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An Examination of Defensive Accommodation to Threat:
Exploring the Conditions under which People Will Modify their Protective Beliefs

by

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Dedication

To my friend and mentor, Dr. Ted Wright, whose guidance and encouragement in my early development as a student spurred me to pursue graduate studies, and thus ultimately led to this dissertation.

Abstract

Although terror management research has focused extensively on defensive responses to threat such as derogation, scant research to date has assessed alternative responses. One such alternative, termed *accommodation*, involves accepting and incorporating parts of the threatening information into existing belief-structures. The present research assessed the effects of threat, mortality salience, and trait self-esteem on accommodation of protective beliefs. Five studies are presented showing that people will generally accommodate their worldview (Studies 1-4) and self-esteem (Study 5) beliefs in response to threat. Moreover, accommodation is found to result from the same conditions that promote derogation (Study 4), and engaging in one type of defense was found to generally reduce the tendency to engage in another (Studies 2-5). In response to worldview threat under conditions of mortality salience, only participants with low self-esteem tended to respond with accommodation. Participants with high self-esteem, by contrast, refused to accommodate (Studies 1-3) and opted instead to derogate the source of threat (Studies 2-3). Inducing people with low self-esteem to affirm an important value prior to the mortality salience manipulation produced a similar tendency to forgo accommodation in favour of derogation (Study 3). Discussion focuses on implications for terror management theory generally, with specific reference to available responses to worldview and self-esteem threat, and the role of trait self-esteem in these responses.

Keywords: accommodation, derogation, worldview defense, threat, mortality salience, self-esteem, terror management theory

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Table of Contents

List of Tables

List of Figures

CHAPTER 1:

General Introduction

An Examination of Defensive Accommodation to Threat: Exploring the Conditions under which People Will Modify their Protective Beliefs

At one point or another, we all have experiences that lead us to change the way we think about something. The child, for instance, who finds a cache of Christmas presents hidden under his parents' bed, comes to doubt his previously unshakable belief in Santa Claus. By the same token, the scientist who finds evidence that contradicts his theoretical perspective may start to question the theory and attempt to modify it to fit the data. However, the way in which we change our beliefs – especially those pertaining to issues that we deem important – does not always proceed in a rational and unbiased manner.

Changing our beliefs in response to contradictory evidence is often something that we undertake with great hesitation. Indeed, beliefs can be highly resistant to change, even in the face of overwhelming evidence (e.g., Festinger, Riecken, & Schachter, 1964; see also Knowles & Linn, 2004). One theoretical perspective that attempts to shed light on the underlying reasons for this resistance is terror management theory (TMT; Greenberg, Pyszczynski, & Solomon, 1986). According to TMT, we resist changing beliefs that are important to us because of the protective properties that they possess. From this perspective, beliefs about the nature of reality serve a death-anxiety buffering function (Becker, 1973), and changing them could compromise their ability to protect us from this anxiety. Nevertheless, people do sometimes change beliefs that are quite important to them, and despite the risks associated with this change, sometimes it precedes as a

way of defending the self against threat. The purpose of this dissertation is to outline and discuss the conditions under which people will change certain aspects of their beliefs as a way of defending themselves.

Terror Management Theory and the Function of Important Beliefs

According to TMT, the human condition is characterized by a fundamental paradox in which we simultaneously possess an insatiable desire for continued life, and the awareness that we must inevitably die (Becker, 1973). This existential dilemma creates the potential for paralyzing anxiety, which must be managed on a regular basis to ensure psychological equanimity. This task is accomplished by investment in a dual-component cultural anxiety-buffer, consisting of (1) a cultural worldview and (2) self-esteem.

A cultural worldview is essentially a broad-based belief system, which renders reality comprehensible and predictable, suggesting that death is not a cause for immediate concern. Moreover, worldviews provide answers to our most basic questions about existence: such as how life arose, how it should be lived, and what happens after death. In terms of how life arose, religious worldviews, for example, typically maintain that life was created by God or some supernatural force. By contrast, secular/scientific worldviews maintain that life arose due to natural forces involving evolution. By prescribing how life should be lived, a cultural worldview provides a set of value standards through which individual members of the culture, or particular ways of living a life, can be evaluated. These standards thus provide the basis for self-esteem, which represents an individual's subjective belief that he or she is successfully living up to the values of the

cultural worldview. From this perspective, self-esteem can be conceived as an indicator of the degree to which the worldview is effectively providing protection against death-anxiety. People with high self-esteem feel securely embedded in the social fabric as valuable members of an enduring culture, while people with low self-esteem feel devalued, unappreciated, or even expendable; and that the world would be either better off or no different without them. Finally, worldviews contain beliefs about what will happen to us when we die, and usually promise some form of death-transcendence to those who successfully adhere to the cultural standards of value. Some worldviews promise literal immortality, typically in the form of a blissful afterlife, while others offer symbolic forms of immortality. Although each individual member of society must one day die, cultures can endure and carry on the memory of those who provide exceptional contributions to society in their historical records. In summary, although the number of different worldviews is limitless, from the perspective of TMT, these beliefs, and the self-esteem that we derive from them, ultimately function to shield us from concerns about death.

Empirical Support for TMT

The vast majority of empirical support for TMT is derived from the mortality salience (MS) hypothesis (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989), which states that if a set of beliefs provides protection against thoughts of death, then reminding people of mortality should increase their need for these beliefs. In other words, inducing people to think about their death should increase their faith in their cultural worldview and their

need for self-esteem. To date, hundreds of studies have supported this hypothesis (see Burke, Martens, & Faucher, 2010; Solomon, Greenberg, Pyszczynski, 2004, for reviews). For instance, priming thoughts of death or making mortality salient has been shown to increase people's confidence in the validity of their worldview beliefs (Pyszczynski et al., 1996). Likewise, MS has been found to increase liking for people and ideas that support one's worldview and decrease liking for people and ideas that challenge one's worldview (Greenberg et al., 1990; Rosenblatt et al., 1989). Moreover, MS has even been shown to increase people's tendency to behave aggressively toward people who threaten their worldview (McGregor et al., 1998), and to increase their support for violent confrontation with worldview-threatening out-group members (Pyszczynski et al., 2006). Similarly, thinking about death has also been found to increase people's reluctance to violate cultural standards (Greenberg, Simon, Porteus, Pyszczynski, & Solomon, 1995), and increase their motivation to perform well at valued tasks that convey self-esteem (e.g., Taubman-Ben-Ari, Florian, & Mikulincer, 1999; Peters, Greenberg, Williams, & Schneider, 2005). Importantly, MS effects do not appear to be the result of heightened self-awareness, physiological arousal, negative mood (Rosenblatt, et al., 1989), or priming of cultural values (Greenberg, et al., 1995); nor does thinking of other aversive topics (e.g., intense pain; Arndt, Greenberg, & Cook, 2002) produce the same effects as thinking about death (but see Heine, Proulx, & Vohs, 2006, for an antithetical perspective). Thus, it appears that the effects induced by mortality salience are specifically associated with the problem of death.

