic contact-anxiety links. This new adaptation to intergroup studies incorporated a contingency-based approach to the measurement of learning and generalization effects. Including contingency, or a CS+ and CS- design, allowed for the measurement of both generalization along a gradient, and generalization to a new exemplar. Incorporating contingency into the design allowed for the development of two distinct generalization curves; the aversive, anxiety-inducing CS+ and its generalization curve, as well as the relative safety of the CS- and its generalization curve. Hence, generalization can be measured by both the spread of anxiety from the original target stimulus to its variations, as well as comparing each CS+ variation with its CS- counterpart. This type of design is advantageous because including the CS- acts as a control variable, which accounts for spontaneous changes in responses over time, known as non-associative influences (Rescorla, 1988). One type of non-associative influence that the inclusion of a CS- controls for includes increases in fear driven by sensitization, which refers to increases in anxiety because of repeated exposure to an aversive event (Thompson & Spencer, 1966). This means that sensitization could lead to individuals becoming afraid of any stimuli that are presented after the conditioning procedure. However, including also a CS- within a learning paradigm controls for increases in anxiety due to sensitization, and also allows for the demonstration that it is not only fear that generalizes, but also safety. Thus, this thesis can also inform us of mechanisms involved in safety learning.

By demonstrating that episodic anxiety generalizes to outgroup members most similar to the original target CS+, but not to stimuli perceived as similar to the original CS- following direct and vicarious intergroup contact experiences, this research has provided an important contribution to the contact literature. Specifically, this research has highlighted the powerful nature of vicarious contact experiences, confirming past literature that suggested that vicarious experiences are comparable to direct experiences (Cook & Mineka, 1987, 1989, 1990; Olsson et al., 2007; Olsson & Phelps, 2004; for a review, see Griffin, 2004). Moreover, the thesis emphasizes the importance of contingency, and by extension, similarity to the original target stimuli for the generalization of intergroup anxiety, or chronic contact-anxiety effects. Finally, the data demonstrate the dynamic interplay between episodic anxiety and the generalization of episodic anxiety to more chronic forms of anxiety over time.

This thesis has shown that order effects emerged when direct and vicarious intergroup contact was experienced consecutively. More specifically, vicarious experiences when followed by direct learning, compared to direct then vicarious learning, resulted in broader levels of generalization of the acquired episodic anxiety to the entire outgroup (i.e., chronic anxiety). Hence, vicarious experiences might ‘prepare’ individuals for direct experiences (Galef & Whiskin, 2001), which then consolidate the initial experiences and crystallize perceptions regarding the group. For effective group-level interventions, policy makers would want positive group-level (vs. individual-specific) shifts in attitudes, perceptions and behaviors. Hence, policy makers should take heed that group-level effects are enhanced when vicarious experiences precede direct ones, at least for negative experiences (for more discussion about positive experiences, see section below entitled ‘limitations and future research’).

Moreover, consistent with the learning literature, contingency awareness was shown to be a significant factor in the learning process. Research has consistently demonstrated that in a CS+/CS- learning design, contingency awareness facilitates learning of the desired responses (Lovibond, Saunders, Weidemann, & Mitchell, 2008). Specifically, in a direct aversive learning paradigm, researchers have shown that participants’ ability to demonstrate their knowledge of the CS+ being paired with electrical stimulation and the CS- not being paired with negativity is a key predictor of the episodic anxiety displayed by participants. Within this thesis, the importance of contingency awareness for developing episodic responses has been extended to also include vicarious aversive learning paradigms.

Moreover, this thesis has demonstrated that contingency awareness also facilitates the development of chronic responses following aversive learning. Hence, this thesis has verified the central role that contingency awareness exerts within direct aversive learning paradigms on episodic responses, and has extended this to vicarious aversive learning paradigms and chronic responses. The thesis has also advanced the literature associated with Bandura’s vicarious learning (Bandura, 1977, 1989). Bandura found evidence that individuals mimic the behaviors of other individuals. This thesis has demonstrated that individuals engaging in an aversive vicarious learning paradigm mimic the anxiety reactions of another individual, and that certain factors associated with the model facilitate this process of vicarious learning. Individuals were more likely to demonstrate vicarious learning if they perceived the model to be similar to themselves, if the model was perceived to be believable, and if the model appeared anxious. Hence, vicarious learning was facilitated by a model that was perceived by the observer to be believable, anxious, and similar to themselves.

Finally, through a minimal group paradigm, it has been shown that group-level generalization effects are evident, and are influenced primarily by global cues indicative of group membership cues, as opposed to having similar facial features, to the original stimulus. By demonstrating the ‘dark side’ of intergroup anxiety, which provides evidence that participants generalized their episodic anxiety into more chronic forms following aversive experiences, this suggests that the converse may also be true; that individuals are likely to generalize their positivity from, and thus reduce their anxiety towards, individual outgroup members to similar outgroup members (for more discussion about future research ideas related to positive contact, see the section below entitled ‘limitations and future research’). Hence, any outgroup members that are presented within a direct or vicarious intergroup anxiety intervention strategy should be typical of that group. Not only will that ensure that the group membership and physiognomy of that individual outgroup member will be similar to other outgroup members, thus facilitating generalization or the spread of chronic responses, but it should promote category salience, a known moderator of prejudice (for a review, see Brown & Hewstone, 2005). Therefore, this thesis has extended the ideas of Brown and Hewstone into the ‘dark side’ of intergroup contact by suggesting that category salience moderates not only decreases, but also increases, in negativity towards the outgroup.

All in all, this thesis has demonstrated the dynamic interplay between episodic and chronic contact-anxiety links. Episodic contact was measured and controlled using laboratory-based presentations of outgroup faces, whilst cumulative contact was measured by collecting individuals' past histories of contact quality with the outgroup. Episodic anxiety was measured by psychophysiological equipment, namely skin conductance responses, while chronic anxiety was measured both by the generalization of psychophysiological anxiety to outgroup members not involved in the anxiety learning task, and through a chronic anxiety scale. The thesis provides a methodology that allows for future research to investigate the dynamic interplay between episodic and chronic contact-anxiety links over time, building on the foundations established by Blascovich and colleagues (2001).

Although this research program has clear benefits for theory, research and practice, it needs to be acknowledged that this series of studies focused on negative contact and thus, increases (vs. decreases) in intergroup anxiety. This approach was taken since this research program was intended to address a gap within the literature; the lack of knowledge of how intergroup anxiety is generated, sustained, and transferred to the group in the first place. Hence, while this thesis focused on the direct and vicarious learning of negative responses, the amelioration tools (discussed below) will obviously need to use positive experiences. Put differently, while the below section will provide some recommendations regarding the practical implications that arise from this series of studies, and in particular, the applicability of these results to intervention programs that target the reduction of intergroup anxiety, these should be taken with caution. This is because positive contact might work differently to negative contact. In particular, category salience has been shown to be a catalyst for anxiety reductions following positive contact (Harwood, Hewstone, Paolini, & Voci, 2005; Voci & Hewstone, 2003a, 2003b). Thus, future research should investigate the dynamic interplay between episodic and chronic contact and anxiety using an appetitive learning paradigm.

An appetitive learning paradigm would involve a positive outcome being associated with the CS+ instead of a negative one; such as a pleasant odors, tastes, sensations, or images (c.f. electrical stimulation). From the available literature, it becomes apparent that comparisons between appetitive and aversive learning experiences are quite scarcely investigated (Andreatta & Pauli, 2015). This is because it is difficult to equate a positive and negative outcome, and often to provide a positive reward, such as food, prior conditions, such as hunger, must be met (for a review, see Clark et al., 2012). However, the key difference that has been demonstrated within the literature is that aversive learning reduces the effectiveness of subsequent appetitive learning towards the same stimulus (Konorski & Szwejkowska, 1956; Scavio, 1974). Doing so would add to the body of knowledge and if it confirms the results contained within the aversive learning paradigm used within this thesis, the appetitive learning paradigm has the potential to directly inform anxiety reduction interventions.

Pragmatically, this series of studies has valuable potential for intervention programs. For example, this series of studies suggests that future interventions can adopt either first-hand or vicarious strategies when targeting intergroup anxiety. These interventions should ensure that they focus on contact quality in order to ensure that episodic experiences consolidate and crystallize over time, to result in a more positive cumulative contact and reduce chronic anxiety towards the outgroup. When using vicarious strategies however, a number of factors have been shown to be influential on the amount with which observers mimic the behavior of the model. This includes the perceived similarity with the model, the believability of the model, and model anxiety, all of which facilitated the acquisition of episodic and chronic responses.

Future research should investigate these processes using positive contact (for more discussion about positive experiences, see section below entitled ‘limitations and future research') to verify that episodic and chronic contact-anxiety links operate similarly following positive intergroup experiences. The contingent nature of the experience should also be made obvious to promote contingency awareness; that is, it should be clear to individuals that the outgroup member is associated with positivity. Alternatively, interventions could ensure that individuals report (i.e., are aware of) the relationship between good things and outgroup members by explicitly and/or implicitly asking or recording. Interventions should also consider incidental positivity associated with the context of the intergroup encounter as well; that is, make the surroundings, and not just the outgroup member, perceived positively. This is because this thesis found that incidental negativity was influential for episodic and chronic anxiety; the aversive nature of the electric shock was not delivered by the outgroup member, it was simply a co-occurrence of two events.

Moreover, to strengthen the generalization of individual-level effects to a group-level, a two-pronged contact intervention should be adopted. In particular, the present collection of experiments suggests that when individuals experience direct, and the vicarious intergroup contact, individual-level responses towards specific outgroup members are more amenable to change compared to vicarious and then direct experiences. However, group-level responses towards other outgroup members were more susceptible to change when individuals underwent vicarious, and then direct, experiences with outgroup members, as opposed to direct and then vicarious experiences. Hence, policy makers and intervention strategies should be aware that if the aim is to change episodic responses, then the most effective strategy is to undergo direct, and then vicarious experiences. In contrast, chronic responses are more effectively modified if individuals undergo a vicarious intergroup intervention, followed by direct experiences with outgroup members. Hence, due to the comparability in magnitude of vicarious and first-hand experiences, and given the potential for vicarious experiences to be applied on a large-scale, future intervention strategies aiming to ameliorate intergroup anxiety should 1) focus on positive intergroup experiences and 2) focus on vicarious strategies to reduce intergroup anxiety.

Taken together, these results illustrate the complex and dynamic interplay between episodic and chronic anxiety. More broadly, the present body of work provides support for the learning model of intergroup anxiety (Paolini et al., 2015), demonstrate the cyclic nature of episodic and chronic contact-anxiety links, and isolate basic social psychological processes that are relevant to intergroup relations. The thesis has also identified a number of new factors that influence episodic and chronic contact-anxiety links, including the perceived similarity of new outgroup stimuli to the original stimuli, model anxiety, model believability, perceived self-model similarity and participant anxiety. Finally, the important role of contingency within vicarious learning, as well as for generalization, has been identified and explored.

Limitations and Future Research

A limitation of this thesis is that, except for Chapter 5, the research contained within this thesis focused on outgroup anxiety (vs. outgroup *and* ingroup anxiety). That is, apart from the minimal group paradigm, participants were only presented with outgroup stimuli (Black faces), and not ingroup stimuli (Caucasian faces). As discussed in Chapter 2, this thesis' studies focused on outgroup fear and anxiety only, similar to Plant and Butz (2006). This decision was made due to feasibility issues; the concern was that since using an aversive learning study was going to include generalization, the number of stimuli presented to participants would be doubled if an ingroup condition was included. Hence, the concern was one of habituation (Rankin et al., 2009).

However, since previous research has demonstrated and validated group differences in intergroup anxiety learning (Mallan et al., 2009; Navarrete et al., 2009; Olsson et al., 2005), this thesis was more interested in focusing more closely on outgroup learning and generalization effects. The implications here are that, apart from Chapter 5, these results are applicable to outgroups only and do not necessarily reflect ingroup-outgroup asymmetries in episodic and chronic contact-anxiety links. Future research could delve more into the intricacies of ingroup-outgroup asymmetries, following in the footsteps of previous researchers who have attempted to isolate and identify ingroup-outgroup differences (Mallan et al., 2009; Navarrete et al., 2009; 2012; Olsson et al., 2005).

Furthermore, there were a number of ethical considerations that were addressed throughout this series of studies. These ethical considerations also had implications for decisions that were made during the designing of the study. In particular, the protocol for each of the reported studies included safety measures to ensure that any acquired anxiety towards individuals was extinguished prior to participants leaving the laboratory testing session. That is, to ensure that participants left with the same level of physiological arousal as when they commenced the study, it was ensured that each participant underwent an extinction procedure (Mallan et al., 2009; Navarrete et al., 2009, 2012; Olsson et al., 2005), in which their acquired anxiety towards the outgroup faces was returned to baseline. Moreover, all participants were presented with a positive visualization task, and were provided with a full debriefing following the completion of the testing session. Hence, measures were taken to ensure that the ethical principle of non-maleficence (i.e., do no harm) was upheld.

Thirdly, the research presented within this thesis could be limited by stimulus sampling restrictions. Stimulus sampling issues arise when including only a limited amount of exemplars to represent a group or category (Wells, & Widschitl, 1999). Due to issues surrounding the practicality and feasibility of this thesis, all participants who underwent vicarious learning were presented with a video of the same female Caucasian model, and/or the same female Asian model. Hence, the actors within the videos may not accurately represent the intended group. That is, this thesis may have found the purported vicarious learning effects due to some characteristic specific to the female models that were used. To resolve this problem, future research should sample the relationship between similarity and learning in more detail to measure the generalizability of these findings. This could be done by using a number of models, representative of both female Caucasian and Asian populations, which are presented to individuals during an aversive vicarious learning paradigm. If future studies find comparable results when testing this design with other models, this would confirm that the models used within this thesis were representative. However, it should be noted that this thesis revealed that model-related characteristics, such as model anxiety, model believability, and perceived self-model similarity, as anticipated within the pilot studies, directly affected the outcome variables. As such, this thesis has provided some solid data that indicates which aspects of the model are the key drivers of the found effects.

Moreover, all facial stimuli presented to participants throughout this series of studies were of young, male faces. Hence, the sex of the target stimuli was always male. The decision to present participants with only male faces was based on results by Navarrete and colleagues (2009), which found that differential fear responding was amplified when the target stimuli were male (vs. female). Thus, according to previous research, using male faces was most likely to generate results. This decision was also consistent with an evolutionary perspective; since males were historically competitors for resources, they were more likely to generate fear or anxiety in observers, and therefore, are more threatening stimuli (Daly & Wilson, 1988; Keeley, 1996; Kelly, 2005; Wrangham & Peterson, 1996). Future research could investigate whether similar results are obtained when using female facial stimuli. This thesis, in line with previous research on contingency awareness, points towards the adverse circumstances surrounding the event in which individuals get the contingency wrong. In this thesis, those who did not accurately identify the contingencies were less likely to display episodic anxiety learning. Future research could focus on the effect of individual's inability to identify the contingency information on intergroup relations; if individuals erroneously attribute contingency to an outgroup member, does this result in mistaken learning? Hence, future research could clarify the integral role of contingency information for intergroup relations and intervention strategies.

Moreover, although this thesis has investigated a particular type of vicarious intergroup experiences, namely observational, vicarious contact in and of itself is rather broad in nature. This is because incorporated within vicarious intergroup contact are a number of types of intergroup contact, including observational, e-contact, and instructed contact. Most research to date has focused on observational contact (e.g., Joyce, & Harwood, 2014; Mazziotta, Mummendey, & Wright, 2011; Olsson & Phelps, 2004; Ortiz & Harwood, 2007; Wright et al., 1997). A growing amount of research has focused on another type of indirect contact, which does not incorporate socially learnt information and therefore is not considered vicarious, namely imagined contact (Husnu & Crisp, 2010; Stathi, & Crisp, 2008; Turner, & Crisp, 2010; Turner, Crisp, & Lambert, 2007; Vezzali, Capozza, Giovannini, & Stathi, 2012). In contrast, relatively limited intergroup research has been conducted using instructed contact (Olsson, & Phelps, 2004), which involves individuals being instructed explicitly that one stimulus is associated with a negative outcome and one stimulus is not, without being told which stimulus leads to which outcome. This instructed contact also incorporates positive intergroup contact as conveyed by reading stories (Cameron & Rutland, 2006). However, there is an emerging trend and interest within an Australian laboratory to investigate contact over the internet, known as e-contact. In particular, virtual e-contact has recently been found to be a new and effective strategy of prejudice reduction (White, & Abu-Rayya, 2012; White, Abu-Rayya, & Weitzel, 2014). The research group has designed a virtual e-contact strategy where individuals from different religious groups use internet chat facilities to communicate synchronously to cooperate and achieve a common goal. Thus, future research could expand the observational learning studies presented within this thesis by investigating the acquisition and generalization of intergroup anxiety via imagined, instructed, and/or e-contact experiences.

An important point to raise is that ‘contact’ typically implies face-to-face experiences with individual outgroup members (Pettigrew and Tropp, 2006). In contrast, this thesis has used the term intergroup contact as an umbrella term to incorporate both direct and vicarious forms of intergroup contact. Moreover, contact in this thesis has been used rather loosely; it includes the presentation of outgroup stimuli on computer screens without direct engagement. Thus, a criticism may also be raised regarding the ecological validity of the intergroup experiences contained within this thesis. In other words, some scholars might question to what extent this paradigm captures the processes that are shared by face-to-face experiences with the outgroup in everyday occurrences. Whilst this is a valid point, it should be noted that the key aim of this thesis was to develop and advance theoretical knowledge of the processes that underlie the development, spread and maintenance of intergroup anxiety responses. That is, this thesis was not intended to provide a comprehensive analysis of real-world ingroup-outgroup relations; instead, this thesis has developed building blocks that address many key limitations evident within previous intergroup anxiety research, as well as targeting particular aspects of the anxiety process that were to date untapped. Hence, it is likely that certain aspects of this thesis will map directly onto real-world intergroup contact experiences, whilst others may not. These differences are likely to be evident due to the artificial nature of laboratory testing environments, which would suggest that certain aspects of real-world intergroup contact are not fully captured by these methods. However, these controlled conditions were essential to isolate and explore both basic processes (e.g., episodic and chronic anxiety) and peripheral factors such as mediators and moderators of the basic processes (e.g., contingency awareness, model believability etc.) during aversive intergroup contact. Future research could attempt to investigate similar processes in face-to-face contact experiences.