More recently, TMT studies have begun to examine the converse of the MS hypothesis, which Schimel, Hayes, Williams, and Jahrig (2007) refer to as the death-thought accessibility (DTA) hypothesis (see also Hayes, Schimel, Faucher, & Williams, 2008). According to this hypothesis, if a set of beliefs provides protection against thoughts of death, then attacking or threatening these beliefs should compromise their integrity, rendering thoughts of death more accessible to consciousness. In other words, threatening important worldview or self-esteem beliefs should increase DTA. In support of this idea, Schimel et al. (2007) found that threatening people's cultural worldview increased DTA (see also Friedman & Rholes, 2007; Hayes, Schimel, & Williams, 2008; Landau et al., 2004). Notably, this effect does not appear to be the result of a general increase in the accessibility of negative constructs, nor increased anger or anxiety (Schimel et al., 2007). Potent threats to close personal relationships (Mikulincer, Florian, Birnbaum, & Malishkevich, 2002), or to one's overall sense of self-esteem (Hayes, Schimel, Faucher, et al., 2008; Ogilvie, Cohen, & Solomon, 2008) have also been found to increase DTA, and fortifying self-esteem through self-affirmation (Steele, 1988) can eliminate this effect (see Hayes, Schimel, Arndt, & Faucher, 2010, for a full review).

The Threat of Opposing Worldviews and Various Ways of Responding

Given that our beliefs about the world (cultural worldview) and about ourselves (self-esteem) function in part to manage thoughts and concerns about death, a good deal of energy is devoted to their overall maintenance. For cultural worldview beliefs to function effectively, they must be perceived as valid. One of

the most important means through which people maintain faith in the validity of their worldview beliefs, is by observing others who share these beliefs. Maintaining faith in one's beliefs is relatively easy when other people validate those beliefs (implicitly or explicitly) on a regular basis. By implication, however, the mere existence of others who do *not* share one's faith in one's worldview poses a threat to the ultimate validity of that worldview. Other people who have faith in a different conception of reality imply that one's own beliefs may be false – and this is especially the case when certain aspects of their belief system are directly at odds with one's own. For example, the Judeo-Christian belief that God is the creator of the universe and life on earth is in direct conflict with the scientific notion that the universe arose through natural causes and that life arose through evolution. Thus, people who believe in creationism often feel threatened by scientists who study evolutionary history, and vice-versa (Larson, 2004). Regardless of the specific nature of the conflict, however, whenever one's worldview beliefs run up against alternative beliefs, the validity of the worldview is threatened. And given that worldview beliefs function to manage existential anxiety, defensive responses are generally initiated to reduce this threat.

Derogation

Following Becker (1973; 1975) and Berger and Luckmann (1966), TMT proposes that there are several ways of defending against worldview threats (see e.g., Solomon, Greenberg, & Pyszczynski, 1991). Typically, the first line of defense is to dismiss the threatening beliefs, often by derogating adherents to such beliefs as untrustworthy or unintelligent. For example, if the people who possess

these beliefs are perceived as intellectually inferior and therefore unable to differentiate between what is correct and what is incorrect, then one need not be concerned with what they think. As such, one can remain convinced that one's own beliefs are indeed still valid, because only those deemed to be fools would think otherwise.

A large number of empirical studies have shown that people do indeed derogate adherents of alternative worldview beliefs. In research on the effects of exposure to counter-attitudinal messages, for instance, source derogation has often been assessed as a way of resisting the persuasion attempt (e.g., Festinger & Maccoby, 1964; Jacks & Cameron, 2003; Lapinski & Boster, 2001; Tannenbaum, Macaulay, & Norris, 1966). Jacks and Cameron (2003), for example, found that participants will spontaneously derogate the source of a counter-attitudinal message, and this effect is most pronounced among those with strong attitudes toward the issue in question. From a TMT perspective, strongly held attitudes represent central components of an individual's worldview. Increased derogation among individuals with strongly held attitudes is therefore consistent with the notion that derogation provides defense against the threat of alternative worldview beliefs. Moreover, several attitude researchers have long argued that attitudes should be understood in terms of their functions (e.g., Dillard, 1993; Katz, 1960; Smith, Bruner, & White, 1956), and many have argued that important attitudes can serve an ego-defensive function (Katz, 1960; Lapinski & Boster, 2001; Steele, 1988). TMT would suggest that attitudes – especially strong attitudes that one holds dear – represent important aspects of an individual's worldview and

therefore function in part to manage concerns about death. Direct support for the idea that derogation provides worldview defense as a means of protecting specifically against death-anxiety was obtained by Greenberg et al. (1990) who found that mortality salience increases people's tendency to derogate attitudinally dissimilar others.

Evidence for the use of derogation as a defense against threat can also be found in the real world. In ancient Rome, for instance, Christians were often persecuted by non-Christians, and their rituals were denigrated as incestuous and cannibalistic (MacCulloch, 2009). Even today, people of differing religious faiths often have difficulty getting along, as adherents to the alternative faith are commonly derided for not being able to see the "error" of their ways. According to TMT, such discord results from the mutual threat posed by those who possess alternative worldview beliefs.

From a functional perspective, derogation can provide a very adaptive means of defense, as it preserves the existing belief structures. By derogating the source of information or beliefs that are inconsistent with existing knowledge structures, one can avoid having to change these structures – a task that would require relatively large amounts of cognitive energy and would risk placing the entire worldview in a state of disequilibrium (Heider, 1958; Piaget, 1977).

The trouble with derogation, however, is that the targets of derogation are often not dissuaded by such efforts. People who hold an alternative worldview will usually persist in their beliefs, despite efforts to derogate them. Moreover, if the number of adherents to the alternative belief-system is too great, it becomes

increasingly difficult to remain convinced that only wrong-minded people would believe such things. This difficulty is further compounded when members of alternative worldview groups are in constant contact with each other. Such a presence would represent a constant reminder that one's own beliefs are not absolute. Thus, although derogation is an effective means of defense in the short term, and against a relatively small and numerically static group of non-believers, this mode of defense often fails in long-term cases of repeated contact, and must therefore be supplemented by additional defenses.