Despite the obvious implications of this thesis for theory and practice, as discussed above, this series of studies has (necessarily) been conducted with a focused or limited view of the aversive effects following episodic experiences. In practical terms, there are consequences or effects that eventuate from negative intergroup contact above and beyond anxiety. For example, Mazziotta, Rohmann, Wright, Tezanos-Pinto and Lutterbach (2015) demonstrated that negative vicarious contact, operationalized in their work as knowing that other ingroup members have had negative intergroup contact, predicts negative attitudes towards the outgroup. Furthermore, in a master's thesis by Bitacola (2013), vicarious contact, which was operationalized as observing intergroup contact, was found to affect the behavioral intentions of low-status group members, an effect that was found to be mediated by affect towards the outgroup. The researchers found that negative vicarious contact resulted in more anger towards the outgroup, which reduced the willingness for ingroup members to engage in collective action to address the inequalities between the groups. Hence, there are consequences stemming from negative vicarious intergroup contact beyond anxiety, which have a negative effect on intergroup relations.

More broadly, and from a theoretical perspective, Stephan (2014) recently proposed a model that extended on an earlier model of intergroup anxiety (Stephan & Stephan, 1985), and a more recent integrated threat model (Stephan & Stephan, 2000), by specifying categories of antecedents and consequences of intergroup anxiety. The recent model by Stephan (2014) proposes that antecedents, including personality traits, attitudes, personal experiences, and situational factors, all influence intergroup anxiety. Within the model, intergroup anxiety can take the form of affective, cognitive or physiological responses. This anxiety then informs what is termed 'consequences' of intergroup anxiety, including cognitive, affective, and behavioral outcomes. Stephan's (2014) model provides a comprehensive theoretical view on intergroup anxiety, and appreciates the complex array of antecedents of, and consequences following intergroup anxiety. When assessing the contribution of this thesis, it should be noted that only some aspects of Stephan's (2014) comprehensive model were investigated and addressed. For example, this thesis has focused on physiological intergroup anxiety, and has incorporated the antecedents of personal experiences (e.g., through prior outgroup quality, and chronic anxiety) and situational factors (e.g., through the influence of the various characteristics of the model). Hence, whilst this thesis has attempted to draw conclusions and focus on intergroup anxiety, Stephan's (2014) model should demonstrate an appreciation that the intergroup anxiety literature is much broader than the scope of this thesis. Future research should continue to test aspects of Stephan's (2014) model to continue to develop a more sophisticated knowledge of intergroup anxiety, with the aim of working towards more efficacious intervention strategies.

Final Summary

Throughout this thesis, intergroup contact has been presented as an opportunity afforded to individuals in which they are able to learn about the outgroup. During intergroup contact, individuals acquire new knowledge about the outgroup, meaning that affective, emotional, evaluative, and behavioral responses towards them may change. From this theoretical perspective, five organizing principles and a learning model of anxiety were proposed. Four empirical studies were then conducted to assess various aspects of the proposed organizing principles and the learning model of anxiety.

The four empirical studies within this thesis provided a methodological advancement on previous studies investigating the acquisition and generalization of intergroup anxiety. Specifically, the methodology adopted an experimental (vs. correlational) design, which collected a physiological measure of anxiety (vs. self-reported or subjective measures). Hence, the studies assessed a more objective and less controllable anxiety measure compared to past intergroup contact-anxiety research.

Altogether, the four empirical studies presented within this thesis provided support for the five organizing principles and the proposed learning model of intergroup anxiety. It has been shown that contact experiences are discrete, since individuals displayed increases in their anxiety towards unsafe outgroup members. The thesis also demonstrates that episodic experiences affect chronic group responses, since generalization occurred from single outgroup members to other outgroup members. Moreover, the thesis has shown that chronic responses in turn shape episodic responses, since the immediate effects of episodic contact are reduced by positive (or exacerbated by negative) group-level perceptions or history. Thus, the data presented within this thesis illustrate the complex and dynamic interplay between episodic and chronic contact-anxiety links and isolates basic social psychological processes that are relevant to intergroup relations.

Moreover, although direct and vicarious learning results in a comparable magnitude of anxiety learning, this thesis' data show that there are order effects. Hence, interventions need to be aware of these order effects and their differential impact on episodic and chronic anxiety. Key mediators were also confirmed and/or identified within the learning model of anxiety, showing that learning is not a simple contact-anxiety process. The importance of intergroup anxiety has been shown by previous research to be a key determinant of avoidance of intergroup contact. Hence, intergroup anxiety is a key contributing factor for society missing out on the benefits of intergroup contact for intergroup relations. Therefore, understanding intergroup contact-anxiety links contributes to understanding of intergroup relations and can inform remedial interventions.

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Appendix A: Publications Arising from This Thesis

Paolini, S., Harris, N., & Griffin (2015). Learning anxiety in interactions with the outgroup: Towards a learning model of anxiety and stress in intergroup contact. *Group Processes & Intergroup Relations*. Doi: 10.1177/1368430215572265

Learning Anxiety in Interactions with the Outgroup:

Towards a Learning Model of Anxiety and Stress in Intergroup Contact

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Abstract

While '*knowledge learning*' about the outgroup has been regarded as one of the key mechanisms for the contact-prejudice relation since the contact hypothesis' first inception (Pettigrew & Tropp, 2008), '*learning*', more broadly, has rarely been used as an explanatory framework to investigate the consequences of intergroup contact. In this article, we lay the foundation of a learning model of anxiety and stress in ingroup/outgroup interactions. We distinguish between episodic and chronic anxiety responses to the outgroup and recommend investigations on the complexities of their dynamic interplay, as individuals accumulate and dynamically integrate their experiences with the outgroup over time. Through a review of established and emerging psychophysiological and behavioral research of anxiety during ingroup/outgroup interactions, we identify evidence consistent with this dynamic outlook of intergroup contact effects. In this context, we also advance novel and untested predictions for future investigations onto the temporal integration of contact effects during an individual's lifespan.

Key words: intergroup contact, intergroup anxiety, learning, generalization, psycho-physiology

Despite the well-established idea that intergroup contact improves intergroup relations because it increases knowledge about the outgroup (Allport, 1954), social psychological research using learning as an explanatory framework to investigate the consequences of intergroup contact is scant (Eller & Paolini, 2011). This may be because this tradition narrowly defines 'learning' as 'knowledge learning' or learning about outgroup characteristics and cognitions (see e.g., Pettigrew & Tropp, 2008). We redress this by re-defining intergroup contact, more broadly, as *the process by which we learn about the outgroup.* From this broader stance, during intergroup contact, we do not simply acquire new knowledge about the outgroup and its members, we also learn about modal affective responses, emotions, and evaluations typically associated with the outgroup (see also Stephan, 2014). For instance, intergroup contact offers the opportunity to learn to be anxious towards, and around the outgroup, and the opportunity to revise those anxieties—we call this process of revising affective responses to the outgroup in light of new outgroup experiences, *anxiety learning*.

In this article, we review old and new research on intergroup anxiety in ingroup/outgroup interactions using a new learning model of intergroup anxiety and stress. We first define intergroup anxiety and discuss its central role within the intergroup contact literature; we revisit Blascovich and colleagues' influential study (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001) identifying two key components of the model. The following section then outlines the model's organizing principles and describes its key features and properties. We then discuss a new generation of research, which measures psychophysiological and behavioral manifestations of intergroup anxiety and stress to assess changes in anxiety over time (i.e., 'anxiety learning') during contact. We argue that these emerging time-sensitive methodologies are powerful tools for testing the predictions generated by the anxiety learning model. We also offer an overview of new data from our own research laboratory, bridging methods from the learning and conditioning research tradition and contemporary investigations of intergroup phenomena.

We aim to demonstrate that the appeal of contemporary research on intergroup anxiety rests in its ability to test new and complex segments of a time-bound process of intergroup anxiety learning, whereby episodic and chronic process variables interact over time in a complex and non-linear fashion.

Using the learning model, we identify some novel and untested predictions about how episodic and chronic process variables may interact, which we hope will guide future research.

Intergroup Anxiety Shapes Intergroup Relations, and Determines Whether Individuals Will Engage and Benefit from Intergroup Contact

Recent interest in intergroup anxiety reflects a broader cultural zeitgeist and a growing attention to how affect and emotions shape intergroup processes more generally (Esses & Dovidio, 2002; Mackie, Devos, & Smith, 2000), and ingroup/outgroup interactions or 'intergroup contact' more specifically (Devine, Evett, & Vasquez-Suson, 1996; Greenland & Brown, 1999).

Intergroup anxiety has acquired a central role in the intergroup contact literature. At the broadest level, intergroup anxiety stems from negative expectations about ingroup/outgroup interactions and emerges when outgroup members are seen or expected to pose a threat to the ingroup or individual ingroup members' goals, motives, or sensitivities (Cottrell & Neuberg, 2005; Plant & Devine, 2003; Smith, 1993; Stephan, 2014; Stephan & Stephan, 2000). Empirical investigations, however, focus on a range of specific negative expectations (e.g., threats to physical integrity, Mallan, Sax, & Lipp, 2009; threats of rejection, Mendoza-Denton, Pietrzak, & Downey, 2008; threats of uncertainty, Plant & Devine, 2003). To complicate matters, several of these alternative sources of anxiety can co-exist at any given time and contribute to anxiety's net impact on the individual and group (Blascovich, Mendes, Hunter, & Lickel, 2000; Greenland, Xenias, & Maio, 2012).

There is growing evidence for the detrimental effects of intergroup anxiety. Intergroup anxiety is associated with increased concerns for the self (Vorauer & Kumhyr, 2001), negative emotions (Crandall & Eshleman, 2003), simplified information processing and reduced attention to disconfirming information (Wilder & Shapiro, 1989), increased dominant responses (Islam & Hewstone, 1993), and decreased task performance (Blascovich et al., 2001, Mendes, Blascovich, Hunter, Lickel, & Jost, 2007a). Recent experimental research has started to isolate acute and chronic adverse consequences of intergroup anxiety on health (Mendes, Gray, Mendoza-Denton, Major, & Epel, 2007b; Trawalter, Adam, Chase-Lansdale, & Richeson, 2012).

The consequences of intergroup anxiety for the groups involved in contact are also well documented. High intergroup anxiety is typically associated with negative intergroup judgments, including prejudice (Bizman & Yinon, 2001), low perceived variability (Islam & Hewstone, 1993), overt hostility (Plant & Devine, 2003), and unwillingness to engage in future outgroup contact (i.e., informal group segregation; Greenland, Masser, & Prentice, 2001). Conversely, *reduced* intergroup anxiety explains why intergroup contact typically *improves* intergroup judgments. For instance, investigations of first and second-hand experiences of cross-community friendship in sectarian Northern Ireland predicted reduced outgroup prejudice and heterogeneous outgroup perceptions, an effect mediated by sizeable reductions in intergroup anxiety (Paolini, Hewstone, Cairns, & Voci, 2004a).

In 2006, we identified only ten studies documenting the mediational role of intergroup anxiety for the contact-prejudice link (Paolini, Hewstone, Voci, Harwood, & Cairns, 2006; see also Turner, Hewstone, Voci, Paolini, & Christ, 2007). This number has grown considerably since and now includes longitudinal mediational data (e.g., Binder et al., 2009; Swart, Hewstone, Christ, & Voci, 2011). Recent research has also led to the appreciation of the generality of these effects: Similar mediational findings have been found for extended (e.g., Turner et al., 2007), vicarious (Mazziotta, Mummendey, & Wright, 2011), and imagined contact (West, Holmes, & Hewstone, 2011). Hence, it is now generally recognized that virtually *any* positive outgroup interaction—whether face-to-face, imagined, or via conversations with ingroup members—can improve intergroup relations by reducing the anxiety individuals feel or anticipate feeling in the presence of the outgroup.

Pettigrew and Tropp (2008) recently meta-analyzed studies testing for mediators of the contact-prejudice link to compare the mediational role of decreased anxiety, increased outgroup knowledge, and increased outgroup empathy after contact. While all three mechanisms demonstrated a significant mediational effect and contributed to explaining the contact-prejudice link, intergroup anxiety was found to be the most robust mediator (however, cf. Swart et al., 2011). Thus, among various psychological underpinnings of intergroup contact effects, reduced intergroup anxiety is prominent and thus a legitimate target for social interventions aimed at improving intergroup relations.

More recently, intergroup contact scholars have recognized that intergroup anxiety should be lessened not only to reduce its *direct* negative consequences on intergroup judgments (e.g., prejudice, stereotyping, etc.), but also to contain its *indirect* negative effects on one's willingness to engage in further outgroup contact. Experimental and longitudinal evidence now complements established correlational evidence of an anxiety-contact avoidance link (see Greenland et al., 2012; Henderson-King & Nisbett, 1996; Levin, Van Laar, & Sidanius, 2003; Page-Gould, 2012; Page-Gould, Mendoza-Denton & Tropp, 2008; Plant & Butz, 2006; cf. correlational evidence in Paolini et al.'s, 2006 Table 11.1) and demonstrates that intergroup anxiety typically *causes* people to avoid intergroup interactions. Based on functional analyses of emotions, anxiety and other negative affective states signal threats to the safety and integrity of the organism, and as such, they trigger physiological and behavioral responses, the main function of which is to limit further damage and threat. Hence, one of the most common outcomes of these processes is the avoidance of potentially dangerous or threatening stimuli—in intergroup settings, the avoidance of contact with outgroup members.

Yet, approach motivators – including individuals' promotion focus, extroversion, motivation to self-expand, egalitarian worldviews etc. – have the potential to significantly attenuate and possibly even revert these adverse effects of intergroup anxiety (Mendes et al., 2007b; Page-Gould, 2012; Wright, Aron, & Tropp, 2002) by encouraging the individual to actively address and approach (vs. avoid) *subjectively positive* intergroup stressors and harness the associated heightened physiological activation towards increased task engagement, improved performance, and salutary health responses (for initial evidence, see Epel, McEwen, & Ickovics, 1998; Mendes et al., 2007b; Page-Gould, 2012; Page-Gould et al., 2008; Page-Gould, Mendes, & Major, 2010). Hence, among some individuals and under certain conditions, intergroup contact with acute task demands can lead to beneficial changes in physiology and behavior both in the short term (e.g., preparatory and challenge responses; Mendes et al., 2007b) and long term (e.g., chronic salutary health responses; Page-Gould et al., 2010; Trawalter et al., 2012). Therefore, while contact avoidance following intergroup anxiety may be widespread and a default response for most people, physiological reactivity and anxiety are not always harmful for the individual, the intergroup interaction and, by extension, intergroup relations.

To ensure that intergroup harmony can be achieved and maintained through peaceful intergroup interactions, and individuals' wellbeing during ingroup/outgroup interaction protected, efforts should focus on increasing knowledge of intergroup anxiety. This requires an improved understanding of how intergroup anxiety *develops* in the first place and *changes over time* (aka. anxiety learning), as individuals integrate a range of experiences with the outgroup over their lifespan.

To this aim, we revisit research by Blascovich and colleagues (2001) next, and show how their results integrate findings from two traditionally independent strands of research on intergroup contact and anxiety, and capture two distinct effects of intergroup contact on anxiety, each with their own unique time course. These two effects will become key building blocks of our learning model of intergroup anxiety.

Intergroup Anxiety is Exacerbated in the Present and Reduced in the Long Run: Recognizing Distinct Contact-Anxiety Links

In 2001, Blascovich, Mendes, and colleagues (Blascovich et al., 2001) published very influential research. In this work, non-stigmatized individuals (i.e., healthy White American college students) were asked to become familiar, and interact with, an unknown individual who was either a stigmatized individual (e.g., an individual with a facial birthmark, Black ethnicity, low SES status; intergroup condition) or an unfamiliar non-stigmatized individual (i.e., a White/control individual; intragroup condition). After a short face-to-face interaction with their contact partner, participants were asked to deliver a short (anxiety-provoking) video-recorded speech, which they expected to be later reviewed by their contact partner. While delivering their speech, all participants were attached to physiological equipment that recorded changes in cardiac and hemodynamic (blood flow) output.

Across three experiments, intergroup contact participants displayed signs of heightened anxiety, whereas intragroup contact participants did not. Participants paired with a stigmatized partner exhibited cardiovascular reactivity indicative of a threat response, typical of a situation where people expect task demands to outweigh their task resources (Blascovich & Tomaka, 1996), and which usually results in contact avoidance. In contrast, intragroup contact participants exhibited reactivity indicative of a challenge response, signaling that they evaluated their personal resources to be sufficient, or in excess of task demands, a response typically associated with approach behavior. Moreover, the intergroup (vs. intragroup) participants showed poorer performance during a cooperative task (i.e., fewer words found in a word-finding task).

These systematic differences in psychophysiological and behavioral anxiety between the intergroup and intragroup contact participants reflect the *acute* anxiety-*provoking* effects that *discrete* experiences of intergroup contact can exert *in the present* – at least when individuals are engaged in motivated performance tasks like those extensively used in experimental tests of the contact-anxiety link. Hence, as the individual is pressed by a difficult task and/or social evaluation, *intergroup* exchanges typically cause *higher* levels of anxiety than intragroup exchanges.

While Blascovich and colleagues' 2001 article epitomizes a new generation of experimental research on intergroup contact and anxiety, their basic intergroup vs. intragroup effect is not entirely new. Similar evidence was isolated in earlier studies and has been replicated several times since. Table 1 summarizes intergroup contact work on physiological and/or behavioral anxiety, which has used a intergroup vs. intragroup contact experimental design, with most studies focusing on ethnicity as the intergroup dimension (however, cf. Townsend, Major, Gangi, & Mendes, 2011).[1].

--INSERT TABLE 1 HERE--

Table 1 classifies studies by operationalizing intergroup anxiety in four distinguishable ways. First, studies were classified along the tripartite operational definition of anxiety and threat responses (Blascovich et al., 2001; Mendes, Blascovich, Lickel, & Hunter, 2002). Drawing from multifaceted models of generic anxiety and emotions (Lang, 1985; Zajonc, 1998), these scholars discriminate between: (1) *physiological* markers (i.e., autonomic system responses, like sweating and increased heart rate), (2) *behavioral* markers (e.g., non-verbal cues, depleted performance, and contact avoidance), and (3) *subjective* markers (i.e., self-reported responses). Second, each anxiety measure was classified as an individual-level (individual-specific) or group-level (broadly representative of the entire outgroup) measure. Third, the appraisal source of the anxiety measures was classified using Greenland et al.'s (2012) distinction between *outgroup-focused* anxiety (i.e., anxiety resulting from perceived outgroup's threats) and *self-focused* anxiety (i.e., anxiety resulting from concerns over self and ingroup standards). Finally, measures were coded for whether they were continuous or discrete.