Assimilation

When derogation is insufficient to reduce the threat implied by adherents to an alternative worldview, assimilation may be used as another type of defense. This use of the term assimilation is distinct from the way in which Piaget and other cognitive psychologists have used it. Rather than referring to assimilation of the information, this use of the term refers to assimilation of the person who perpetuates the information. That is, assimilation as a mode of defense in the present context involves active attempts to convince non-believers of the merits and validity of one's own perspective. Religious missionary work and political proselytizing are among the most common forms of assimilative efforts. When assimilation is successful, faith in one's beliefs is boosted and any doubt that may have been experienced as a result of contact with non-believers is reduced or eliminated. Indeed, recent research by Gal and Rucker (2010), shows that it is precisely when confidence in one's beliefs is shaken and feelings of doubt start to creep in that people are most motivated to convince others of the merits of the

threatened beliefs (cf. Festinger et al., 1956). What better way to assert the validity of one's beliefs than to convince others to abandon their beliefs in favour of one's own? Certainly, no rational person would do so if the beliefs in question were not clearly superior. Thus, much like derogation, assimilation acts as a defense against threat by reinforcing faith in one's beliefs, and thereby mitigating the threat implied by the existence of alternative belief systems.

Annihilation

All too often, however, neither derogation nor assimilation is successful at providing relief from the threat of alternative worldviews. Adherents to such alternatives are usually not convinced to abandon their beliefs. Moreover, to the extent that members of each worldview group are equally threatened by the existence of the other, derogation and attempts at assimilation are likely to be mutually enacted. In such cases, people will sometimes go to extremes to defend their beliefs by lashing out violently (McGregor et al., 1998) and advocating the annihilation of the opposing group (Pyszczynski, Abdollahi, et al., 2006). Unfortunately for humanity, the result of these efforts is often protracted inter-group violence and bloodshed, as both groups of people are bent on the annihilation of the other. History is fraught with examples of violent war between people who maintain alternative conceptions of reality. The ongoing Israeli-Palestinian conflict serves as a potent example of a self-perpetuating cycle of death and destruction that can ensue when people of opposing worldviews enter into violent conflict.

From a theoretical perspective, annihilation may be the ultimate form of defense, as the complete annihilation of adherents to an alternative worldview will eradicate the threat once and for all. But also, when members of an opposing worldview group die, it implies that their beliefs were insufficient to protect them from the ultimate threat of death, which reinforces faith in one's own beliefs. As Hayes, Schimel, and Williams (2008) demonstrated experimentally, learning that a group of worldview violators has died can eliminate the impact of their violations by reducing concerns about one's own death. Thus, when other types of defenses are insufficient or fail to bring the threat under control, the annihilation of adherents to an opposing worldview is another, more extreme, form of defense against threat.

Conversion

Although derogation, assimilation, and annihilation all involve defending against threats by reinforcing faith in the validity of one's beliefs, there are at least two other types of responses that do not function in this manner. First, while highly rare, another way of disposing of the threat implied by an alternative conception of reality is simply to convert to the alternative perspective – abandoning one's own worldview and taking up the other. As the saying goes, "if you can't beat them, join them." This type of response is essentially the converse of assimilation, wherein one's own beliefs are changed rather than attempting to change the beliefs of others.

In order for conversion to be undertaken, the alternative worldview must be viewed as highly compelling. In other words, it might be perceived as the

"right" worldview (Barro, Hwang, & McCleary, 2010). But persuasiveness aside, conversion is rare because this response often entails trading a threat posed by an alternative worldview for the threat that would (after conversion) be posed by one's previously held worldview. Moreover, given that groups of people who share similar beliefs usually spend more time together (Byrne, 1971), converting to another worldview often involves exchanging one's network of friends. Thus, conversion becomes more likely when one becomes associated with people who possess the alternative worldview (Lofland & Skonovd, 1981). In general, one's social network, as well as the general social context in which one lives, can convey a number of costs and benefits associated with conversion, which will in turn influence whether or not a person converts (Barro et al., 2010; Rambo, 1993). From the perspective of TMT, conversion is most likely to occur among people with very few connections with other people who share their worldview, or among people with very low self-esteem (Zinnbauer & Pargament, 1998) or insecure attachment (Pirutinsky, 2009) who do not benefit from the protection against anxiety that a worldview should offer. The promise of a new way of life in which personal value is conferred upon an individual who otherwise feels insignificant can be a compelling motive for changing one's belief-system. Indeed, many conversion experiences are precipitated by a personal crisis or a period of intense anxiety, which is ultimately alleviated by conversion (James, 1902/2002; Rambo, 1993; Ullman, 1982). It should therefore be no wonder that the people of post-WWI Germany, who were economically and socially

devastated by the Treaty of Versailles, chose to follow Hitler – a visionary leader who provided a promise of prosperity to the German people.

Accommodation

While conversion is always an option, a more common response to highly compelling beliefs that conflict with one's current beliefs is to accommodate one's worldview to include certain aspects of the alternative. Specifically, accommodation involves accepting or modifying peripheral aspects of one's worldview, while retaining one's core beliefs. Indeed, often this type of defense involves divesting the threatening material of its impact on core worldview beliefs, which is accomplished by modifying peripheral worldview beliefs.

For example, at the societal level, the hippie counter-culture that arose in the United States during the 1960s advocated a return to simpler times in which status, appearance and gross-earnings were devalued (see e.g., Pyszczynski, Solomon, & Greenberg, 2003). Wearing blue jeans and eating wholesome, down-to-earth foods like granola, for example, were iconic expressions of this counter-culture. From the perspective of the mainstream cultural worldview, however, the hippie movement constituted a threat to the established order. In response, the entrenched corporations of the time accommodated the public's desire to express these counter-cultural ideals, while co-opting them for the maintenance of the status quo. High status clothes manufacturers, for instance, began marketing designer blue jeans and selling them for high profit. Similarly, mainstream cereal companies started making chocolate covered granola bars, filled with corn syrup and other complex, but cheaply produced substances. Thus, the accommodation of

the hippie counter-culture into mainstream society did not involve changing the core values and life-style of American culture, but rather only changed peripheral aspects of the culture to integrate features of the counter-culture that no longer carried any threat to the status quo.

An empirical illustration of accommodation can be seen in the research of Alhuwalia (2000), who studied attitudes toward Bill Clinton during the Monica Lewinsky affair. Alhuwalia (2000) observed that upon exposure to difficult-to-refute evidence of Clinton's unethical behaviour regarding the affair and lying to the grand jury under oath, Clinton supporters were compelled to downgrade their perceptions of Clinton's morality and honesty. However, whereas this effect easily spread to influence perceptions of Clinton in other domains (such as compassion and leadership ability) among non-supporters, those who supported Clinton limited the impact of the affair to attributes that were directly related to his misconduct. Clinton-supporters' perceptions of his compassion and leadership ability remained unaffected by the information regarding his affair, and in some cases (such as intelligence) they even upgraded their perceptions in compensation. Thus, for Clinton-supporters, whose worldview was highly invested in Clinton's overall ability to lead the country, the threat posed by the Lewinsky affair affected only their peripheral beliefs regarding his honesty and morality, but not core beliefs regarding his abilities as President.

Accommodation therefore represents a compromise, wherein some (but not all) previously held beliefs are abandoned or modified, and aspects of the alternative (threatening) beliefs are incorporated into an accommodated

worldview. The notion that this sort of cognitive-shuffling acts as a type of defense against threat is consistent with a number of long-standing perspectives on how people respond to information that is inconsistent with their extant beliefs.[1] For example, Piaget (1977) described events that cannot be assimilated by current schemata as "disturbances" or "intrusions," which disrupt cognitive equilibrium and therefore motivate accommodation of the defective schemata in order to re-establish equilibrium. Similarly, in his seminal work on scientific revolutions, Kuhn (1962) argued that when the validity of a scientific paradigm is threatened by the repeated occurrence of anomalous research findings, the paradigm is said to be in crisis. The experience of a prolonged crisis is said to be accompanied by a feeling of malaise among the scientific community. Scientific activity is then devoted toward resolving the crisis by modifying (i.e., accommodating) the paradigm; at least until the point at which modifications are no longer sufficient, and the adoption of a radically new paradigm is inevitable.

Historically, accommodation may be as prevalent as violence and war among opposing worldview groups. In response to the growing threat of Christianity, for instance, Roman culture eventually incorporated Christian beliefs into the mainstream worldview (MacCulloch, 2009). Similarly, in the early years of the spread of Christianity, many slightly divergent perspectives emerged, often sparking conflict among differing sects. Eventually, commissioned by Emperor Constantine, church leaders would come together at the council of Nicaea to reconcile (i.e., accommodate) these various perspectives (MacCulloch, 2009). Likewise, during the enlightenment, the increasingly compelling worldview

promoted by scientists, especially astronomers, that the earth revolves around the sun was initially resisted by the Roman Catholic Church (Kelter, 2005), but ultimately led the Vatican, and the world over, to revise the previously held belief that the earth was positioned in the centre of the cosmos (Kuhn, 1957; see also Russell, Stoeger, & Coyne, 1990). Given the repeated historical instances of accommodation among previously irreconcilable worldviews, which are often hailed as great accomplishments among ensuing generations, a refined understanding of how and when worldview accommodation will proceed is very much needed.

Under What Circumstances Will People Defend their Protective Beliefs via Accommodation?

Although TMT maintains that people will sometimes accommodate their worldview beliefs when those beliefs are threatened, no research to date has addressed the conditions under which this type of response is likely to take place. In the subsections that follow, I outline a few factors (there are no doubt others) that will likely influence the degree to which people will accommodate their worldview in response to threat.

Potency of Threat

Perhaps the most important factor that is likely to affect whether or not people will accommodate threatened beliefs is the potency of the threat levelled against those beliefs. Certainly, accommodation is more likely to ensue following strong threats than weak threats. Accommodating one's worldview should only be enacted when other means of defense are no longer viable (cf., Alhuwalia, 2000).

Weak threats can be more effectively disposed of through dismissal (by e.g., derogating the source of the threat). Resorting to accommodation too quickly would likely be maladaptive, as modification of the worldview is effortful and risks throwing one's conception of reality into flux. Moreover, should belief change ultimately prove unwarranted, the belief-change would then have to be reversed. As Block (1982) argues, when confronted with information that invalidates our beliefs, it may be most adaptive to follow a general pattern of "assimilate if you *can*, accommodate if you *must*" (p. 286). In other words, the first line of defense against threat is to stick with pre-existing beliefs until this strategy is no longer feasible, at which point accommodation is acceptable. Thus, accommodation should ensue only following relatively potent or repeated threats.

Mortality Salience and Death-Thought Accessibility

According to TMT, people have an increased need to defend their cultural worldview when mortality is salient, or when DTA is high. As such, one might expect accommodation to be most likely following MS, or following threats that increase DTA. This reasoning follows from the idea that worldview defenses are most necessary when the individual needs the worldview to provide its function (i.e., the MS hypothesis). Since worldviews are posited to provide protection against thoughts and concerns about death, worldview defenses such as accommodation should be most likely to ensue following threat when mortality has previously been made salient or when DTA is high.

Self-Esteem

Finally, TMT maintains that self-esteem buffers the individual from death-anxiety. Thus, another factor that might affect accommodation is self-esteem; especially under conditions of MS. However, there is some question regarding how self-esteem provides its buffering function. According to current theoretical articulations of TMT (e.g., Solomon et al., 2004), high levels of self-esteem provide *insulation* against death-anxiety. As such, death contemplation does not produce the same, high degree of defensiveness for people with high self-esteem as for people with low self-esteem (Harmon-Jones et al., 1997).

More recent articulations of the role of self-esteem in TMT, however, seem to suggest the opposite pattern. Specifically, McGregor, Gailliot, Vasquez, and Nash (2007) argue that, rather than providing insulation, high self-esteem provides the *resources* necessary to respond to self-threats such as MS (see Spencer, Josephs, & Steele, 1993; vanDellen, Campbell, Hoyle, & Bradfield, 2011). From this perspective, people with high self-esteem have more affirmational resources at their disposal than do people with low self-esteem. When faced with threat, high self-esteem affords the individual a greater pool of positive experiences and positive beliefs about the self from which to draw upon as a way of affirming the overall integrity of the self. In other words, people with high self-esteem are buffered against threat because they are more easily able to call upon and activate protective beliefs when threatened (Dodgson & Wood, 1998). Thus, in contrast to the insulation model of self-esteem, the resource model maintains that people with high self-esteem respond to death contemplation with *more* defensiveness than do people with low self-esteem, because they have the

available resources to activate defensive responding. In sum, although both perspectives maintain that high self-esteem serves an anxiety-buffering function, they differ with respect to the manner in which it provides this function, which leads to differing predictions regarding high (vs. low) self-esteem and defensiveness.