Irrespective of how anxiety is operationalized, the extant experimental work reveals convergent evidence for reliable differences in anxiety between intergroup and intragroup contact conditions. Critically, these differences are *always* in the direction of high*er* anxiety in the intergroup (vs. intragroup) contact condition (however, see Mendes & Koslov, 2012). Hence, it is evident that in the vast majority of experimental tests, discrete interactions with outgroup members cause an increase in anxiety levels—i.e., a positive and excitatory link between intergroup contact and anxiety.

Since anxiety is an aversive emotion, it typically has a negative impact on health and performance, acts as an avoidance motive for intergroup contact, and has detrimental effects on intergroup judgments. In other words, the outcome of discrete experiences of intergroup contact—*at least in the short term*—is detrimental for both the individuals immediately involved and the intergroup relations in which these individuals are embedded.

Curiously, while the immediate, often adverse effects of intergroup anxiety on health and performance have begun to be acknowledged in the literature (e.g., Mendes et al., 2007b; Trawalter et al., 2012; see earlier section), this is not so for the short-term detrimental effects of intergroup contact on intergroup judgments, group-level variables, and intergroup relations more broadly. Thus, despite the straightforward bleak *implications* of intergroup-intragroup differences in anxiety for intergroup relations, most current experimental tests of the contact-anxiety link have not tested these implications directly. Of 60 studies identified (Table 1), only seven (11.67%) included group-level variables—like measures of outgroup prejudice, outgroup stereotyping, outgroup trust etc.—as outcome variables.[2] Hence, these studies do not help in ascertaining whether laboratory intergroup interactions, besides heightening the contact partners' anxiety, also increase prejudice, stereotyping, and discrimination towards the entire outgroup and, thus, adversely impact the quality of intergroup relations more broadly.

The lack of experimental tests on group-level measures limits researchers' awareness that intergroup contact may have sharply different short-term vs. long-term effects and that any dissociations over time need to be investigated empirically and explained theoretically. As a result, this gap slows the development of a model that makes integrated predictions for both individual-level and group-level effects of intergroup contact over time and their possible interactions.

Intergroup contact does not necessarily result in high intergroup anxiety, however: Blascovich et al. (2001) captured distinct short vs. long-term effects of intergroup contact on intergroup anxiety. In a third experiment, White/control individuals (i.e., non-stigmatized) interacted with a Black (intergroup) or White (intragroup) contact partner. The *overall amount* of close intergroup contact participants reported having had with Black people in general *prior to* coming to the laboratory moderated their physiological responses. Specifically, prior contact did not moderate physiological responses for intragroup contact participants, whereas threat responses among the intergroup contact participants were higher among those who reported having had *limited* prior contact with the outgroup; they were significantly weaker (and non-significant on some indicators) among those who had had *more* prior close contact. These moderation findings map closely onto extensive cross-sectional correlational research on anxiety and contact (see research listed in Table 11.1 of Paolini et al., 2006). In mainstream, traditional correlational research, participants' prior *histories* (vs. discrete experiences) of contact with the outgroup typically ensue beneficial and *not* detrimental effects on intergroup anxiety (e.g., Paolini et al., 2004a; Paolini, Hewstone & Cairns, 2007; Pettigrew & Tropp, 2008). Hence, this research tradition returns an extensive body of evidence for a negative and inhibitory link between intergroup contact and anxiety.

Blascovich et al.'s (2001) approach was ground-breaking since it isolated in a single design immediate and acute anxiety-inducing effect of discrete contact experiences and the potentially slower anxiety-reducing effects of accumulated prior intergroup contact. That is, by randomly allocating participants to an intergroup-intragroup between-group design, and then showing that accumulated contact protected participants against acute or episodic anxiety experienced during a discrete contact experience, Blascovich and colleagues demonstrated that the immediate anxiety-provoking effects of discrete intergroup contact, once integrated over time through repeated and accumulated contact, produce a long-term beneficial anxiety-reducing effect.

This temporal integration between short-term and long-term effects of intergroup contact on anxiety is displayed in Figure 1. The diagram illustrates Blascovich et al.'s (2001) moderating effect of prior, accumulated contact as two group means along the episodic anxiety y-axis, for 'Low contact' and 'High contact', in the bottom panel. The diagram shows that this effect is the same beneficial effect of intergroup contact as captured in abundant past correlational research, and as displayed by the inclined slope for the relationship between intergroup contact and chronic anxiety in the diagram's top panel. Also, while correlational studies typically do *not* include an intragroup/control condition, we used a dashed line in the diagram's top panel to indicate a hypothetical correlational data set showing no relationship (or a zero-slope) between *inter*-group contact and *intra*-group anxiety. Thus, the graph identifies two equivalent inter/intra-group differences in anxiety (the 'D' in each of the top and bottom panels) in the two research traditions[3] and unveils similarities between the findings of different research traditions otherwise masked by systematic differences in research designs.

--INSERT FIGURE 1 HERE--

From this vantage point, the two *prima facie* contradictory contact-anxiety effects detected by Blascovich et al. (2001) and by distinct research traditions are no longer at odds with each other; rather they fit together nicely in a temporally integrated outlook of intergroup contact experiences over time. However, we recognize that these distinct contact-anxiety effects can also be explained by invoking factors and processes other than temporal integration.[4]

Among the many factors that differentiate the methods in the experimental vs. correlational research traditions (Paolini et al., 2006), three stand out as suitable -- alternative but complementary -- explanations of distinct contact-anxiety effects: (i) contact valence, (ii) the on-line/memory-basis of the interaction, and (iii) individuals' motivational goals. In vivo interactions between the contact partners in most experimental tests are skewed towards negativity: These interactions are objectively more negative, than positive, since the participants' primary task is to complete difficult cognitive-behavioral tasks under expected or actual social evaluation rather than enjoying the contact partner's company (see Blascovich & Mendes, 2010; Dickerson & Kemeny, 2004 for methodological foundations); this negativity bias may be further amplified by attentional and encoding biases towards negative (vs. positive) aspects of the interaction and contact partner during on-line processing (Baumeister et al., 2001).

In contrast, correlational studies are biased towards sampling more positive interactions (Graf, Paolini, & Rubin, 2014; Paolini, Harwood, & Rubin, 2010; Pettigrew, 2008), where researchers typically probe retrospective self-reports of past interactions with outgroup members, as they took place in the field or in structured prejudice-reduction settings (Pettigrew & Tropp, 2006). Thus, they recruit a more variable and positive range of motivational states and valences (Graf et al., 2014; Paolini et al., 2010); this potential positivity bias may be further amplified by retrieval processes that favor positive (vs. negative) contact experiences (Graf et al., 2014; Unkelbach, Fiedler, Bayer, Stegmuller, & Danner, 2008). Hence, experimental studies return positive contact-anxiety effects because they disproportionately focus on on-line negative contact experiences; correlational studies return negative contact-anxiety effects because they focus on retrieved positive contact experiences.

From our theoretical perspective, however, these positive and negative contact-anxiety links are more than the mere byproduct of differences in negative and positive contact: They are the constituent building blocks of a novel model of anxiety learning in intergroup contact that temporally integrates contact effects on anxiety over the individual's lifespan.

In the next section, we first outline a broad learning meta-theoretical framework to intergroup contact effects, against which we then anchor our learning model of anxiety. We call the former 'meta-theory' and the latter 'model' purposely, to stress marked differences in breadth and supporting evidence: The former is a broad, overarching, testable, but yet untested, theory; the latter is more narrow, more precise in its predictions, and already enjoys supporting evidence.

A Learning Outlook to Intergroup Contact Effects

To discuss intergroup contact in a temporally integrated framework, we conceptualize intergroup contact as the process by which we learn about the outgroup. During intergroup contact, we acquire new knowledge about the outgroup and its members, and we learn about modal affective responses, emotions, and evaluations typically associated with the outgroup. As a consequence, our responses towards the outgroup may change, for better or worse, over time – through a learning process. With relation to anxiety, intergroup contact offers the opportunity to learn to be anxious towards the outgroup, but also to revise those anxieties. It is these changes in outgroup anxiety over time that we operationally define as 'anxiety learning'.

Organizing Principles of Inductive and Deductive Learning

Five organizing principles can be used to describe the time course of affective, evaluative, and cognitive processes during ingroup/outgroup interactions: (1) contact experiences are discrete learning experiences with individual outgroup members and about specific ingroup/outgroup interactions, which inform about the cognitions, affect, emotions and evaluations associated with specific outgroup members and ingroup/outgroup interactions, and result in what we call *episodic* or *individual-level* responses; (2) episodic/individual-level cognitions, affect, emotions, and evaluations form the basis of relatively context-free and time-free cognitive, affective, emotional, and evaluative responses towards, and expectations about, the outgroup *as a whole* and ingroup/outgroup interactions *in general*—what we call *chronic*, or *group-level responses*; (3) chronic/group-level responses shape, in turn, episodic/individual-level responses; that is, expectations about the outgroup as a whole and ingroup/outgroup interactions in general, affect responses to specific outgroup members and ingroup/outgroup interactions; (4) this feedback effect linking episodic/individual-level responses to chronic/group-level responses [*inductive learning* or individual-to-group generalization], and feed-forward effect linking chronic/group level responses to episodic/individual-level responses [*deductive learning* or group-to-individual generalization], form a dynamic loop that is repeated continually as experience with the outgroup accumulates throughout one's lifetime; (5) both episodic/individual-level and chronic/group-level responses to the outgroup change over the lifespan through reciprocal interaction, and the accumulation of repeated and diverse episodic contact experiences, reflecting individuals' unique histories and intergroup contexts' unique ecologies.

We first introduced the distinction between episodic/individual-level and chronic/group-level responses in an earlier paper (Paolini et al., 2006; see also Page-Gould et al., 2008; Paolini, 2008). Here, we extend it further to encompass affect, emotions, cognitions, and evaluations. Consequently, we use the labels *episodic* and *individual-level* variables interchangeably to refer to state and context specific variables tapping onto affective, emotive, cognitive, evaluative responses to *specific* outgroup members in *specific* ingroup/outgroup interactions (e.g., episodic intergroup anxiety coded as 'I' in Table 1). We use the labels *'chronic'* and 'group-level' variables to refer to more enduring, trait-like and relatively context-free variables, tapping onto affective, emotive, cognitive, evaluative responses to the outgroup as a whole and their members more generally and measured *without* reference to a specific intergroup encounter (e.g., chronic intergroup anxiety coded as 'G' in Table 1).

Principles (2) and (3) posit explicit links between episodic/individual-level responses and chronic/group-level responses. We suggest that these links are underpinned by two distinct forms of generalization relevant to intergroup contact experiences, namely inductive and deductive learning. In social psychology, inductive learning is often called individual-to-group (Brown & Hewstone, 2005) or member-to-group generalization (Paolini, Hewstone, Rubin, & Pay, 2004b; Stark, Flache, & Veenstra, 2013). Generalization of cognitions are typically the domain of stereotype change researchers (e.g., McIntyre, Paolini, & Hewstone, 2015; Paolini et al., 2004b). Intergroup contact researchers have traditionally focused on generalization of evaluations and global affect (for a discussion, Pettigrew & Tropp, 2011; Stark et al., 2013), but recently started to consider generalization of specific emotions (e.g., empathy, anxiety; Paolini et al, 2006; Paolini et al., 2010; Stephan, 2014). Similarly, we call deductive learning, going from chronic/group-level responses to episodic/individual-level responses, group-to-member or group-to-individual generalizations (Wilder & Shapiro, 1991), which also potentially take place at the level of evaluations, specific emotions, cognitions and affect.

A Model of Anxiety Learning in Interactions with the Outgroup

When applied to intergroup anxiety, the five organizing principles described above take the shape of the model depicted in Figure 2. Central to our time-integrated model of anxiety learning, Figure 2 illustrates the temporal integration of chronic and episodic anxiety including the inductive feed-back and the deductive feed-forward links. Figure 2 also illustrates how episodic anxiety is generated by a specific, discrete experience of contact ('episodic contact') with outgroup members. In contrast, chronic anxiety takes its source in individuals' cumulative past history of contact with the outgroup (or simply, cumulative contact or 'CC' in figure).

--INSERT FIGURE 2 HERE--

Critically, we do not simply argue that episodic/individual-level processes and chronic/group-level processes should both be taken into consideration and measured. Rather, this anxiety learning model explains how episodic/individual-level processes and chronic/group-level processes *interact* to determine individuals' net anxiety responses: It guides us in advancing specific predictions for these interactions, identifying emerging evidence relevant to testing these predictions, and understanding where further research is needed. Figure 2 illustrates some of this emerging complexity (see next section). For example, it shows how chronic anxiety and outgroup prejudice moderate inductive and deductive learning links, respectively.

There are several key differences between our anxiety learning model and Blascovich and Tomaka's (1996) biopsychosocial model (BPSM) of challenge and threat. Firstly, the BPSM focuses most heavily on acute/episodic anxiety responses (i.e., episodic contact-anxiety links), whereas our learning model incorporates the impact that cumulative experiences of contact with the outgroup possibly exert on chronic and episodic anxiety responses (i.e., cumulative contact-anxiety links). Hence, even though the BPSM can be made to incorporate the effects of chronic anxiety responses by considering cumulative intergroup contact experiences as one of the resources individuals bring to episodic encounters, the BPSM's analysis of task demands is heavily weighted (but not exclusively generated) by episodic (i.e., task-specific) resources.

In contrast, our learning model of intergroup anxiety advocates more explicitly the dynamic interaction between, and delves more deeply into, episodic *and* chronic experiences interacting over time. As such, it frames the acute anxiety responses of the BPSM in a more complex manner, which includes both acute *and* chronic anxiety and their interaction over time. Consequently, our model is unique in explicitly addressing processes of generalization, linking episodic anxiety responses to more chronic, generalized anxiety responses, and in highlighting potential mechanisms and moderators of these processes. Thus, our model brings to the forefront the mutual dynamic interplay of both acute and chronic anxiety responses over time.

This temporally dynamic outlook to intergroup anxiety raises potential complexities and dissociations that are difficult to conceive from more static outlooks of intergroup anxiety and contact. The next section clarifies how our learning model of anxiety is consistent with emerging psychophysiological and behavioral evidence for the contact-anxiety link.

The Interplay Between Episodic and Chronic Intergroup Anxiety: Emerging Evidence and Directions for Future Research

Traditional research on anxiety in intergroup contact has failed to appreciate the complex and time-dependent interplay between episodic and chronic anxiety as individuals' experiences with outgroups accumulate over the lifespan (Paolini, 2008; Paolini et al., 2006). However, since Blascovich and colleagues' (2001) ground-breaking work, time-bound analyses of intergroup anxiety and stress have started to thrive. Advancements in unobtrusive, on-line, psycho-physiological measurements of anxiety have revolutionized our understanding of episodic anxiety—including galvanic skin responses, heart reactivity, cortisol release, etc. (see Guglielmi, 1999). Moreover, a growing use of time-sensitive research paradigms—including conditioning paradigms, cortisol release monitoring, and diary methods—make it possible to explore the processes that bridge episodic and chronic anxiety and their dynamic interplay.

In this section, we dissect these emerging research outcomes using our model of anxiety learning. We start by discussing the limited research on anxiety learning (i.e., Figure 2's link from 'episodic contact' to 'episodic anxiety', and the contingency-bound learning loop) and inductive anxiety learning (i.e., Figure 2's link from 'episodic anxiety to 'chronic anxiety'), and then move onto more extensive work on deductive anxiety learning (i.e., Figure 2's link from 'chronic anxiety to 'episodic anxiety') and its key moderators (see diamonds on that link). Throughout, we advance untested predictions and provide ideas for new research.

Initial Evidence for Intergroup Anxiety Learning

The strong emphasis on remedial intergroup interventions in social psychology has to date unduly constrained the scope of intergroup contact research to investigations on intergroup anxiety *reductions* (e.g. Paolini et al., 2004a, 2007; Turner et al., 2007). For a fuller understanding of the dynamic interplay between episodic and chronic anxiety, we cannot avoid investigating the conditions under which anxiety both *increases,* and *decreases*.

Olsson and colleagues (Olsson, Ebert, Banaji, & Phelps, 2005) have recently broken with the tradition of studying anxiety reductions. They used an aversive conditioning procedure to examine the stimulus-specific acquisition and extinction of intergroup anxiety ('contingency-bound learning' in Figure 2)[5]. They presented White and Black participants with two White and two Black faces and repeatedly paired one of each with a mild electric shock, and another of each with no shock.

Following aversive conditioning, participants underwent extinction: faces were presented repeatedly without any shocks. Results revealed that participants acquired anxiety responses towards the ingroup and outgroup faces paired with shock relative to the faces not paired with shock; however, learnt anxiety responses towards the outgroup (vs. ingroup) extinguished more slowly. Olsson et al. (2005) interpreted their findings within an evolutionary framework of learning preparedness, whereby outgroups constitute evolutionarily fear-relevant stimuli that are more strongly associated with fear, like spiders and snakes (Ohman & Mineka, 2001). From a learning outlook, these findings demonstrate that Pavlovian conditioning contributes to the first-hand learning of outgroup anxiety and suggest that outgroups are slower to be *dis*-associated from anxiety.

Our research extends Olsson et al.'s (2005) analysis to conditions in which we learn to become anxious of outgroups *second-hand* by observing others (Harris, Griffin, & Paolini, 2015a; Harris, Paolini, & Griffin, 2015b). Like Olsson et al., White Australian participants learnt to respond anxiously to the outgroup by experiencing pairings of a Black face and a mild electrical stimulation (i.e., 'first-hand' contingency-bound learning). In a second experimental condition, participants instead watched a video of a White individual receiving face-shock pairings and appearing uncomfortable when one Black face was presented, and relaxed when another Black face appeared (i.e., 'second-hand' contingency-bound learning). We found that skin conductance responses displayed similar levels of anxiety acquisition for both learning conditions.