Assuming that accommodation is a type of worldview defense just like any other, if self-esteem provides *insulation* against death-anxiety, MS should interact with self-esteem following threat such that MS will increase accommodation predominantly among people with low self-esteem. If self-esteem furnishes the *resources* necessary to defend against death-anxiety, however, MS should produce the opposite pattern of results. Specifically, MS should lead people with high self-esteem to become more accommodating following threat.

Overview of the Current Research

The present research seeks to explore some of the conditions under which people will accommodate their worldview beliefs in response to threat. Five studies are conducted to explore worldview accommodation in response to both worldview threat (Studies 1-4) and self-esteem threat (Study 5). Within the worldview threat studies, two distinct worldviews (Study 1, religious; Studies 2-4, scientific) are examined. Studies 2-4 also demonstrate the selective manner in which worldviews are accommodated following threat, providing a distinction between the modification of peripheral and core worldview beliefs. The present studies also use convergent methodologies to explore the conditions under which accommodation is most likely to be enacted as a defense against threat.

Specifically, whereas Studies 1-3 and 5 examine accommodation from the perspective of the MS hypothesis, Study 4 examines this issue using the DTA hypothesis. In addition to investigating worldview (or self-esteem) defense via accommodation, Studies 2-5 examine the relationship between accommodation and derogation as alternative modes of defense against threat. Finally, in all five studies, trait self-esteem is examined as a potential moderator of the effects.

CHAPTER 2:

Study 1 – Exploring the Effects of Threat, MS, and Self-Esteem on Worldview Accommodation

According to TMT, worldview beliefs function to insulate us from a deeply rooted fear of death. Threatening these beliefs will therefore motivate defense of the beliefs to ensure that death-anxiety remains carefully managed, and such defense will be intensified when mortality concerns are salient. In keeping with theory and research on TMT (Friedman & Rholes, 2007; Schimel et al., 2007), as well as that on attitude change (Alhuwalia, 2000; Petty & Cacioppo, 1986), defensive resistance to information that violates one's pre-existing belief-system should be most pronounced among people who strongly adhere to the beliefs under attack. As such, the present study sampled only among students who were strongly committed to their attitude position. In this case, the population under consideration consisted of students who strongly believed that life on earth was created by God rather than evolutionary processes.

Additionally, given that the focus of the current research is worldview defense via accommodation, the threatening communication designed to encourage such defense was also carefully selected. Following research and theory by Alhuwalia (2000) and Block (1982) suggesting that accommodation may represent an alternative of last resort, the present study employed a worldview threat manipulation consisting of a highly persuasive argument in favour of the evolutionary account of creation (and therefore against the creationist account; Gould, 1995) that would be quite difficult for most people to outright refute or dismiss. It was hypothesized that relative to a neutral, non-threatening control article, this article would promote worldview accommodation. To investigate the effect of MS on this process, a third condition was included in

which participants were reminded of their mortality prior to reading the threatening article. Given that worldview defense has been shown to be intensified by MS, it was hypothesized that accommodation would be highest in this condition.

Finally, TMT maintains that self-esteem moderates the effects of MS on worldview defense. To investigate whether self-esteem will moderate the effect of MS on worldview accommodation, all participants completed a measure of trait self-esteem prior to participation in the study. Although extant evidence demonstrating the moderating role of self-esteem has focused exclusively on worldview defense via derogation of the source of threat (Harmon-Jones et al., 1997; McGregor et al., 2007), there is no reason to believe that defense via accommodation should yield a different pattern of results. As previously mentioned, however, the precise nature of the moderating effect of self-esteem on worldview defense following MS is ambiguous and research has produced mixed results. As such, the current study sought to distinguish between the *insulation* and *resource* models of self-esteem in TMT. On the one hand, if self-esteem provides insulation, MS should lead to greater accommodation among participants with low (vs. high) self-esteem. On the other hand, if self-esteem provides the resources necessary for defense, MS should lead to greater accommodation among participants with high (vs. low) self-esteem. Importantly, these hypotheses rest on the assumption that accommodation does, in fact, follow from the same antecedent conditions as any other known defense against threat (such as derogation).

Method

Participants and Design

Participants were 43 (11 male, 32 female) introductory psychology students at the University of Alberta, who received partial credit for their participation. Three participants were excluded from the data analysis for indicating suspicion of the cover story. Participants were made eligible to participate in the study on the basis of their responses to a mass-testing survey administered at the beginning of the academic term. Specifically, only participants who indicated a strong belief in creationism (responded with a 7 or above on a 9-point scale to the questions "*To what extent do you believe in the Judeo-Christian account of creation?*", and "*To what extent is the belief of creationism an important part of your life?*") and a low to moderate belief in evolution (responded with a 5 or below on a 9-point scale to the question "*To what extent do you believe in evolution?*") were eligible to sign up for the study. Participants' level of trait self-esteem (Rosenberg, 1965) was also assessed within this same mass-testing survey (sample $M = 45.8$, $SD = 8.8$). Once in the lab, participants were randomly assigned to one of three conditions (*Control* vs. *Threat* vs. *MS/Threat*).

Procedure

The study was presented as an investigation of the relationship between personality characteristics and reading comprehension. Participants were told that after completing a packet of personality questionnaires, they would read a sample of text and thereafter answer some comprehension questions regarding the text.

The personality packet consisted of 3 filler questionnaires and a mortality salience (vs. dental pain control) induction. Participants in the *MS/Threat* condition received the MS induction, in which they were asked to "*Briefly describe the emotions that the thought of your own death arouses in you*" and "*Jot down, as specifically as you can, what you think will happen to you as you physically die and once you are physically dead*." Participants in the remaining two conditions were asked two parallel questions regarding dental pain. For all participants, the MS (or dental pain) induction was placed second in the packet, leaving two filler questionnaires to provide delay following MS (see Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994).

After completing the personality packet, participants proceeded to the next phase of the study in which they read one of two texts. In the *Threat* and *MS/Threat* conditions, participants read a modified section of Steven Jay Gould's (1995) *Dinosaur in a Haystack*, which presented evidence for evolution and was very critical of creationism (see Appendix A). Participants in the control condition read a non-threatening text describing the history of attitude measurement (Ajzen & Fishbein, 1980).