This behavioral evidence for direct and observational learning of anxiety in the intergroup domain (Harris et al., 2015a) contributes to recent neurophysiological and imaging data suggesting an overlap in the neural circuits in direct and vicarious fear learning (Olsson, Nearing & Phelps, 2007). This evidence suggests that people not only learn to feel comfortable and respond positively to outgroups by directly witnessing positive ingroup/outgroup interactions (Mazziotta et al., 2011; Paolini et al., 2004a, 2007; Turner et al., 2007; Wright, Aron, McLaughlin-Volpe, & Ropp, 1997). The same mechanisms of observational and vicarious learning are also involved when experiencing negative intergroup interactions (Weisbuch, Pauker, & Ambady, 2009), thus, helping explain how people become anxious and learn to respond negatively to outgroups in the first place.

Initial Evidence for Inductive Anxiety Learning

Our research on observational learning of outgroup anxiety has also contributed to understanding the processes that underpin inductive anxiety learning or individual-to-group generalization (Harris et al., 2015b)—the link going from ‘episodic anxiety’ to ‘chronic anxiety’ in Figure 2. We explored how episodic anxiety generalizes from outgroup members directly involved in the aversive contact experience (e.g., paired with the shock) to outgroup members not directly involved. For this, we used a face morphing software and generated progressively less outgroup-like variations of our target faces, as well as new faces of comparable “Black-ness”. We found that episodic anxiety generalized along a similarity-dissimilarity gradient: Intergroup anxiety generalized to Black faces that were configurally most similar (vs. dissimilar) to the target Black faces.

Importantly, social and intergroup dimensions of the observational learning experience played a key role in the amplitude of these generalization effects. The generalization effects were more pronounced among individuals from an ethnic minority (Asian Australians vs. White Australians) and when learning to become anxious from a majority model (White vs. Asian model). Moreover, perceived model believability and self-model similarity mediated these effects, confirming the need to embed any test of *intergroup* anxiety learning into the social and intergroup context in which these phenomena take place.

A sophisticated understanding of the processes conducive to generalization is essential to managing intergroup relations; psycho-physiological and behavioral research is scant in this area and more work is needed. Because of individual-to-group and group-to-individual generalization (i.e., inductive and deductive learning), discrete negative and positive experiences with the outgroup have far-reaching consequences on future intergroup interactions and on intergroup relations. Similarly, because of these generalization processes, positive intergroup contact is a legitimate intervention tool to improve intergroup experiences, responses of individuals and entire groups (Brown & Hewstone, 2005; Pettigrew & Tropp, 2006, 2011). Without generalizations, interventions fostering positive intergroup contact are limited to specific contact experiences with specific outgroup members and any improvements in response to whole outgroups cannot reverberate back to other individual outgroup members and future ingroup/outgroup interactions. Hence, we call for more research in this area.

Possible Moderation by Category Salience

Tests of moderation provide a way to improve our understanding of generalization of anxiety and there are important lessons to be learnt from existing evidence: Positive generalized changes in chronic/group-level *evaluations* and *cognitions* can be achieved after contact (Pettigrew & Tropp, 2006, 2011), facilitated by positive contact and high category salience, or awareness of the ingroup/outgroup category distinction (for a review, Brown & Hewstone, 2005). Hence, consistent with classic cognitive analyses of generalization (Rothbart & John, 1985; Rothbart, Sriram, & Davis-Stitt, 1996), for successful individual-to-group generalization, the contact partners must see themselves as representatives or typical of their group, and the contact experience as an 'intergroup' (vs. interpersonal) interaction.

Whereas the above research dealt with generalization of evaluations and cognitions, category salience may play a similar moderating role in inductive learning of emotions, and, in particular, of anxiety (see CS diamond on the link from episodic anxiety to chronic anxiety in Figure 2), an idea contemplated by Eliot Smith (1993):

> Suppose almost every encounter with a group member leads to similar emotions, and that *the ingroup/outgroup distinction is so salient* that the outgroup is viewed as quite homogeneous (…). Then the perceiver would end up reacting in the same way to just about any outgroup member (Smith, 1993, p. 305; emphasis added).

We found initial evidence supporting Smith's contention in our work and that of research collaborators (see Paolini et al., 2006): Individuals more aware of their group memberships during contact displayed larger anxiety reductions after individual (Harwood, Hewstone, Paolini, & Voci, 2005, Study 2) or repeated positive contact experiences with individual outgroup members (Voci & Hewstone, 2003a, 2003b). Alternatively, those who were less aware of their group membership during contact exhibited poor (Harwood et al., 2005, Study 2; Voci & Hewstone, 2003a, Study 1) or no anxiety-reductions after contact (Voci & Hewstone, 2003a, Study 2; Voci & Hewstone, 2003b, Study 1). Hence, preliminary evidence suggests that category salience is a catalyst for anxiety reductions following positive contact.

Evidence suggests that category salience may play a stronger moderating role in anxiety *increases* (vs. decreases) after negative contact experiences. Recent research has shown that category salience is higher when contact goes badly (Paolini et al., 2010; 2014). The implications of these valence-salience effects are poignant as they suggest that generalizations of negative consequences after negative contact may be comparably larger and more robust than generalizations of positive consequences after positive contact. We have published contact data confirming that asymmetries in generalization may occur for evaluations (Barlow et al., 2012; Graf et al., 2014; however, cf. Stark et al., 2013), and future research should investigate whether these also hold for intergroup anxiety.

Evidence of Deductive Anxiety Learning

While research on the mechanisms of contingency-bound anxiety learning and inductive anxiety learning is still scant, evidence of deductive anxiety learning—i.e., group-to-individual generalization—is growing faster (see Table 2). In Figure 2, we represent deductive learning by connecting chronic anxiety ('CA') to the episodic contact-episodic anxiety link; depicted in this way, chronic anxiety moderates anxiety produced by episodic contact. In addition, we superimpose several chronic/group level moderator variables on the deductive learning link (see diamonds on deductive learning link in Figure 2) to show that these may moderate deductive learning, and hence the anxiety produced by episodic contact. Finally, chronic anxiety might moderate changes in anxiety as a consequence of the contact experience, as depicted by the diamond on the contingency-bound learning link in Figure 2.

--INSERT TABLE 2 HERE--

Moderation by Chronic Anxiety

Based on our organizing principles and learning model of anxiety, chronic/group-level anxiety should moderate (1) episodic/individual-level anxiety and (2) contingency-bound anxiety learning (Fig. 2) (see also Page-Gould et al., 2008). Consistent with the first prediction, Ofan, Rubin, and Amodio (2013) found that individuals' chronic social anxiety and situationally-induced intergroup anxiety moderated participants' attendance of interethnic differences—a key cognitive precursor of intergroup threat responses—as measured by the N170 component of brain event related potentials; a difference in N170 between White and Black faces appeared only among those high (vs. low) in dispositional social anxiety being monitored by the experimenter "for signs of prejudice" (a 'public' or 'audience' condition).

Consistent with the second prediction, we found evidence suggesting that chronic intergroup anxiety moderates stimulus specific *increases* in episodic anxiety (i.e., anxiety learning) following direct and observational aversive conditioning of interethnic anxiety (Harris et al., 2015a). White Australians' chronic anxiety towards Black people *in general* (i.e., chronic anxiety) moderated the acquisition of intergroup anxiety, such that galvanic skin responses to the faces paired with shock were larger among those who reported a high chronic anxiety towards Black people than among those who were less chronically anxious, among both direct and observational learning participants. Hence, chronic anxiety was a catalyst of anxiety learning across both direct, and vicarious anxiety learning.

While the above research shows that chronic anxiety moderates acute anxiety responses and stimulus-specific learning of acute anxiety, recent work by Trawalter and colleagues (2012) demonstrates that chronic anxiety *at the onset* moderates also the *development* of chronic anxiety over time (i.e., chronic anxiety as the end point or outcome of inductive anxiety learning; for simplicity this effect is omitted in Figure 2). Using a diary method to monitor daily intergroup contact of college students, the researchers took repeated measurements of cortisol release to assess healthy and unhealthy stress responses following contact. They found that the proportion of intergroup contact that participants reported having had the previous day predicted the amplitude of cortisol boosts the following day, suggesting that *all* participants experienced intergroup exchanges as stressful and requiring the mobilizing of extra resources. However, chronic intergroup anxiety—operationalized as concerns about appearing prejudiced—moderated the long term outlook of these cortisol boosts (i.e., chronic anxiety as outcome). Over the academic year, individuals initially low in chronic intergroup anxiety showed a steepening of cortisol diurnal rhythms following increases in interethnic contact, indicative of healthy chronic stress responses and increased resilience over time. However, individuals initially high in chronic intergroup anxiety showed a progressive flattening of cortisol slopes, indicative of chronic ill health and stress. The findings indicate that chronic anxiety increases the attendance of threat related cues, accelerates the acquisition of episodic intergroup anxiety and leads to the establishment of chronic stress responses.

However, chronic anxiety is not necessarily a predictor of negative outcomes; rather it may act more generally as an amplifier of episodic anxiety responses and anxiety learning in both increasing and decreasing directions. Page-Gould, Mendoza-Denton and Tropp (2008) measured acute stress responses as intergroup friendships between White and Latino/a college students across three sessions. Declines in cortisol reactivity as friendships developed were observed exclusively among participants high in race-sensitivity, another variant of chronic intergroup anxiety (Mendoza-Denton et al., 2008), or among individuals high in implicit race prejudice. These results indicate that chronic intergroup anxiety can act as the catalyst of both positive and negative changes in anxiety.

Moderation by Outgroup Prejudice

Individual difference variables highly correlated with chronic intergroup anxiety may mimic the potentially complex and dissociated moderating effects we discussed earlier for chronic anxiety (see e.g., Mendes & Koslov, 2012; see the moderation outgroup prejudice (‘OP’) diamond for outgroup prejudice in Figure 2). Westie and De Fleur’s (1959) pioneering study on the physiology of intergroup relations exposed the anxiety-exacerbating effects of prejudice. They found that prejudiced individuals displayed higher skin conductance responses to Black than White photographs, whereas non-prejudiced individuals did not.

Importantly, as Westie and De Fleur's (1959) participant groups had been carefully matched along a variety of social demographics (age, sex, social class, residential history), including *previous contact with Black people*, demonstrating that the higher anxiety of the prejudiced group was driven by differences in prejudice. A recent study by Mendes and colleagues (2007b) demonstrates that prejudice may also be associated with *fewer positive* outcomes. When monitoring acute neuroendocrine stress responses during a stressful task performed in front of a White vs. Black evaluator, Mendes et al. found that all intergroup and intragroup participants displayed a similar pattern of malignant stress responses (catabolic/cortisol releases) to the stressful task, irrespective of their implicit race prejudice on a race Implicit Association Test (IAT). Implicit prejudice, however, moderated the presentation of the benignant stress counterpart (anabolic/protective responses): Those allocated to the Black evaluator and who were higher on implicit prejudice did *not* display the salutary stress responses displayed by those allocated to the Black evaluator and low in implicit prejudice, suggesting that prejudiced individuals suffer from both the presence of malignant intergroup stress and the *lack of* benignant intergroup stress.

The outlook of moderation by prejudice is however not necessarily bleak. As indicated earlier, in Page-Gould et al.'s (2008) experimental study of intergroup friendship formation, it was *only* those who had scored high (vs. low) on implicit race prejudice (or race-sensitivity) at pre-test, who (a) displayed significant declines in cortisol release as intergroup friendship developed, (b) showed reduced anxious mood on the days in which they engaged in intergroup interactions, and (c) reported more self-initiated intergroup interactions. Hence, while prejudiced individuals might suffer from higher anxiety levels, there is evidence that they benefit the most from prejudice and anxiety reduction interventions (for more data, see Hodson, 2011).

Moderation by Prior Outgroup Contact

As we move outward from the core of our anxiety learning model, we expect individuals' past outgroup contact to play a key moderating role (see Figure 2's moderation diamond for cumulative contact on the deductive learning link). We found growing evidence that individuals' histories of *positive* outgroup contact protect against intergroup anxiety and intergroup anxiety learning. As discussed earlier, Blascovich and colleagues (2001, Study 3) measured the amount of quality outgroup contact non-Black participants had with Black people before attending their lab session (e.g., 'how much contact have you had with African-Americans as close friends?', p. 261). This study found reduced and, at times, no evidence of cardiovascular threat responses during interactions with a Black confederate among those participants who had a history of extensive and positive outgroup contact. Similarly, we measured participants' pre-test levels of quality contact with Black people (e.g., 'thinking about the past interactions you have had with Black people, are most interactions pleasant?') and found that this chronic variable buffered against the stimulus-specific *acquisition* of outgroup anxiety during both a direct and an observational aversive conditioning procedure (Harris et al., 2015a). Hence, White individuals with histories of positive contact with Black people were less likely to learn to become anxious of Black faces when faced with negative outgroup experiences.

Extending this reasoning, Olsson and colleagues (2005) checked the moderating effects of prior outgroup contact on the *extinction* of intergroup anxiety, as acquired during a direct aversive conditioning procedure. At pre-test, they measured the number of interracial dates as a proxy of prior quality contact with Black people, and found a significant negative correlation with the number of times a Black (vs. White) face needed to be presented without shock to reduce participants' heightened arousal. Hence, the more past quality contact participants had with the outgroup, the faster they recovered physiologically from an aversive intergroup experience.

Results from a diary study by Page-Gould (2012) shed some initial light on the processes contributing to the anxiety-buffering effects of intimate intergroup contact. Page-Gould found that individuals who had a relatively broad and intimate network of intergroup friends were more likely to initiate (vs. avoid) new intergroup interactions following interpersonal conflict with an outgroup member—an obviously anxiety-provoking experience; whereas individuals with fewer intergroup friends were more likely to avoid outgroup members altogether after conflict. Mediational tests revealed that the network of intergroup friends buffered against the contact avoidance effects of interpersonal conflict with outgroup members by offering (intergroup) social support post-conflict.

To summarize, there is growing and convincing evidence that positive prior contact shapes anxiety learning and mitigates a variety of negative outcomes in ways consistent with our model (Figure 2): It buffers against anxiety experienced during intergroup exchanges, mitigates the development of intergroup anxiety following aversive first-hand and observational intergroup contact, accelerates return to normality after heightened intergroup anxiety and encourages outgroup approach (vs. avoidance).

Altogether this evidence advances our understanding of how *past* contact with the outgroup shapes the presentation of anxiety during intergroup contact in the *present* and *over time*. Yet, there are at least three areas where more research is needed.

First, future research should test the moderating effects of individuals' *negative* histories of past contact. Intergroup contact research has been criticized for a focus on positive contact experiences and a neglect of sub-optimal and negative contact (see Paolini et al., 2010; Pettigrew, 2008; Pettigrew & Tropp, 2011). This critique extends to extant tests of moderation. Future research should test the robustness and invariance of the buffering effects discussed earlier and ascertain the extent to which these beneficial effects are restricted to cumulative positive experiences with the outgroup, like those associated with intergroup friendship and intergroup dating. Histories of negative intergroup contact, like those more frequently experienced in conflict areas (e.g., Northern Ireland, Cyprus, South Africa, etc.), should result in diametrically opposite outcomes. Rather than buffering, they should exacerbate anxiety responses and anxiety learning, and increase the amplitude of inductive and/or deductive generalization effects, possibly through their associations with chronic anxiety.

Hence, we call for replications of Blascovich et al. (2001), Harris et al. (2015a), and Olsson et al. (2005) in contexts where reasonable variations in past contact quality—positive *and negative*—are observed and can be measured. Experimental analogues of these field tests could involve *priming* or remembering positive vs. negative experiences of outgroup contact (e.g., through a biographical recall task) *prior* to the implementation of aversive vs. appetitive conditioning procedures. The implications of these predicted dissociations in anxiety learning along positive vs. negative chronic moderators are important. These dissociations would imply that new ingroup/outgroup interactions are most likely to *confirm* (vs. disconfirm), pre-existing expectations about the *typical* ingroup/outgroup interaction, thus, leading to a negative or positive spiraling of intergroup relations where expectations are already negative or positive, respectively.

Second, moderation evidence relies on indices that incorporate both quality and quantity of past outgroup contact such as *number* of intergroup *friendships* or intergroup dates (Allport, 1954; Brown, Maras, Masser, Vivian, & Hewstone, 2001; Voci & Hewstone, 2003a). As a result, it is unclear whether the effects of these chronic variables are driven by valence of past ingroup/outgroup interactions, by their number, or by an interaction between the two. Knowing this is key to intervention designing (Paolini et al., 2006). Based on human and animal learning research (Kent, 1997; Lubow, 1998; Mineka & Cook, 1986), there may be more scope to change (increase/decrease) anxiety early in one's experience with the outgroup. Hence, contact quantity *in its own right* might have a unique effect on learning trajectories during contact. This idea is consistent with putative mechanisms of moderation advanced by Blascovich (e.g., Blascovich et al., 2001; Mendes et al., 2002) whereby contact quantity decreases anxiety and limits anxiety learning because it increases perceived control, reduces perceived uncertainty about future ingroup/outgroup interactions, and leads to increased intergroup self-efficacy (for a similar point, see Olsson et al., 2005; Plant & Devine, 2003). Because of decreasing uncertainty about the outcome of intergroup contact as contact quantity increases, we also advanced the possibility that the quality of discrete contact experiences might matter more at early stages of outgroup acquaintance (see Paolini et al., 2006 for predictions drawn from the mere exposure literature).

More generally and more importantly, the psychological underpinnings of moderation by chronic variables, as detected so far and discussed above, are interesting but remain substantially untested conjectures (for an isolated notable exception, Page-Gould, 2012). Hence, as evidence of moderation grows, we must learn more about the exact mechanisms that chronic variables—like chronic anxiety, outgroup prejudice, prior contact quantity and quality—recruit as the individuals' experience of contact with the outgroup evolves over time. This, we believe, is where the challenges of future research lie and future research should concentrate.

Summary and Conclusions

Past contact research has failed to look at the dynamic interplay between episodic and chronic intergroup anxiety and, as a consequence, has returned a static and selective understanding of intergroup contact effects (Paolini, 2008). In 2006, we located around 30 studies of intergroup anxiety in intergroup contact (Paolini et al., 2006), with the evidence reflecting a sharp research disconnect between experimental tests isolating the anxiety-provoking effects of episodic contact and correlational tests isolating the anxiety-reducing effects of cumulative outgroup contact. In this article, we explained how these two usually separate traditions were bridged for the first time in a single design by Blascovich and colleagues' (2001) ground-breaking research.