In the final phase of the study, participants proceeded to answer 10 reading comprehension questions pertaining to the text they had read, followed by nine items assessing the extent to which they would accommodate their worldview beliefs to include beliefs about evolution (see Table 1). These items were constructed to assess participants' willingness to include evolution as at least a partial explanation for the origins of life on earth. Thus, many items assessed the

overall compatibility of creationism and evolution (e.g., "*Evolution and creationism are fundamentally inconsistent with each other*"), and others assessed the idea of evolution as a process that is overseen by God (e.g., "*God created life on earth and then guided the process of evolution*"). Upon completion, participants were probed for suspicion, fully debriefed, and thanked for their participation.

Results

To test the effects of self-esteem and experimental condition on accommodation, we first examined the internal consistency of the accommodation items. These items were found to have high reliability (Cronbach's $\alpha = .87$), and were therefore combined to form an overall mean accommodation score for each participant.

Multiple regression techniques were then used to examine the pattern of results on the accommodation scores. First, the experimental conditions were dummy coded using two vectors. Dummy1 represented the contrast between the *Threat* and *Control* conditions, while Dummy2 represented that between the *MS/Threat* and *Control* conditions. Second, self-esteem scores were

Table 1

Accommodation Items used in Study 1.

1. The existence of life on earth is adequately explained by evolution alone.
2. The existence of life on earth is adequately explained by God (creation) alone. (R)
3. Life on earth is the result of a combination of both creation and evolution.
4. I believe that both evolution and creation (by God) are true.
5. Evolution and creationism are fundamentally inconsistent with each other. (R)
6. The idea that humans evolved from lower life-forms is surely false. (R)
7. God created life on earth and evolution is completely false. (R)
8. God created life on earth and then guided the process of evolution.
9. God created life on earth and then allowed it to undergo evolution.

Note. Participants were asked to rate their agreement with each item on a 7-point scale (1=completely disagree, 7=completely agree). Items followed by (R) are reverse scored.

centred on the sample mean, and two cross-products were created by multiplying the centred self-esteem scores with each of the dummy variables. These variables were then entered into a step-wise regression equation with both of the dummy variables and centred self-esteem together in the first step, and the two interaction variables entered in the second step (Aiken & West, 1991). The first step in this procedure was non-significant, F_{step1} (3, 36) = 1.84, $p < .16$, but notably, the effect for dummy1 (*Control* vs. *Threat*) approached significance, $\beta = .34$, $p < .07$. Most importantly, however, the predicted interaction of self-esteem × condition in the second step was marginally significant, F_{step2} (2, 34) = 2.58, $p = .09$ (see Figure 1). Moreover, the simple interaction of self-esteem × dummy2 (*Control* vs. *MS/Threat*) was significant, $\beta = -.46$, $p < .05$. Simple slopes tests revealed a significant effect of self-esteem only in the *MS/Threat* condition, $\beta = -.77$, $p < .05$, such that accommodation decreased as self-esteem increased.

Discussion

In general, the results of this initial study indicated a marginal increase in accommodation in the *Threat* relative to the *Control* condition. When threat was coupled with MS, however, self-esteem played a moderating role such that participants with high self-esteem accommodated significantly less than their low self-esteem counterparts. Whereas participants with low self-esteem accommodated their worldview in response to threat to the same degree regardless of whether mortality was salient, those with high self-esteem accommodated significantly less when mortality was salient than when it was not. Overall, the

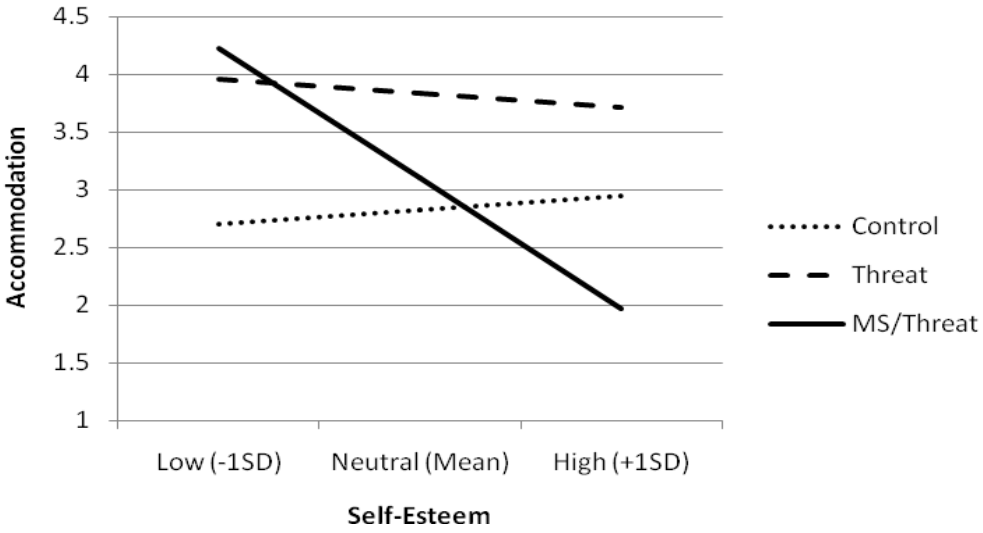


Figure 1. Effect of Self-Esteem by Condition on Accommodation in Study 1.

results are broadly consistent with the hypotheses, and provide the first TMT examination of worldview accommodation following worldview threat.

The results also shed light on the controversy regarding which model of self-esteem in TMT fits the available data. On the surface, given that participants with low self-esteem evinced higher levels of accommodation within the *MS/Threat* condition, it would appear that the insulation model of self-esteem is supported by the current study. Upon closer inspection, however, this conclusion may merit revision. Although self-esteem was found to be a significant moderator within the *MS/Threat* condition, when compared to the *Threat* condition, the precise pattern of results indicate that MS *reduced* accommodation among participants with high self-esteem, whereas no effect of MS was observed among participants with low self-esteem. Thus, MS seemed only to affect participants with high self-esteem.