In this article, we built up on our early analysis and review of evidence: We argued the need for a learning model of anxiety and stress responses during ingroup/outgroup interactions, encompassing both episodic and chronic anxiety towards the outgroup and their interactions, to provide a temporal integration of intergroup contact effects over the lifespan. With this learning outlook in mind, we documented and discussed recent empirical advancements.

Very recent psychophysiological and behavioral investigations of intergroup anxiety by prominent intergroup contact researchers—like, among others, Blascovich, Mendes, Mendoza-Denton, Page-Gould, Richeson, Shelton, and Trawalter—as well as clever extensions of conditioning paradigms to the intergroup domain—e.g., by Olsson, Phelps, Harris, Griffin, and Paolini—all share a common learning framework; we made this explicit, here, in terms of five organizing principles. This research is, in our view, revolutionary and paradigm-shifting since it investigates how cumulative outgroup contact and chronic responses to the outgroup equip the individual for new contact encounters and shape, for better or worse, their episodic responses to the outgroup. In so doing, these studies look at multiple segments of a complex and time-bound learning process of anxiety and reveal a non-linear and dynamic outlook of contact effects.

A model that incorporates both episodic and chronic process variables, as well as their dynamic interplay, has significant theoretical and empirical merits. Theoretically, it is sufficiently flexible and broad to potentially accommodate a disparate number of process variables (e.g., emotions, affect, evaluations and cognitions). Empirically, it helps reconcile mixed and complex contact evidence, as well as formulate new and untested predictions. From a more pragmatic point of view, it provides a stronger and more powerful platform to predict changes in intergroup relationships over time.

We must recognize, however, that the methodological and analytical costs of testing learning models of contact as we define them here are not small: These advantages can be fully enjoyed only if both episodic and chronic measures of key process variables are included in the research design and if the latter allows for repeated assessments of these variables over time and as individuals' experience with the outgroup grows.

It is worth noting that we have provided a limited discussion of longitudinal contact research because, while longitudinal tests of intergroup contact effects have recently flourished (see e.g., Brown et al., 2007; Christ et al., 2010, 2014; Tropp et al., 2012; see also recent symposium by Gonzalez and Tropp, 2014), only some of these tests have included measures of intergroup anxiety (Binder et al., 2009; Eller & Abrams, 2003, 2004; Levin et al., 2003; Swart et al., 2011). Furthermore, only one study (Page-Gould et al., 2008) fits the physiologically-centered inclusion criteria for our review of new generation research and thus was described in detail. Longitudinal designs have the potential to contribute to our analysis of complex dynamic changes in intergroup anxiety over the time course and to be instrumental in testing our anxiety learning model. Yet, those studies currently available offer limited insight in the complexities discussed therein as they have been driven by either a focus on cross-lagged relationships between contact and anxiety (Binder et al., 2009; Eller & Abrams, 2003, 2004; Levin et al., 2003) or more recently by a focus on cross-lagged relationships between anxiety and other mediators of contact-prejudice links (see e.g., Swart et al. 2011 for longitudinal links between anxiety and empathy). Hence, even in investigations where changes in anxiety (episodic and/or chronic) over time could have been explored, these changes were either not investigated, or were reported for the sole purpose of ascertaining construct stability over time or establishing baseline model estimates (see e.g. Swart et al.'s, 2011 discussion of imposed load equivalence in auto-regressive models of anxiety).

Conditional growth curve modelling—via multi-level or Structural Equation Modelling (SEM)—is a promising alternative to past approaches to the modelling of longitudinal anxiety data. This powerful and flexible analytical approach can significantly advance our understanding of the dynamics of intergroup anxiety over the individual's life-span by surpassing traditional approaches in important ways (see Christ & Wagner, 2012; Curran, Obeidat, & Losardo, 2010): Once optimal baseline anxiety growth models are established (i.e., functional forms of the anxiety trajectories over time), these growth models can be expanded to include one or more predictor(s) of growth; the chronic variables we discussed in this article (e.g., chronic anxiety, outgroup prejudice, accumulated past contact). Critically for the dynamics at stake in our anxiety learning model, these predictors can be treated analytically as time-invariant (i.e., not changing over time), or as time-varying covariates (i.e., as themselves changeable over time). The former type of predictor is the kind involved in traditional moderation analysis, whereby stable or invariant characteristics of the individual or experimental treatments are used to predict lower (vs. higher) starting points in the outcome (i.e., anxiety intercepts) and/or steeper (vs. flatter) rates of change over time (i.e., anxiety slopes). Analyses with time-varying predictors, instead, assume that any given repeated measure of anxiety at any point in time is jointly determined by the underlying growth factors (i.e., the autoregressive component) and the impact of the time-varying (chronic) covariate at that time period. This means that conditional growth models that include time-varying chronic variable predictors can be expanded to incorporate changes in these chronic variables over time, and changes in the magnitude of their effects over time, as well as interactions between multiple covariates over time (for an extensive and accessible discussion, Christ & Wagner, 2012). As such, we believe that this type of model is the way of the future in testing the dynamic and complex interplay between episodic and chronic anxiety (as well as other concurrent and potentially interacting learning processes involving other intergroup emotions, cognitions, and evaluations) over an individual's lifespan.

To conclude, in advancing our learning outlook to intergroup contact effects, we argued that five broad learning principles—about the time course of affect, emotions, cognitions and evaluations in ingroup/outgroup interactions—implicitly underpin large sections of contemporary intergroup research. We pointed out that while testable, these learning principles most often remain 'assumed' and 'untested' (hence, *meta-theoretical* principles). Yet, recruiting and expanding on these broad learning principles allowed us to develop a more narrow, fully testable model of anxiety learning during ingroup/outgroup interactions; a learning model that is gaining some traction and is accruing significant amounts of supporting evidence. We advise that this transition from a meta-theoretical learning framework to a testable learning model is not restricted to intergroup anxiety; as it is possible, and indeed, desirable in parallel areas of intergroup research. Ultimately, we hope that the learning framework we advanced here may provide a theoretically unifying umbrella that encompasses models and evidence from *within* the contact literature, as well as from outside the contact literature (e.g., stereotyping, attitudes, evaluative conditioning, etc.). In our view, the next level of complexity in analyses of contact effects over time will most likely require the integration of what we know from these traditionally separate research areas, towards the investigation of even higher order interactions between learning of affect, emotions, cognitions *and* evaluations over time. We hope that our present analysis assists intergroup researchers in the first steps of the research endeavors that lie ahead.

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Zajonc, R. B. (1998). Emotions. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (Vol. 1, 4th ed., pp. 591-632). New York: McGraw-Hill.

Footnotes

6. The articles listed in Tables 1 and 2 were located in Psycinfo and Pubmed. Reference lists of located articles and key authors' publication pages were also used to identify relevant publications. Articles were included in the review if they investigated outgroup anxiety or compared outgroup anxiety with ingroup anxiety (i.e., intergroup-intragroup comparisons) on psychophysiological and/or behavioral markers of anxiety. Studies including exclusively self-reports of anxiety were excluded (see Paolini et al.'s 2006 for a review of this literature), but findings on self-report measures were considered if reported side-by-side psychophysiological or behavioral findings.
7. This research trend is at odds with the research practices of mainstream and traditional correlational research of the contact-anxiety link; there the inclusion of group-level outcomes was a standard routine (see Table 11.2 in Paolini et al., 2006; n = 17 out of 18 studies or 94.44% of reviewed studies at that time included outgroup-level variables) because of a concurrent interest in the broader contact-prejudice link.
8. Future research still needs to identify the conditions under which D, i.e., the inter/intra-group difference in anxiety, tends to zero (bottom panel), which is equivalent to the intergroup and intragroup lines intersecting in the top panel.
9. In our earlier work (Paolini et al., 2006), we offered an extensive discussion of several important methodological differences between experimental and correlational investigations of intergroup contact and anxiety. In this article, our intention is not that of providing a comprehensive explanation of this apparent disconnect between research traditions. Hence, after discussing the possible involvement of systematic differences in contact valence, the on-line/memory-basis of the interaction, and individuals' motivational goals, our discussion selectively turns to methodological differences that are most relevant to an explanation of this apparent research disconnect in terms of temporal integration of contact experiences over the

lifespan—i.e., our learning model of anxiety.

10. In reviewing emerging physiological and behavioral research, the term ‘anxiety learning’ will be used in a narrower and more technical way than in earlier sections of this article to refer to changes in episodic anxiety that are *stimulus-specific* or *contingency bound*; a process called in the learning literature ‘acquisition’ of anxiety.

Tables

Table 1. Intergroup contact studies that have experimentally investigated physiological and behavioral forms of intergroup vs. intragroup anxiety

Study	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type and Anxiety Source*	Direction of Intergroup (vs.Intragroup) Effect**
Amodio (2009)	White American students interacting with a White or Black individual	A study about social attitudes	Physiological: Cortisol (I) Behavioral: Weapons Identification Task (G) Subjective: State Affect Checklist (S)	Physiological: Null effect Behavioral: Black-faced primes speeded responses to handguns compared to tools Subjective: Higher in intergroup
Amodio & Hamilton (2012)	White American female students interacting with a White or Black female partner	Discussing their views about social issues	Behavioral: IAT (G) Subjective: State Affect Checklist (S)	Behavioral: Unpleasant words categorized more accurately than pleasant words in the context of Black faces, whereas pleasant words categorized more accurately than unpleasant words in the context of White faces Subjective: Higher in intergroup
Blascovich, Mendes, Hunter, Lickel & Kowai-Bell (2001, Study 1)	American female students interacting with an individual with or without a birthmark	Study on “interpersonal styles and working together”.	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C)	Physiological: Increased cardiovascular threat
Blascovich, Mendes, Hunter, Lickel & Kowai-Bell (2001, Study 2)	American female students interacting with an individual with or without a birthmark	Study on “interpersonal styles and working together”.	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (I)	Physiological: Increased cardiovascular threat Behavioral: Depleted task performance via less words generated
Blascovich, Mendes, Hunter,	Non-black American female	Study on “interpersonal styles and	Physiological: Ventricular Contractility, Cardiac	Physiological: Increased cardiovascular threat

Lickel & Kowai-Bell (2001, Study 3)	students interacting with a White or Black individual of high or low SES	working together".	Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (I)	Behavioral: Depleted task performance via less words generated
Brown, Bradley & Lang (2006)	African American or European American students viewing African American or European American faces	Not provided	Physiological: Skin Conductance and Electromyogram (I, C) Behavioral: Viewing time (I, C)	Physiological: European American participants had larger skin conductance responses when viewing White faces; For the Electromyogram, African American participants had larger corrugator responses when viewing unpleasant Back faces than unpleasant white faces; Behavioral: Participants viewed pleasant pictures of their ingroup for longer than pleasant pictures of their outgroup
Gray, Mendes & Denny-Brown (2008)	White or Black Americans interacting with a White or Black interviewer	Not provided	Physiological: Cortisol (I) Subjective: Research assistants rated participant's level of anxiety via a silent videotaped recording (O)	Physiological: Observer ratings of anxiety predicted cortisol changes; Same-race research assistants positively predicted cortisol increases whereas different race research assistants negatively predicted cortisol increases Subjective: Same-race research assistants rated participants as more anxious when engaging with an outgroup interviewer; No difference when the research assistant was of a different race to the participant.
Littleford, Wright & Sayoc-Parial (2005)	White, Black and Asian American students interacting with White, Black or Asian individuals	A study on the effect of interracial interaction on health and attitudes	Physiological: Blood Pressure (I, C) Subjective: Self-reported anxiety (CLQ) (G)	Physiological: Increased blood pressure Subjective: Higher in intergroup

Mallan, Sax & Lipp (2009)	Caucasian Australians viewing White or Asian faces	Not provided	Physiological: Skin Conductance and Startle Blink (I, C)	Physiological: Resistance to extinction (i.e., lack of reduction in anxiety)
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 2)	American male students interacting with a Male White or Latino partner of high or low SES	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: Increased cardiovascular threat Behavioral: Least amount of words found if paired with Latino high SES partner than all other conditions. Most words found if paired with White high SES partner
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 3)	American female students interacting with a White or Asian Female partner, who had a Southern or regional accent	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Behavior coding (Affirmations and body language of participant) (O); Word-finding task (I)	Physiological: Increased cardiovascular threat Behavioral: Less affirmations and positive body language, as well as least amount of words found if paired with Asian Southern Accent partner than all other conditions. Most affirmations, positive body language and words found if paired with White Regional Accent partner
Mendes, Blascovich, Lickel & Hunter (2002)	Non-black American male students interacting with a White or Black individual	A study on interpersonal styles and working together	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: Increased cardiovascular threat Behavioral: Depleted task performance via less words generated
Mendes & Koslov (2012, Study 1a)	White and Black American students interacting with a White or Black female	A study on physiological responses during laboratory tasks	Behavioral: Behavior coding (smiles, nodding, laughing, positive statements) by research assistants of participant interaction with confederate (O)	Behavioral: White participants smiled, laughed and nodded more frequently when interacting with an outgroup member
Mendes & Koslov (2012, Study	Female American students	A study on getting to know each	Physiological: Cardiac Output and Total	Physiological: Participants interacting with a stigmatized partner displayed a

1b)	interacting with an individual with or without a birthmark	other	Peripheral Resistance (I, C) Behavioral: Behavior coding (smiles, nodding, laughing, positive statements) by research assistants of participant interaction with confederate (O)	positive relationship between smiling frequency and physiological threat whereas those interacting with a non-stigmatized partner displayed a negative relationship between smiling frequency and threat Behavioral: Participants smiled more frequently when interacting with a stigmatized partner
Navarrete, McDonald, Asher, Kerr, Yokota, Olsson & Sidanius (2012)	White and non-white American students viewing white faces with different colored t-shirts	Not provided	Physiological: Skin Conductance (I, C)	Physiological: Higher levels of skin conductance to outgroup members relative to ingroup members following conditioning task
Navarrete, Olsson, Ho, Mendes, Thomsen & Sidanius (2009)	White and Black Americans viewing white faces with different colored t-shirts	A study that explores the mind-body connection in response to social groups	Physiological: Skin Conductance (I, C) Behavioral: IAT (G) Subjective: Explicit Race Bias (Attitudes Towards Blacks scale) (G)	Physiological: Resistance to extinction (i.e., lack of reduction in anxiety) Behavioral: Not reported Subjective: Not reported
Olsson, Ebert, Banaji & Phelps (2005, Study 2)	White and Black Americans viewing White and Black faces	Not provided	Physiological: Skin Conductance (I, C) Behavioral: IAT (G)	Physiological: Resistance to extinction (i.e., lack of reduction in anxiety) Behavioral: White participants displayed negative stereotypes with Black Americans, whereas Black participants displayed no outgroup bias
Plant & Butz (2006, Study 1a)	Non-black American psychology students interacting with a Black or White partner	A study examining interracial interactions	Behavioral: Automatic attitudes (modelled after Fazio, Jackson, Dunton & Williams, 1995) (G) Subjective: Self-reported anxiety (Anxiety scale)	Behavioral: Null finding Subjective: Higher in intergroup

			(I)	
Porier & Lott (1967)	White American males interacting with White and Black experimenters	Not provided	Physiological: Skin Conductance (I, C)	Physiological: Null effect
Rankin & Campbell (1955)	White American male students interacting with White and Black experimenters	Not provided	Physiological: Skin Conductance (I, C)	Physiological: Increased skin conductance responses
Townsend, Major, Gangi & Mendes (2011; Study 1)	European females interacting with Male interviewer, competing for position with either Male or Female	A study measuring the body's stress response during interview situations	Physiological: Cortisol (I) Subjective: Self-reported anxiety (Brief Symptoms Inventory; how often participant experiences subset of anxiety symptoms) (S)	Physiological: Increased cortisol levels Subjective: Null effect
Trawalter, Adam, Chase-Lansdale & Richeson (2012, Study 1)	White American students viewing White and Black faces	Study on the physiology of social behavior during an interaction	Physiological: Cortisol (I)	Physiological: Increased cortisol levels
Vanman, Paul, Ito & Miller (1997, Study 1)	White, non-Hispanic American students interacting with White and Black individuals	Not provided	Physiological: Electromyogram (I, C)	Physiological: EMG showed more positive facial affect for White, relative to Black, contact partners
Vanman, Paul, Ito & Miller (1997, Study 2)	White, non-Hispanic American students interacting with White	Not provided	Physiological: Electromyogram (I, C)	Physiological: EMG showed more positive facial affect for White, relative to Black, contact partners

	and Black individuals			
Vrana & Rollock (1998)	Black and White American students interacting with White or Black partners	A study on the psychophysiology of emotional imagery	Physiological: Heart rate, Skin Conductance, and Electromyogram (I, C)	Physiological: Increased heart rate when interacting with an outgroup partner; Null for skin conductance; EMG displayed greater zygomaticus activity when interacting with an outgroup partner

Note. * For anxiety type, we rely on Blascovich, Mendes and colleagues' tripartite definition of physiological, behavioral and subjective anxiety (Blascovich et al., 2001; Mendes et al., 2002). For anxiety source, we rely on Greenland et al.'s (2012) distinction of anxiety appraisal sources. ** Unless otherwise indicated, effects are in the direction of anxiety being higher in the intergroup than intragroup condition. I = indicates individual level variable (episodic anxiety relevant to a specific individual outgroup member/s). G = indicates group level variable (chronic anxiety relevant to entire outgroup). O = indicates anxiety stemming from other individual(s). S = indicates anxiety stemming from participant self-reflecting on own anxiety; C = Continuous measure of anxiety (measure is not a one-off measurement but is rather collected continuously throughout the task; by exclusion all other measurements are discrete in nature).

Table 2. Intergroup contact studies that have experimentally investigated physiological and Behavioral forms of intergroup anxiety and tested for moderation

Study	Moderator Category	Participants and Intergroup Setting	Task/Cover Story	Anxiety Type* and Target of Anxiety (Individual vs. Group)	Moderation Effect**
Mendes, Gray, Mendoza-Denton, Major & Epel (2007b)	Attitudes (IAT)	White American students interacting with a White or Black interviewer	Not provided	Physiological: Catabolic and Anabolic Cortisol release and recovery (I) Behavioral: Task performance (I) Subjective: Interviewer ratings of participant anxiety (O)	Physiological: At low level of bias: Higher anabolic cortisol reactivity and faster cortisol reaction At high level of bias: Lower anabolic cortisol reactivity and slower cortisol reaction Behavioral & Subjective: At low level of bias: Higher anxiety ratings by interviewer during task performance At high level of bias: Lower anxiety ratings by interviewer during task performance
Trawalter, Adam, Chase-Lansdale & Richeson (2012, Study 1)	Chronic Anxiety (motivation to respond without prejudice)	Black and White American students interacting with White and Black research assistants	Study on the physiology of social behavior during an interaction	Physiological: Cortisol (I) Behavioral: Behavior coding (smiles, eye gaze) by research assistants of participant interaction with confederate (O)	Behavioral & Physiological: At low motivation to respond without prejudice: Lower Behavioral and physiological indicators of stress At high motivation to respond without prejudice: Higher Behavioral and physiological indicators of stress

Trawalter, Adam, Chase-Lansdale & Richeson (2012, Study 2)	Chronic Anxiety (motivation to respond without prejudice); Past Contact (quantity)	Black and White American students who reported on daily intergroup interactions	Not provided	Physiological: Cortisol slopes (I) Behavioral: Self and other initiated intergroup contact throughout the year (G) Subjective: Attitude towards Blacks scale (G, S)	Physiological: At low motivation to respond without prejudice: Greater cortisol slopes during spring the more interracial contact they had during the year At high motivation to respond without prejudice: Greater cortisol slopes during spring the less interracial contact they had during the year Behavioral: Not tested for moderation Subjective: Not tested for moderation
Page-Gould (2012)	Past Contact (intergroup friends)	Canadian participants who reported on cross-group ethnic contact	Not provided	Behavioral: Approach/avoidance (G, S) Subjective: Initiation of intergroup contact (G, S)	Behavioral: At low cross-group friendships: Unrelated to social support following conflict At high cross-group friendships: Sought cross-group social support following conflict Subjective: At low cross-group friendships: Less intergroup interactions initiated following intergroup conflict At high cross-group friendships: No change in intergroup interactions initiated following intergroup conflict
Page-Gould, Mendes &	Past Contact	Black and White (American	Not provided	Physiological: Respiratory Sinus Arrhythmia	Physiological:

Major (2010)	(friendship quality)	or Canadian) adults interacting with a White or Black partner		and Parasympathetic activity (I, C) and Cortisol (I)	For low contact quality: Less respiratory sinus rebound and slower cortisol recovery after and intergroup stressor For high contact quality: Greater respiratory sinus rebound and faster cortisol recovery after an intergroup stressor
Page-Gould, Mendoza-Denton & Tropp (2008)	Past contact (Quantity); Chronic Anxiety (Rejection Sensitivity); Attitudes (IAT)	American students who interacted with White or Latino/a partner	Study on the effect of friendship on college adjustment	Physiological: Cortisol (I) Subjective: Daily intergroup contact diary (G, S)	Physiological: For low contact: Cortisol reactivity was positive for high rejection sensitivity; flat effect for low rejection For high contact: Cortisol reactivity was negative for high rejection sensitivity; flat effect for low rejection At low level of bias: No relationship between cortisol and time as friendships developed At high level of bias: Lower cortisol reactivity across time as friendships developed Subjective: At low level of bias: No effect of friendship condition At high level of bias: More cross-group contact was self-initiated and reduced anxious mood reported following cross-group contact in the lab
Blascovich, Mendes, Hunter,	Past Contact (quantity)	Non-black American female	Study on “interpersonal	Physiological: Ventricular Contractility,	Physiological:

Lickel & Kowai-Bell (2001, Study 3)		students interacting with a White or Black individual of high or low SES	styles and working together".	Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	For low contact: Lower Ventricular Contractility and Cardiac Output, but higher Total Peripheral Resistance For high contact: Higher Ventricular Contractility and Cardiac Output, but lower Total Peripheral Resistance, all indicative of threat Behavioral: Not reported
Olsson, Ebert, Banaji & Phelps (2005, Study 2)	Past contact (interracial dating)	White and Black Americans viewing White and Black faces	Not provided	Physiological: Skin Conductance (I, C) Behavioral: IAT (G)	Physiological: For low interracial dating: Greater extinction bias towards outgroup faces For high interracial dating: Lower extinction bias towards outgroup faces Behavioral: Not reported
Navarrete, Olsson, Ho, Mendes, Thomsen & Sidanius (2009)	Past Contact (quantity)	White and Black Americans viewing white faces with different colored t-shirts	A study that explores the mind-body connection in response to social groups	Physiological: Skin Conductance (I, C) Behavioral: IAT (G) Subjective: Explicit race bias (Attitudes Towards Blacks scale) (G)	Physiological: For low contact: Inflated physiological responding to outgroup male faces was reduced more slowly For high contact: Inflated physiological responding to outgroup male faces was reduced more readily Behavioral: Not reported Subjective: Not reported
Jamieson, Koslov, Nock &	Expectancy Violation	Black and White Americans	A study on how the	Physiological: Ventricular Contractility,	Physiological:

Mendes (2013)	(attributional ambiguity)	interacting online with a White or Black avatar	nature of communication has changed now that our social lives are increasingly moving online	Cardiac Output and Total Peripheral Resistance (I, C); Cortisol (I) Behavioral: Behavior coding (approach and avoidance) by research assistants of participant interaction with confederate (O)	For out-group feedback (attributionally ambiguous): Higher Cardiac Output and lower Total Peripheral Resistance For In-group feedback (attributionally non-ambiguous): Greater increases in cortisol following the interaction compared to out-group rejection Behavioral: For out-group feedback (attributionally ambiguous): More observed anger
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 1)	Expectancy Violation (ethnicity crossed with SES)	American female students interacting with a Female White or Latina partner of high or low SES	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: For stereotype consistent: Lower physiological threat responses For stereotype inconsistent: Higher physiological threat responses. Behavioral: No moderation effect found
Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 2)	Expectancy Violation (ethnicity crossed with SES)	American male students interacting with a Male White or Latina partner of high or low SES	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Word-finding task (Boggle) (I)	Physiological: For stereotype consistent: Lower physiological threat responses For stereotype inconsistent: Higher physiological threat responses Behavioral: For stereotype consistent: More words were generated For stereotype inconsistent: Less words were generated

Mendes, Blascovich, Hunter, Lickel & Jost (2007, Study 3)	Expectancy Violation (ethnicity crossed with accent)	American female students interacting with a White or Asian Female partner, who had a Southern or regional accent	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Behavior coding (Affirmations and body language of participant) (O); Word-finding task (Boggle) (I)	Physiological: For stereotype consistent: Lower physiological threat responses For stereotype inconsistent: Higher physiological threat responses Behavioral: For stereotype consistent: More observable positive behavior and more words were generated For stereotype inconsistent: Less observable positive behavior and less words were generated

Mendes, Major, McCoy & Blascovich (2008)	Expectancy Violation (Acceptance/rejection by partner)	Black and White American students interacting with a White or Black confederate	Not provided	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Behavior coding (vigilance, external negative emotions, positive emotions) by research assistants of participant interaction with confederate (O) Subjective: Stephan & Stephan's (1985) intergroup anxiety scale (S)	Physiological: For high rejection from different race partner: lower Cardiac Output, but higher Total Peripheral Resistance For high rejection from same-race partner: Increased cardiac output, but lower Total Peripheral Resistance For high acceptance from same-race partner: Higher Cardiac Output, but lower Total Peripheral Resistance For high acceptance from different-race partner: Lower Cardiac Output but higher Total Peripheral Resistance for Black participants; Higher Cardiac Output, but lower Total Peripheral Resistance for White participants Behavioral: For high rejection: Increased anger when interacting with different-race evaluators; For high acceptance: Increased vigilance when interacting with cross-race evaluators Subjective: For high rejection: Greater negative emotion when rejected by a

					different-race evaluator For high acceptance: Increased positive emotion when interacting with same-race evaluators
Townsend, Major, Sawyer & Mendes (2010, Study 1)	Expectancy Violation (system justifying beliefs regarding status differences)	Latina female participants interacting with a white female confederate who was purportedly prejudiced or not against ethnic minorities	A study on interactions among coworkers	Physiological: Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C)	Physiological: For endorsing meritocracy: Greater threat responses when interacting with a White peer who was purportedly prejudiced against ethnic minorities than a non-prejudiced White peer For prejudice: Less threat responses when interacting with a White peer who was purportedly prejudiced against ethnic minorities, than a non-prejudiced White peer
Townsend, Major, Sawyer & Mendes (2010, Study 2)	Expectancy Violation (system justifying beliefs regarding status differences)	White female participants interacting with a White male confederate	A study of effective interviewing	Physiological: Heart Rate, Ventricular Contractility, Cardiac Output and Total Peripheral Resistance (I, C) Behavioral: Confederate rating of how nervous participant appeared (O)	Physiological: For endorsing meritocracy: Same level of threat, following a sexist or merit rejection, during tasks including speech preparation and delivery, the cognitive task and after the interview For prejudice: Lower threat responses, following a sexist (vs. merit) rejection, during tasks including speech preparation and delivery, the cognitive task and after the interview Behavioral:

	For endorsing meritocracy: Rated by confederates as equally nervous in the sexist and merit conditions For prejudice: Rated by confederates as less nervous in the sexist (vs. merit) condition

Note. * For anxiety type, we rely on Blascovich, Mendes and colleagues' tripartite definition of physiological, behavioral and subjective anxiety (Blascovich et al., 2001; Mendes et al., 2002). For anxiety source, we rely on Greenland et al.'s (2012) distinction of anxiety appraisal sources. ** Unless otherwise indicated, effect is in the direction of anxiety being higher in the intergroup than intragroup condition. I = indicates individual level variable (episodic anxiety relevant to a specific individual outgroup member/s). G = indicates group level variable (chronic anxiety relevant to entire outgroup). O = indicates anxiety stemming from other individual(s). S = indicates anxiety stemming from participant self-reflecting on own anxiety; C = Continuous measure of anxiety (measure is not a one-off measurement but is rather collected continuously throughout the task; by exclusion all other measurements are discrete in nature).

Figure Caption

Figure 1. Explanatory diagram illustrating how Blascovich et al.'s (2001) ground-breaking design isolated simultaneously two distinct contact effects on anxiety traditionally investigated in separate research traditions by incorporating both an intragroup-intergroup between-group condition (Intragroup/Intergroup in the bottom panel) and a prior contact measured moderator (Low contact/High contact Moderator in the bottom panel).

Figure 2. Diagram depicting our time-integrated model of anxiety learning. Diamonds depict moderation effects. Episodic contact causes episodic anxiety (link from 'episodic contact' to 'episodic anxiety'), as well as changes in those anxieties (loop indicating 'contingency-bound (anxiety) learning'). Passage of time from distant past to present is encoded using gradually lighter shades of black to grey. Past contact experiences accumulate over an individual's lifetime to form a repertoire of cumulative contact (CC; medium grey), which underpins chronic anxiety (CA), but also moderates deductive (feed-forward, group-to-individual generalization) and inductive (feed-back, individual-to-group generalization) learning links between chronic and episodic anxiety. Out-group prejudice (OP) moderates deductive learning and category salience (CS) moderates inductive learning, while cumulative contact and chronic anxiety both moderate contingency-bound (anxiety) learning (see text for more details). The effects of contact valence are discussed extensively in the text, but are not depicted diagrammatically for sake of clarity.

Figure 1

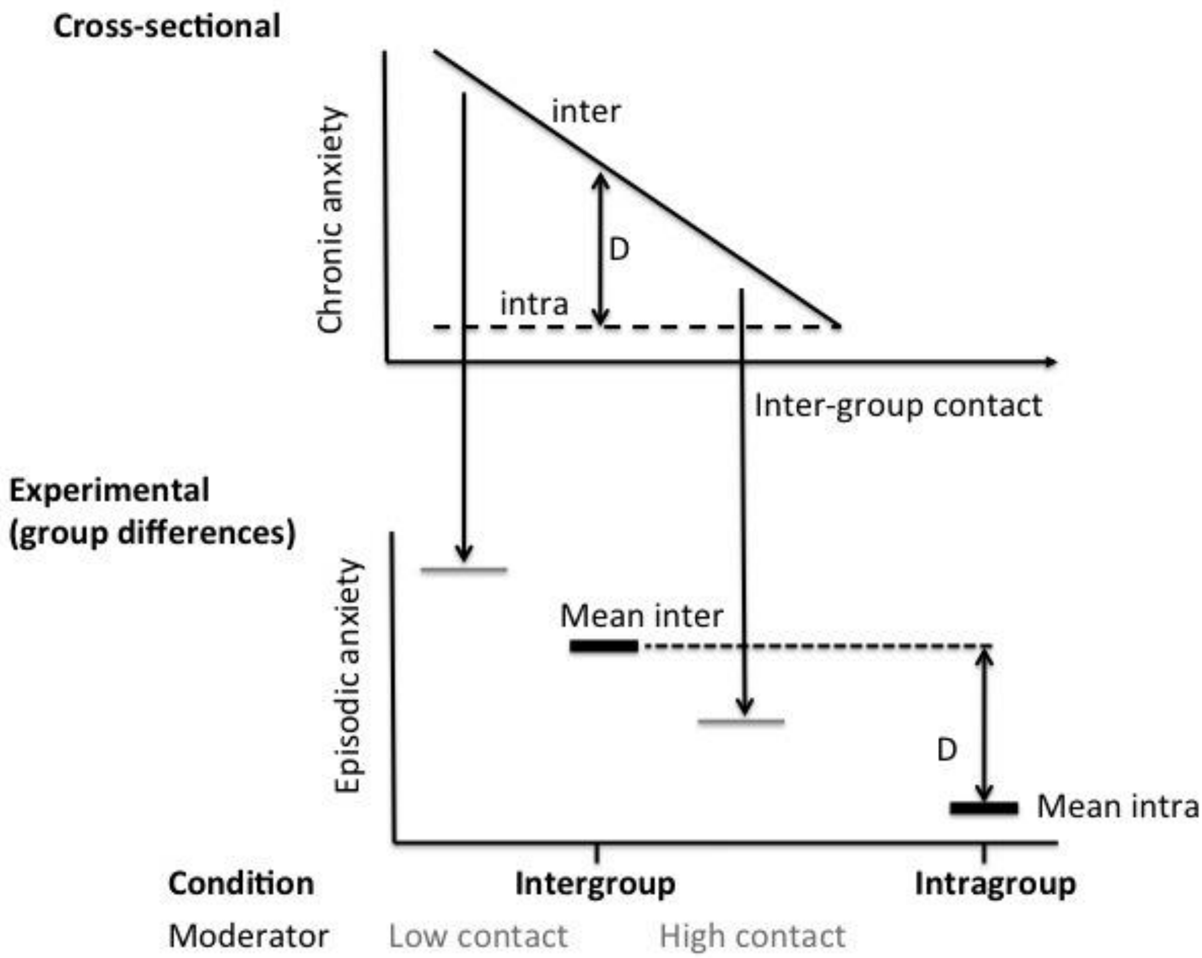
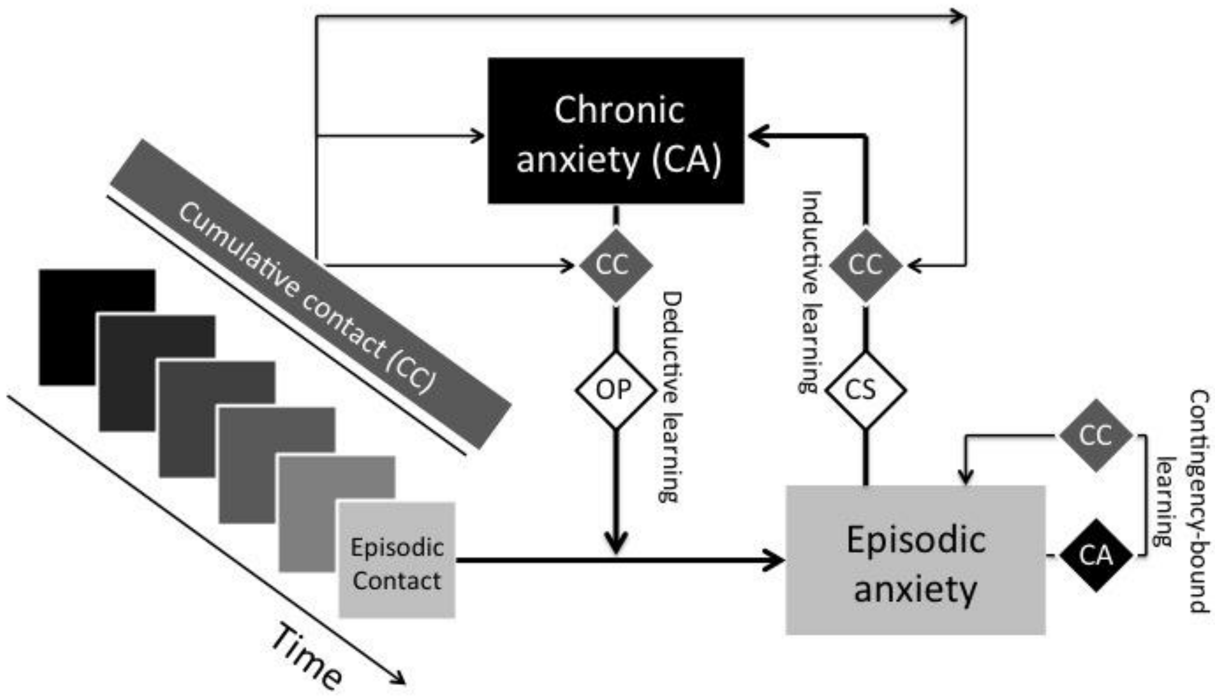

Cross-sectional
Chronic anxiety
inter
D
intra
Inter-group contact
Experimental
(group differences)
Episodic anxiety
Mean inter
D
Mean intra
Condition
Intergroup
Intragroup
Moderator
Low contact
High contact

Figure 2


Chronic anxiety (CA)
Cumulative contact (CC)
CC
Deductive learning
OP
Inductive learning
CC
CS
CC
CA
Contingency-bound learning
Episodic Contact
Episodic anxiety
Time

Appendix B: Ethics Approval for Main Studies

HUMAN RESEARCH ETHICS
COMMITTEE

THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

Notification of Expedited Approval

To Chief Investigator or Project Supervisor:	**Dr Andrea Griffin**
Cc Co-investigators / Research Students:	**Dr Stefania Paolini** **Mr Nicholas Harris** **Miss Jenna Pickard** **Mr Paul Williams**
Re Protocol:	**What's in a face? Intergroup Learning Study (Phase 3)**
Date:	**13-May-2009**
Reference No:	**H-2009-0104**
Date of Initial Approval:	**13-May-2009**
Approved To:	**12-May-2012**

Thank you for your **Response to Deferred** submission to the Human Research Ethics Committee (HREC) seeking approval in relation to the above protocol.