The observed pattern of results on the accommodation measure in the present study is precisely the inverse of the pattern observed by McGregor et al. (2007) regarding derogation of the source of threat. Specifically, these researchers found that MS increased defensiveness only among people with high self-esteem, while the extent of defense among people with low self-esteem remained unaffected by MS. McGregor et al. (2007) reasoned that people with high self-esteem respond to threat with increased zeal and conviction in the validity of their beliefs, leading them to become more derogatory toward those who threaten these beliefs. It seems reasonable to assume that worldview accommodation may possess a degree of non-defensiveness, given that this process involves modifying

one's beliefs to incorporate ideas that did not previously mesh with one's existing belief system. And by the same token, a *refusal* to accommodate one's beliefs may equally contain a degree of defensiveness. Thus, the observed reduction in accommodation under conditions of MS among participants with high self-esteem may represent defensive zeal and compensatory conviction rather than low levels of worldview defense. Accommodating one's worldview involves realizing that the current state of one's belief system is inadequate to account for the existing evidence. Increased certainty in the validity of one's pre-existing beliefs would therefore preclude any need to accommodate them.

The resource model of self-esteem might also be more in line with theorizing on worldview conversion, which is at least conceptually related to worldview accommodation in that both responses involve changing protective beliefs. Pyszczynski et al. (2003), for instance, argued that people with low self-esteem do not benefit from the anxiety-buffering function of their worldview beliefs to the same extent as do people with high self-esteem. As such, they may be more receptive to alternative belief systems, especially if they offer a means of attaining a much needed sense of personal significance and value. This reasoning is consistent with observations of cult recruitment practices, wherein the disenfranchised members of society are often targeted as potential new members (Osherow, 1992). The promise of a new and radical perspective on reality is more alluring to someone on the fringes than someone who is firmly entrenched in mainstream society. As Kuhn (1962) notes, paradigm shifts in scientific theorizing are almost always initiated by younger scientists who are less

committed to the previous way of thinking about the subject matter. The high levels of accommodation observed among participants with low self-esteem might therefore be indicative of the tentative and uncertain nature of their beliefs (Campbell, 1990) and a general tendency toward conversion for these individuals, as their beliefs may not be particularly effective at protecting them from death-anxiety. By contrast, participants with high self-esteem who presumably do benefit from the anxiety-buffering properties of their worldview beliefs, refrained from accommodating their beliefs when mortality was salient because the situation required them to use those beliefs to protect against death-anxiety.

The evidence gathered from this preliminary study appears to suggest that the resource model of self-esteem is most adequate for explaining the available data. Before jumping to any firm conclusions on this matter, however, it may be advisable to attempt a conceptual replication of the current results.

CHAPTER 3:

Study 2 – Accommodation vs. Derogation in Response to Worldview Threat

Although the results of Study 1 seem fairly consistent with previous research and theorizing on TMT, the precise pattern of results did not fully conform to predictions. Thus, to increase certainty that the obtained results are indeed valid, I sought to conceptually replicate these findings using a different sample of participants and different worldview threat material. Whereas Study 1 examined a sample of religious participants who believe in creationism, I thought that it would be appropriate to demonstrate the same effects from the other side of the issue. Study 2 therefore examined a sample of atheist participants who believe that life arose through evolution, and subjected them to arguments against the evolutionary account of origins and in favour of intelligent design.

Accommodation vs. Derogation

According to TMT, accommodation should serve as a defense against threat. Although the foregoing discussion has (at times) taken this for granted, Study 1 offers little evidence that accommodation provides a defensive function. Indeed, in discussing the unexpected pattern of results with regard to MS and self-esteem in Study 1, I proposed that accommodation may contain at least an element of non-defensiveness. A principle goal of Study 2 was therefore to test whether accommodation provides defense against theat. From the perspective of TMT, if a psychological response to threat provides protection against that threat, then there should be no need to defend via any other means thereafter. Consistent with this idea, several studies have shown that inducing participants to defend their beliefs in one way precludes the need to defend in other ways (e.g., Cox et al., 2008; Dechesne, Janssen, & van Knippenberg, 2000; Hayes, Schimel, &

Williams, 2008). Hayes, Schimel, and Williams (2008), for example, showed that providing participants with information regarding the annihilation of members of a threatening group reduced their tendency to derogate members of that group. Thus, if accommodation provides defense against threat, then participants who respond with high levels of accommodation should thereafter show low levels of derogation. In other words, the extent of derogation following threat should be mediated by the extent of accommodation.

Comparing accommodation to derogation in this way might also provide additional information regarding the role of self-esteem in the findings of Study 1. If high self-esteem led to low accommodation in the *MS/Threat* condition due to an insulating function, which precluded the need for defense, then we should also expect to observe low levels of derogation among participants with high self-esteem in this condition. If, on the other hand, self-esteem equips the individual with the resources necessary to initiate an offensive type of defensiveness (McGregor, 2006a) characterized by increased certainty in the validity of one's beliefs (i.e., a *refusal* to accommodate their beliefs), then we would expect to see high levels of derogation among participants with high self-esteem in the *MS/Threat* condition of Study 2.

Core vs. Peripheral Worldview Beliefs

Finally, Study 1 also overlooked what might be a critical component of worldview accommodation. As mentioned in Chapter 1, worldview accommodation involves modifying *peripheral*, but not *core*, worldview beliefs. I therefore attempted to make this distinction clear in the dependent measure of

Study 2. I reasoned that for the atheist who believes in an evolutionary account of origins, the core worldview belief is that God does not exist and therefore created nothing; whereas the peripheral (and thus expendable) belief is that evolution provides a complete explanation of the origins of life. Accordingly, I predicted that relative to participants in the *Control* condition, those in the *Threat* condition would show significantly more accommodation of peripheral worldview beliefs (PERI), but not of core worldview beliefs (CORE). Moreover, in the *MS/Threat* condition, I predicted that the moderating effect of self-esteem would operate predominantly on PERI, rather than CORE.

Method

Participants and Design

Participants were 61 (33 male, 28 female) introductory psychology students at the University of Alberta who received partial course credit for their participation. Three participants were excluded from the data analysis for indicating suspicion of the cover story. Students were made eligible to participate in the study on the basis of their responses to a mass-testing survey administered at the beginning of the academic term. Specifically, only students who selected "*Atheist*" as their religious affiliation, and who also indicated a strong belief in evolution (responded with a 7 or above on a 9-point scale to the question "*To what extent do you believe in evolution?*", and 5 or above on a 9-point scale to the question "*To what extent is the belief in evolution an important part of your life?*"), and a strong disbelief in creationism (responded with a 2 or below on a 9-point scale to the question "*To what extent do you believe in the Judeo-Christian*

account of creation?") were eligible to sign up for the study. As in Study 1, trait self-esteem was also assessed in this mass-testing session (sample $M = 44.4$, $SD = 11.2$). Once in the lab, participants were randomly assigned to one of three conditions (*Control* vs. *Threat* vs. MS/*Threat*).