Your submission was considered under **Expedited** review by the HREC Panel.

I am pleased to advise that the decision on your submission is **Approved** effective **13-May-2009**.

Approval is granted to the date indicated above or until the project is completed, whichever occurs first. If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.

The full Committee will be asked to ratify this decision at its next scheduled meeting. A formal *Certificate of Approval* will be available upon request. Your approval number is **H-2009-0104**.

If the research requires the use of an Information Statement, ensure this number is inserted at the relevant point in the Complaints paragraph prior to distribution to potential participants You may then proceed with the research.

Conditions of Approval

This approval has been granted subject to you complying with the requirements for *Monitoring of Progress*, *Reporting of Adverse Events*, and *Variations to the Approved Protocol* as detailed below.

PLEASE NOTE:
In the case where the HREC has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

- ***Monitoring of Progress***

Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. A progress report is required on an annual basis. You will be advised when a report is due.

- ***Reporting of Adverse Events***

1. It is the responsibility of the person **first named on this Approval Advice** to report adverse events.
2. Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.
3. 3. Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the Approval Advice to the (HREC) by way of the Adverse Event Report form within 72 hours of the occurrence of the event or the investigator receiving advice of the event.
4. Serious adverse events are defined as:
    - Causing death, life threatening or serious disability.
    - Causing or prolonging hospitalisation.
    - Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure.
    - Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the diminution of social reputation, to the creation of psychological fears and trauma.
    - Any other event which might affect the continued ethical acceptability of the project.

5. Reports of adverse events must include:
    - Participant's study identification number;
    - date of birth;

- date of entry into the study;
- treatment arm (if applicable);
- date of event;
- details of event;
- the investigator's opinion as to whether the event is related to the research procedures; and
- action taken in response to the event.

6. Adverse events which do not fall within the definition of serious, including those reported from other sites involved in the research, are to be reported in detail at the time of the annual progress report to the HREC.

- ***Variations to approved protocol***

If you wish to change, or deviate from, the approved protocol, you will need to submit an *Application for Variation to Approved Human Research*. Variations may include, but are not limited to, changes or additions to investigators, study design, study population, number of participants, methods of recruitment, or participant information/consent documentation. **Variations must be approved by the (HREC) before they are implemented** except when Registering an approval of a variation from an external HREC which has been designated the lead HREC, in which case you may proceed as soon as you receive an acknowledgement of your Registration.

Linkage of ethics approval to a new Grant

HREC approvals cannot be assigned to a new grant or award (ie those that were not identified on the application for ethics approval) without confirmation of the approval from the Human Research Ethics Officer on behalf of the HREC.

Best wishes for a successful project.

Associate Professor Alison Ferguson
Chair, Human Research Ethics Committee

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Appendix C: Ethics Approval for Pilot Studies

HUMAN RESEARCH ETHICS COMMITTEE

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

APPROVAL TO CONDUCT HUMAN RESEARCH

To Chief Investigator or Project Supervisor:	**Doctor Stefania Paolini**
Cc Co-investigators / Research Students:	**Miss Jenna Pickard** **Mr Nicholas Harris** **Mr Paul Williams** **Doctor Andrea Griffin**
Re Protocol:	**What's in a face? Intergroup Learning Study (Pilot Testing Phases 1 and 2)**
Date:	**09-Nov-2009**
Reference No:	**H-2009-0044**

Thank you for your recent application to the University of Newcastle Human Research Ethics Committee (HREC) for approval of the protocol identified above.

Details of previous approvals for Initial, Renewal and Variation applications are available upon request.

A *Certificate of Approval* is enclosed.

The *Certificate* and this advice are to be retained
They are important documents

- Note any comments related to the approval.
- **Where the HREC is the lead or primary HREC, if the research requires the use of an Information Statement, ensure the Reference No. is inserted into the complaints paragraph in the approved document(s) prior to distribution to potential participants.**
- Where the research is the project of a higher degree candidate, it is the responsibility of the project supervisor to ensure that the candidate receives this approval advice.

Conditions of Approval

This approval has been granted subject to you complying with the requirements for *Monitoring of Progress*, *Reporting of Adverse Events*, and *Variations to the Approved Protocol* as detailed below.

PLEASE NOTE:
In the case where the HREC has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

- ***Monitoring of Progress***

Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. The *Certificate of Approval* identifies the period for which approval is granted and your progress report schedule. A progress report is required on an annual basis, you will be advised when a report is due.

- ***Reporting of Adverse Events***

1. It is the responsibility of the person **first named on the Certificate** to report adverse events.

2. Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.

3. Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the Certificate to the (HREC) by way of the Adverse Event Report form within 72 hours of the occurrence of the event or the investigator receiving advice of the event.

4. Serious adverse events are defined as:
    - Causing death, life threatening or serious disability.
    - Causing or prolonging hospitalisation.
    - Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure.
    - Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the

diminution of social reputation, to the creation of psychological fears and trauma.
  - Any other event which might affect the continued ethical acceptability of the project.

5. Reports of adverse events must include:
   - Participant's study identification number;
   - date of birth;
   - date of entry into the study;
   - treatment arm (if applicable);
   - date of event;
   - details of event;
   - the investigator's opinion as to whether the event is related to the research procedures; and
   - action taken in response to the event.

6. Adverse events which do not fall within the definition of serious, including those reported from other sites involved in the research, are to be reported in detail at the time of the annual progress report to the HREC.

- ***Variations to approved protocol***

If you wish to change, or deviate from, the approved protocol, you will need to submit an *Application for Variation to Approved Human Research*. Variations may include, but are not limited to, changes or additions to investigators, study design, study population, number of participants, methods of recruitment, or participant information/consent documentation. **Variations must be approved by the (HREC) before they are implemented** except when Registering an approval of a variation from an external HREC which has been designated the lead HREC, in which case you may proceed as soon as you receive an acknowledgement of your Registration.

Linkage of ethics approval to a new Grant

HREC approvals cannot be assigned to a new grant or award (ie those that were not identified on the application for ethics approval) without confirmation of the approval from the Human Research Ethics Officer on behalf of the HREC.

With best wishes for a successful project.

Associate Professor Alison Ferguson
Chair, Human Research Ethics Committee

For communications and enquiries:
Human Research Ethics Administration

Research Services
Research Office
The University of Newcastle
Callaghan NSW 2308
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F +61 2 492 17164
Human-Ethics@newcastle.edu.au

Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref
		,	

HUMAN RESEARCH ETHICS COMMITTEE
Certificate of Approval

Applicant: (first named in application)	Doctor Stefania Paolini
Co-Investigators / Research Students:	Miss Jenna Pickard Mr Nicholas Harris Mr Paul Williams Doctor Andrea Griffin
Protocol:	What's in a face? Intergroup Learning Study (Pilot Testing Phases 1 and 2)

In approving this protocol, the Human Research Ethics Committee (HREC) is of the opinion that the project complies with the provisions contained in the *National Statement on Ethical Conduct in Human Research, 2007*, and the requirements within this University relating to human research.

Note: Approval is granted subject to the requirements set out in the accompanying document ***Approval to Conduct Human Research***, and any additional comments or conditions noted below.

Details of Approval

HREC Approval No: H-2009-0044 **Date of Initial Approval:** 17-Mar-2009

Approved to: 16-Mar-2010

Approval is granted to this date or until the project is completed, whichever occurs first. If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.

Progress reports due: Annually.

If the approval of an External HREC has been "noted", the reporting period is as determined by that HREC.

Approval Details

Initial Application

15-Apr-2009

Approved

The Committee ratified the approval granted by the Chair on 17 March 2009 under the provisions for expedited review.

Variation

15-Apr-2009

Variation to:

1. Add Miss Jenna Pickard as a student researcher (honours) to the research team.

2. Remove the Familiarity Rating Task from Phase I and Phase II testing.

3. Amend the Information Sheets for Phases I and II (now versions 3, dated 20/03/09) and Debriefing Sheets for Phases I and II (now versions 2, dated 20/03/09) accordingly.

Approved

The Committee ratified the approval granted by the Chair on 31 March 2009 under the provisions for expedited review

Authorised Certificate held in Research Services

Associate Professor Alison Ferguson
Chair, Human Research Ethics Committee

Appendix D: Contact Quality Scale Items

Contact Quality (6 items in Study 1, Chapter 2)

The following questions will ask you about the quality of past or future interactions with Black people.

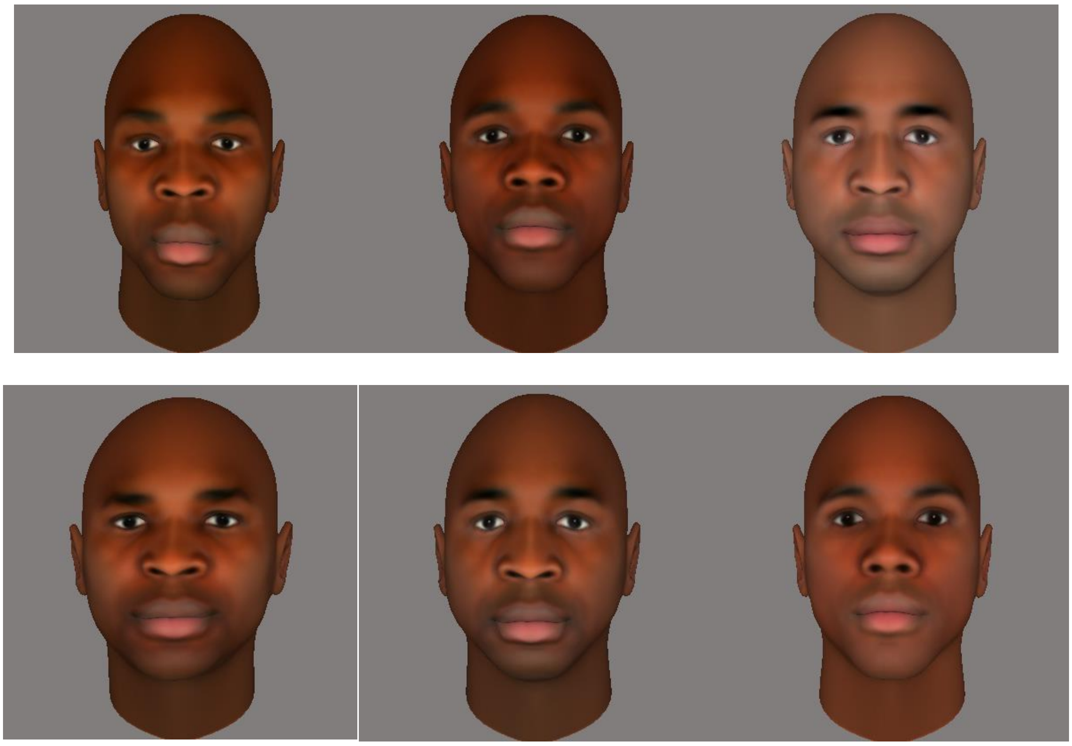
1. Are most interactions pleasant?
2. Are most interactions informal?
3. Are most interactions superficial? (reverse scored)
4. Are most interactions tense? (reverse scored)
5. Are most interactions comfortable?
6. Are most interactions unpleasant? (reverse scored)

Contact Quality (7 items in Study 2, Chapter 2)

1. Are most interactions pleasant?
2. Are most interactions informal?
3. Are most interactions superficial? (reverse scored)
4. Are most interactions tense? (reverse scored)
5. Are most interactions comfortable?
6. Are most interactions unpleasant? (reverse scored)
7. Overall, I would say that the quality of contact I have had/expect to have with black people is

Appendix E: Larger Set of Faces Shown for Generalization Purposes (Chapters 2 and 3, Study 1)

Original Training Faces 75% Similarity faces 50% Similarity Faces



New Outgroup Exemplar Faces

Appendix F: Pictures counterbalanced as the CS+ and CS- (Chapters 2 and 3, Study 1)

Appendix G: Still from the Vicarious Learning Video Containing the White Female Model

Appendix H: Model Believability Scale Items

Model Believability (5 items)

1. The facial expressions of the research participant in the video looked genuine.
2. The body language of the research participant in the video looked genuine.
3. The research participant in the video behaved naturally.
4. The research participant behaved in a way that I would expect most people to behave under the same circumstances.
5. I had the impression the research participant in the video was reacting to the material presented to her.

Appendix I: Still from the Vicarious Learning Video Containing the Asian Female Model

Appendix J: Chronic Anxiety Scale Items

Chronic Anxiety (5 items)

Imagine a hypothetical situation. You are in a group of people, and you are the only person with your ethnic background among people with a Black background. How would you feel in that situation, compared to a situation in which you are in a group of people all sharing your ethnic background? How much would you feel:-

1. Anxious
2. Relaxed (reverse scored)
3. Calm (reverse scored)
4. Distressed
5. Thinking about the past interactions you have had with Black people, are most interactions anxiety provoking

Appendix K: Sample Similarity to the CS+/CS- Item

Soon you will be presented with a series of pairs of faces. Each pair will be presented in turn at the centre of the screen.

Your task will be to rate the pairs in terms of their perceived SIMILARITY.

We are interested in how similar you find the faces within each pair. For this rating task, we would like you to use rating scales like the one below.

SIMILAR

Not at all	1	2	3	4	5	6	7	*Very much*

You will select the number 1 on the rating scale if you regard the two faces to be NOT AT ALL SIMILAR. You will select the number 7 if you regard the two faces to be VERY SIMILAR.

You can choose any number between 1 and 7 that best describes your most immediate reaction to the pair of faces.

SIMILAR

Not at all	1	2	3	4	5	6	7	*Very much*

Appendix L: Model Anxiety Scale Items

Model Anxiety (3 items)

1. In the segments of the video where the participant looked apprehensive or anxious, how apprehensive or anxious did she look?
2. The research participant looked like being more and more anxious as the video progressed?
3. In the segments of the video in which the research participant looked like experiencing pain, how much pain do you think she experienced?

Appendix M: Information Sheet

FACULTY OF SCIENCE AND INFORMATION TECHNOLOGY

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

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E-mail: Andrea.Griffin@Newcastle.edu.au

INFORMATION SHEET

V#1: 17/03/09 (all, lab)

Please read this Information Sheet carefully and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions about the study, please ask the researcher.

Welcome here today and thank you for your interest in participating in this work.

You are invited to participate in the research project identified above which is being conducted by research students Nicholas Harris, and Jenna Pickard from the School of Psychology at the University of Newcastle. This project is being carried out under the supervision of Dr Andrea Griffin and Dr Stefania Paolini, both lecturers in Psychology, also from the University of Newcastle. The purpose of our research is to investigate the role of learning in the acquisition of anxiety responses to human faces. This will be done using responses to faces of people from different backgrounds. Research in this area is important because by understanding whether healthy people learn to behave anxiously in certain situations, we can better help them overcome their fears.

Students from the University of Newcastle can participate in this research. Participation is entirely voluntary. <u>However, you must not have participated in previous phases of this research work.</u> Only those who give their informed consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you. You may also withdraw from the project at any time without giving a reason. However, we do not expect any serious risks or discomfort to arise from your participation.

You should have already completed a brief on-line survey (20 minutes) in your own time prior to attending this laboratory session.

During today's 2-hour lab session, you will be asked to look at a series of computer generated human faces presented on a computer screen and complete some simple rating scales (e.g., attractiveness) to express your reactions to these faces. Several non-invasive psycho-physiological measures of your responses to the facial stimuli will also be collected. These include galvanic skin responses (which detect changes in skin conductance related to sweat gland activity) and respiration rate. For this, two electrodes will be placed around two of your fingers, and you will be asked to place a belt around your chest. This recording procedure is not painful and participants do not regard it as being unpleasant or uncomfortable.

While viewing the computer generated faces, you will be administered a small number (between 5 and 10) of mild electric stimulations to one of your fingers, the level of which you will set yourself at the start of the laboratory session, so that stimulation is definitely uncomfortable, but not painful. As you may feel somewhat apprehensive about the idea of being electrically stimulated, the following information has been designed to provide you with sufficient information about the techniques used to enable you to make an informed decision as to whether you wish to participate in this study. Electrical stimulation is widely used in learning research around the world to induce a slightly heightened level of anxiety or arousal. To give you an idea of the level of arousal we expect you will experience during the study, the sensation will be similar to that you might experience when you watch a thriller, or a war movie on TV, or when someone unexpectedly touches you on the shoulder while you work on your computer. Mild electrical stimulation is delivered by a purpose built device called a stimulus isolator that has passed internationally recognised, and very strict safety standards imposed by International Electrotechnical Commission (IEC; IEC60601), and which is widely used in human psycho-physiological research, including undergraduate teaching labs for students in Human Physiology.

If you agree to take part in the lab study, the second digit of your left hand will be cleaned using a wipe before covering a small area on the shock electrode with a thin layer of standard (NaCl electrolyte) cream. This cream is to protect your skin against any sensation of heat that stimulation might produce. The cream will cause no discomfort. The electrode will then be attached to the surface of your finger using tape.

You will then be taken through a standard ‘work-up’ procedure, which allows you to self-determine your own individual level of stimulation intensity.

As part of the ‘work-up’ procedure, the researcher will first show you the computer to which the electrode is connected and its operation. Second, you will be asked to sample the stimulation, starting at the lowest intensity, which you will hardly be able to feel, and gradually increasing the intensity in small increments yourself until a level is reached that you judge to be definitely uncomfortable, but not painful. Your evaluation of your level of tolerance should take into account that you can expect to receive between 5 and 10 stimulations of your selected level during the subsequent testing session.

You can be reassured that this procedure will not be painful, will not burn you and will not put you in any danger. This is because even if you were to set the level of stimulation at the maximum level this device can deliver, the current you would receive would be so small, and so short that it would not cause you any injury. In the unlikely event that the cream between the electrode and your skin were to dry up during the testing session, a light on the front of the equipment will indicate this to the researcher. If this were to happen, the electrode will be removed and the cream re-applied.

Once you have completed this procedure, you will be ready to take part in the lab portion of the study. Once again, you are free to withdraw from the project at any point during the ‘work-up’ procedure or there after.

Exclusion Criteria

Although risks to the healthy participant are negligible, please note that following the safety recommendations of the PowerLab manufacturer, people with specific health conditions should not undergo electrical stimulation. You will not be allowed to take part in this study if you respond affirmatively, to one or more of the questions below:

1. I have clinical anxiety
2. I have compromised peripheral sensation (e.g., from advanced forms of diabetes, or any other condition that compromises sensation in your fingertips)
3. I have a cardiac condition
4. I am equipped with an implanted or external pacemaker
5. I have a history of epileptic episodes
6. I have suffered a stroke
7. I am pregnant

We aim to collect anonymous data during this study. However, should the data collected during the study suggest that the study has caused your arousal to increase, the researcher will encourage you to provide your contact details and give permission to contact you a few days after the laboratory session to ensure that you are feeling ok. Moreover, if you feel anything in this study has brought up feelings of distress, please contact the University of Newcastle Counseling Service located in the Hunter building at Callaghan campus or student support unit near the library at Ourimbah campus immediately. They can be contacted at Callaghan by telephone (49215801) or at Ourimbah by telephone (43484060) or alternatively by e-mail (counselling@newcastle.edu.au). Their service is free of charge.

You will be free to withdraw from the study without giving a reason and without incurring an academic penalty. Your anonymity will be protected at all times during this study by use of a dummy code. The data from this study will be analysed and reported in an aggregated and de-identified manner and stored securely in the School of Psychology for a minimum of 5 years. You can request a summary of the research results by e-mailing the researcher at Andrea.Griffin@newcastle.edu.au any time after 1st March 2010. Alternatively, you will be able to complete a *Results Feedback Options* form at the end of the laboratory session to ask for the summary to be emailed to you after 1st March 2010.

To participate, you will need to read and sign the Electric Stimulation Check Form and the Consent Form that are in front of you.

Please keep this information sheet for your own reference. Any additional enquiries about the study may be directed to Dr A. Griffin, whose contact details appear at the top of this information sheet.

Thank you for considering this invitation. Your contribution to research in this area is important. By understanding mild anxious responses in healthy people, we can inform better interventions to help anxious people overcome their fears.

Research Team:

Chief Investigators:
Dr A. Griffin, Dr S. Paolini

Research Students:
N. Harris, J. Pickard

Chief Investigators: Dr Griffin, Dr Paolini Research Team: Nicholas Harris, Jenna Pickard, School of Psychology, The University of Newcastle, Telephone: (02) 49217161. This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2009-0104 Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone 02 49216333, e-mail Human-Ethics@newcastle.edu.au

Appendix N: Consent Form

FACULTY OF SCIENCE AND
INFORMATION TECHNOLOGY

THE UNIVERSITY OF
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Fax: +61 2 4921 6980
E-mail: Andrea.Griffin@Newcastle.edu.au

CONSENT FORM

What's In a Face? Intergroup Learning Study

I have been invited to participate in the research project being conducted by Nicholas Harris, Jenna Pickard and Paul Williams, who are supervised by Dr Griffin and Dr Paolini. I agree to participate in the above research project and give my consent freely by signing this form.

I understand that:

- ❖ The study will be carried out as described in the Information Sheet, a copy of which I have retained.
- ❖ The information that I provide during the investigation will be strictly confidential to the research team.
- ❖ I can withdraw from the project or any procedure **at any time** without penalty and do not have to give any reason for withdrawing.

- ❖ I have had all my questions answered to my satisfaction and I understand that I will be fully debriefed about the rationale of the study at the end of my participation.

I consent to

- o Have my data from the Completed on-line survey used for this experiment.
- o Attend a 2 hour session in the psychology laboratories in the behavioural sciences building (Building W) at the Callaghan campus or in the science office building (Building SO) at the Ourimbah campus.
- o Look at a series of human faces presented on a computer.
- o Complete some simple rating scales to express my reactions to these faces.
- o Provide non-invasive psycho-physiological measures of response to the facial stimuli. I understand that this procedure is neither painful nor unpleasant.
- o Receiving electric stimulation to one of my fingers while acknowledging that I do not have clinical anxiety, compromised peripheral sensation, a cardiac condition, an implantable or external cardiac pacemaker, or a history of epileptic episodes; nor have I suffered from stroke.
- o Undergo electrical stimulation to one of my fingers of a level that I will be free to set prior to the beginning of the testing session.
- o Use my own free will to set the strength of the electrical stimulation at a level that I experience as uncomfortable, but not painful.

- Receive between 5 and 10 electric stimulations (at my own specified level) to my finger.
- Participating in a study that may make me feel anxious.

Please print your name, add your signature and the date in the spaces provided below:

Name: …………………………………………………………………..

Signature: ………………………………………………………………

Date: ……………………………………………………………………..

V#1 17/03/09

Chief Investigators: Dr Griffin, Dr PaoliniResearch Team: Nicholas Harris, Jenna Pickard, School of Psychology, The University of Newcastle, Telephone: (02) 49217161. This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2009-0104 Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone 02 49216333, e-mail Human-Ethics@newcastle.edu.au

Appendix O: Electric Stimulation Check Form

FACULTY OF SCIENCE AND
INFORMATION TECHNOLOGY

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

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ELECTRIC STIMULATION CHECK FORM

What's In a Face? Intergroup Learning Study

I have read the information sheet and understand that this study involves electric stimulation that will be delivered to me during the laboratory session of this study. I accept that I will receive electric stimulation and agree to participate. I state that I do NOT have

- Clinical anxiety
- Compromised peripheral sensation
- A cardiac condition
- An implantable or external cardiac pacemaker
- Any history of epileptic episodes
- A history of stroke
- Nor am I currently pregnant

I have read this form and acknowledge that I do not have any of the 6 above conditions. I also confirm that the researcher has verbally checked that I do not have any of the above six conditions before asking me to read and sign the study's Consent Form.

Please print your name, add your signature and the date in the spaces provided below:

Name: ……………………………………………………………………..

Signature: ………………………………………………………………

Date: ……………………………………………………………………

Chief Investigators: Dr Griffin, Dr Paolini Research Team: Nicholas Harris, Jenna Pickard, School of Psychology, The University of Newcastle, Telephone: (02) 49217161. This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2009-0104 Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone 02 49216333, e-mail Human-Ethics@newcastle.edu.au

Appendix P: Debriefing Sheet

FACULTY OF SCIENCE AND
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THE UNIVERSITY OF
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What's in a face? Intergroup Learning Study

Debriefing Sheet

V#2: 22/04/09

Thank you very much for the time you have taken to participate in this study. We appreciate your contribution to our research project. Below you will find a description of the research rationale.

The Need for Confidentiality

Because there is ample evidence that knowing the research hypotheses of a psychological study before taking part in it often invalidates its data, we would be extremely grateful if you did not talk about this study and its nature to your friends and colleagues, who may also decide to participate in the future. This way, future data collection will not be affected by their pre-existing knowledge about the nature of the study. We appreciate your confidentiality.

The Procedure and Research Hypotheses

At the start of this study, you were informed that the research was looking at the role of learning in the acquisition of anxiety responses. This is important because by understanding whether healthy people learn to behave anxiously in certain situations, we can better help them overcome their fears.

We expect that the online survey would be directly related to your learning results. Psychological research suggests that the extent to which one is familiar with a group will affect the extent to which we learn about this group in the future.

(Chapter 2 and 3, Study 1):

During the learning task, half of the participants were randomly allocated to a direct learning condition, where they directly experienced pairing of human faces with electric stimulation. Half of participants were instead allocated to an indirect learning condition, where they did not have a personal experience of the pairing of human faces with electric stimulation. Instead they watched a video about another person experiencing the pairing.

Although learning of aroused responses are likely to be less pronounced in the indirect than in the direct condition, we still expect to detect it in the indirect learning condition.

(Chapter 2 and 3, Study 2):

(Chapter 4):

We expect that the online survey would be directly related to your learning results. Psychological research suggests that the extent to which one is familiar with a group will affect the extent to which we learn about this group in the future.

During the learning task, all participants were allocated to an indirect learning condition, where they did not have a personal experience of the pairing of human faces with electric stimulation. In this section, they watched a video about another person experiencing the pairing. Although they did not experience any electrical stimulation, we still expect to detect arousal responses.

Participants also experienced a direct learning condition, where you did have a personal experience of the pairing of human faces with electric stimulation. The order of these learning conditions was varied, so that half our participants experienced the direct condition first and the other half experienced the indirect condition first.

This study aims to directly test learning and contact theory by comparing and contrasting the learning mechanisms that underpin direct and indirect learning. That is, we are investigating whether the acquisition, generalisation, immunisation and facilitation of anxiety is similar or different when experienced first-hand and when observed. We expect that participants who first watch the video will display lower anxiety levels, since people are more anxious if an aversive event (e.g. stimulation) will occur to them compared to another person (Olsson, Nearing & Phelps, 2007).

(Chapter 5):

During the learning task, half of the participants were randomly allocated to be an under-estimator and the others were assigned to be an over-estimator. Following this, all participants viewed faces from each group, with one over-estimator and one under-estimator face being paired with an electric stimulation, whereas an additional over-estimator and under-estimator face was never paired with an electric stimulation.

This phase is known as acquisition. During acquisition, one face (CS+) is paired with an event, whereas another face (CS-) is never paired with an event. We are interested in generalisation, or spread, of this learned response. That is, it is expected that people change their physiological responses (sweating, breathing) and self-reported responses (anxiety, attractiveness) to a face paired with an event compared to a face not paired with such an event.

(All):

Merits and Significance of This Research

This research is important because it aims to guide the development of effective strategies to reduce intergroup anxiety and intergroup tension in society at the individual-level and societal-level.

By combining learning theory, intergroup contact theory, and physiological measurements of autonomic arousal, the proposed work will form the basis of a powerful and novel approach to examining the role of learning in intergroup relationships. Understanding the nature of the learning mechanisms responsible for acquisition, generalization, and extinction of heightened autonomic responses to ethnic stimuli and identifying how quality and quantity of prior contact and pre-existing anxiety affect acquisition-generalization-extinction will guide both the direction of future research and the development of effective strategies to reduce intergroup tension.

Final Note

Now that you have been fully informed about the nature of this research, you may wish to reconsider your decision to consent to participate. If this is the case, you do not need to give any reason for withdrawing from the research at this stage.

If you feel that you no longer wish to participate, please inform the researcher now and your data will be destroyed as soon as practical. If you wish to allow your data to be included in the research, then please indicate this decision to the researcher now. For practical reasons, we will be unable to withdraw your (de-identified) data at a later time unless you ask for this now.

Contact Details

Again, thank you for taking part in this study. Your help is greatly appreciated. If you have any comments, queries, or complaints, or if you would like to know more about the research, then please contact Dr Andrea Griffin.

University Counselling and Health Services

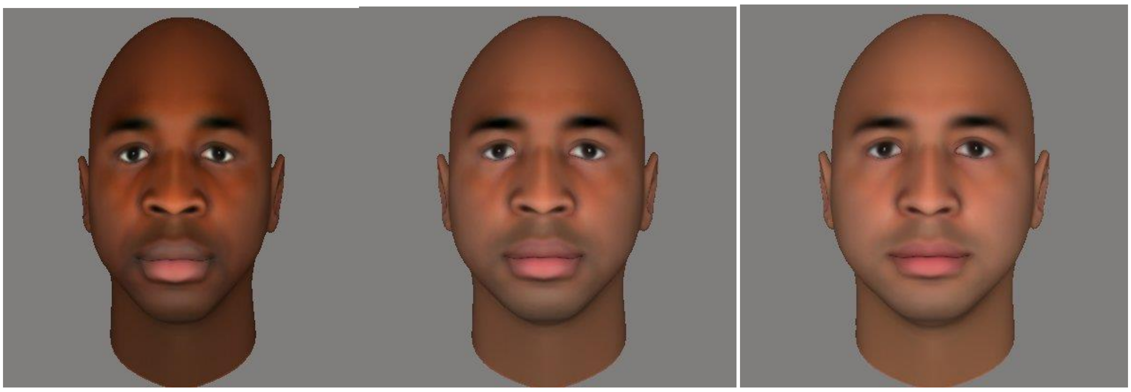
Should you feel that anything in this study has brought up feelings of distress, please contact the University of Newcastle Counselling Service located in the Hunter building on the Callaghan campus or the student support unit near the library at Ourimbah campus. They can be contacted by telephone (49215801 at Callaghan or 4348 4060 at Ourimbah) and by e-mail counselling@newcastle.edu.au). Their service is free of charge.

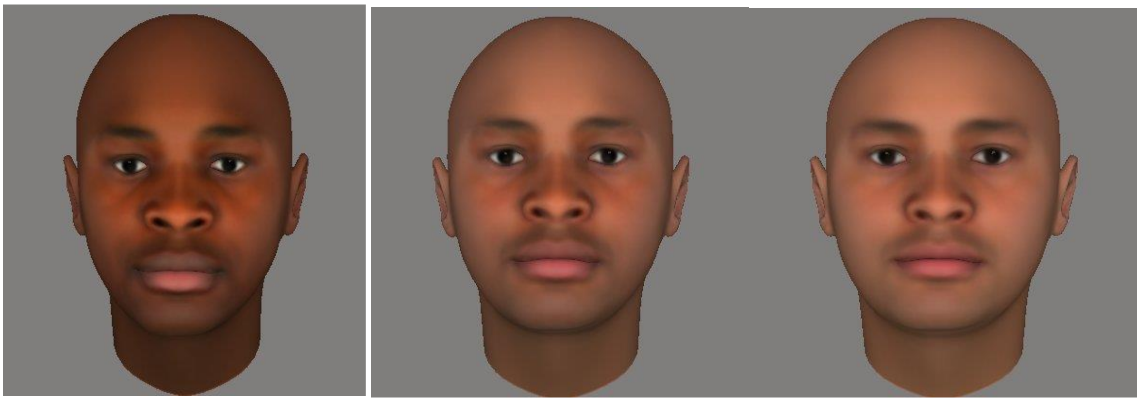
Should you feel that anything in this study has given rise to any physical health concern, please contact the University of Newcastle Health Service and make an appointment to see a General Practitioner. The service can be contacted by phone on 4921 6000 at Callaghan or 4348 4060 at Ourimbah. This service is free of charge.

Ethics Committee, Approval No. H-2009-0104 Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone 02 49216333, e-mail Human-Ethics@newcastle.edu.au

Appendix Q: Larger Set of Faces Shown for Generalization Purposes (Chapters 2 and 3, Study 2, and Chapter 4)

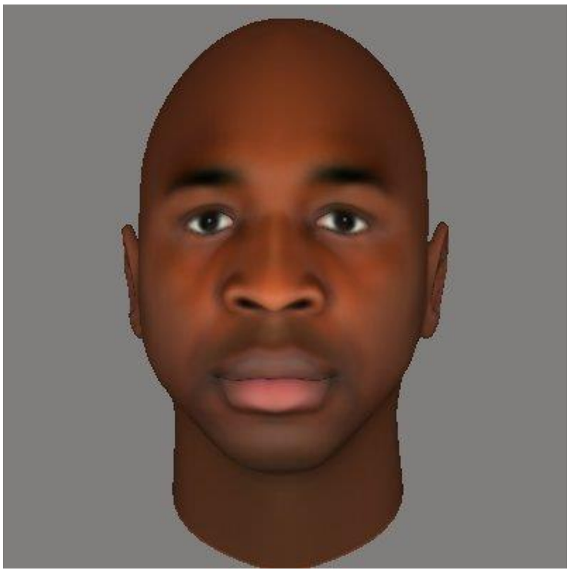
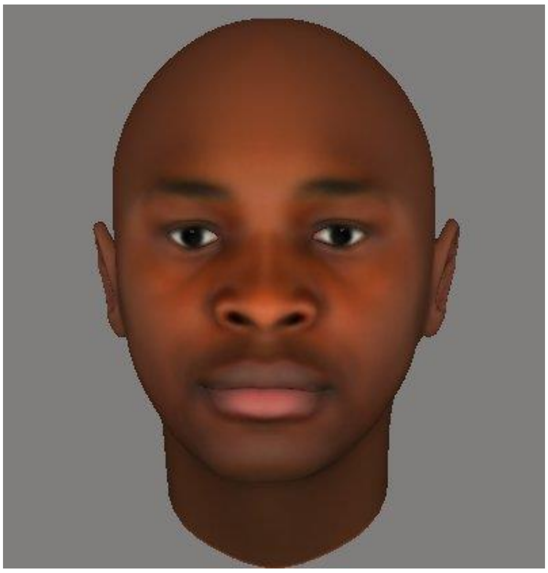
Original Training Faces 75% Similarity faces 50% Similarity
Faces





New Outgroup Exemplar Faces

Appendix R: Pictures counterbalanced as the CS+ and CS- (Chapters 2 and 3, Study 2, and Chapter 4)

Appendix S: Typicality Sample Item

Soon you will be presented with a small set of faces.

We are interested in you indicating how PROTOTYPICAL you see each face in regards to their estimation group. In other words, we want to know how well each face fits your general idea about how "Blue" Over-estimators and "Green" Under-estimators look.

You will be asked to express your ratings on rating scales like the one below

PROTOTYPICALITY RATINGS

"Green" Under-estimator	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	*"Blue" Over-estimator*

During the task, you can choose any number between 1 and 7 that best describes your most immediate perception to the face, with 1 indicating that you perceive the face as being a prototypical "Green" Under-estimator, and 7 indicating you perceive the face as being a prototypical "Blue" Over-estimator.

Please remember to respond based upon your first impression and be as frank as you can.

When you are ready to complete the prototypicality ratings, click the "Continue" button.

PROTOTYPICALITY RATINGS

"Green"	○	○	○	○	○	○	○	*"Blue"*
Under-								*Over-*
	1	2	3	4	5	6	7	
estimator								*estimator*

Appendix T: Contingency Awareness Sample Item

Did you notice any regularity as to when you received electrical stimulations?

○ Yes ○ No

What was the pattern that you noticed? Please provide as much detail as possible.

Which face(s) was/were shown when YOU received electrical stimulations?

(the four target faces shown during the study were displayed here)

How confident are you?

Not at all confident	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	*Very confident*