Procedure

The study procedure was nearly identical to that of Study 1; presented as an investigation of the relationship between personality characteristics and reading comprehension. Participants first completed a packet of personality questionnaires, in which a mortality salience (vs. dental pain) induction was embedded.

After completing the personality packet, participants read a sample of text that was ostensibly taken from a real book and argued that the theory of evolution ultimately fails to account for the origin of life on earth because it cannot explain how something arose from nothing (see Appendix B). In so doing, the author argued in favour of intelligent design as the only answer to the riddle of life's origins. Participants in the control condition read the same non-threatening article used in Study 1 (Ajzen, & Fishbein, 1980).

In the final phase of the study, participants answered 10 reading comprehension questions pertaining to the text they had read, followed by 11 items assessing the extent to which they would accommodate their core and peripheral worldview beliefs, and three items assessing author derogation (see Table 2). Upon completion, participants were probed for suspicion, fully debriefed, and thanked for their participation.

Results

Factor Structure of Items Assessing Accommodation and Derogation

Before proceeding with the primary analysis, I first analyzed the factor structure of the accommodation items together with the derogation items. I recognize that the sample size in the current study may be insufficient for a reliable factor analysis. Kerlinger (1986), for example, recommends a sample of 10 participants for each item included in the factor analysis. My sample contains 58 participants and 14 items to be analyzed, which falls far short of the recommended sample size. However, some researchers suggest that a sample of between 50 and 100 cases may in some cases be sufficient for a reliable factor analysis (Sapnas & Zeller, 2002), especially when each factor has several high loading marker variables (Guadagnoli & Velicer, 1988), which is true of the present case (see Table 2). Moreover, given the exploratory nature of this research and the *a priori* expectation that the accommodation items would tap both core and peripheral aspects of the atheist worldview, I felt it was imperative to probe the factor structure of the accommodation items despite the relatively small sample size. Likewise, it may be equally important to ensure that accommodation is not merely the inverse of derogation in this study. Thus, I felt it necessary to include the derogation items together with the accommodation items in the factor analysis.

Accordingly, an initial principle components extraction was performed to estimate the number of factors. Although this analysis yielded four factors with eigenvalues greater than 1, inspection of the scree plot suggested that a three

Table 2

Factor Loadings for Accommodation and Derogation Items used in Study 2.

Item	Factor Loading 1	2	3
Factor 1: Items Assessing Core Worldview Beliefs:			
1. I believe both that life was created (by an intelligent being) and that life has evolved.	.91	-.03	-.05
2. The existence of life on earth is adequately explained by a creator alone.	.91	-.02	.10
3. Life was created by an intelligent being who then played no further role in the evolution of life forms.	.88	.04	-.05
4. Life on earth is the result of a combination of both creation and evolution.	.83	.04	-.06
5. Life was created by an intelligent being who then guided the process of evolution.	.79	.13	-.05
6. The idea that life was created by an intelligent being is certainly false. (R)	-.35	.12	.21
*Factor 2**: Items Assessing Author Derogation:			
1. The author of this article is well informed. (R)	.01	.92	-.04
2. The author of this article is intelligent. (R)	-.29	.82	-.26
3. I agree with the author of this article. (R)	.33	.71	-.01
*Factor 3**: Items Assessing Peripheral Worldview Beliefs:			
1. The existence of life on earth is adequately explained by evolution alone. (R)	-.05	.16	.83
2. Evolution and the idea of a creator are fundamentally inconsistent with each other. (R)	-.05	.15	.73
3. It is possible that life on earth is the result of some sort of supernatural force.	.12	-.02	-.64
4. The theory of evolution cannot explain the origin of life.	.02	.24	-.58
Percentage of explained variance	*34.20*	*15.31*	*12.04*

Note. Participants were asked to rate their agreement with each item on a 7-point scale (1=completely disagree, 7=completely agree). Items followed by (R) are reverse scored.

* The meaning of Factors 2 and 3 are reversed in the factor solution. Thus, items that are reverse scored appear with positive factor loadings and vice versa. For the purpose of data analysis, these factors are scored such that higher numbers indicated more author derogation for Factor 2 and more accommodation of peripheral worldview beliefs for Factor 3.

factor solution may be more parsimonious. Furthermore, as mentioned above, I generally expected accommodation to be broadly organized into core vs. peripheral beliefs and for derogation to consist of a single factor. As such, a second principle components analysis was conducted, this time forcing three factors. Since I expected some correlation between CORE and PERI, an oblique rotation solution (direct oblimin, delta = 0) was used to allow for this possibility (Tabachnick & Fidell, 2007). Results from this analysis largely conformed to expectations. Item loadings and percentage of variance explained by each factor are displayed in Table 2. One item was excluded from subsequent analyses because it failed to load highly with any of the factors.

Factor 1 (eigenvalue = 4.79) consisted of items revolving around belief in the existence of God and were therefore interpreted to be assessing CORE; factor 2 (eigenvalue = 2.14) consisted of items assessing attitudes toward the essay-author and were therefore interpreted to be assessing author derogation; and factor 3 (eigenvalue = 1.69) consisted of items assessing what was interpreted to be various peripheral worldview beliefs, such as the viability of evolutionary theory as the sole explanation of life's origins. As expected, a moderate correlation was found between the factors representing CORE and PERI (r = .29), but little or no correlation was observed between these factors and the one representing author derogation ($r_{core\text{-}derogation}$ = -.09; $r_{peri\text{-}derogation}$ = .00).

Accommodation of Core and Peripheral Worldview Beliefs

After creating separate composites for each of the factors by averaging the items (reverse scored where appropriate) representing core (α = .83) and

peripheral (α = .61) beliefs respectively, I used the same multiple regression techniques as in Study 1 to examine the pattern of results for these variables. First, two vectors were constructed to dummy code the experimental conditions. As in Study 1, Dummy1 represented the contrast between *Threat* and *Control* condition, and Dummy2 represented that between the *MS/Threat* and *Control* conditions. Self-esteem scores were centred at the sample mean, and two cross-products were created by multiplying the centred self-esteem scores with each of the dummy variables. Following Aiken and West (1991), these variables were then entered into a step-wise regression equation with both dummy variables and centred self-esteem together in the first step, and the two interaction variables in the second step. When CORE was entered as the dependent variable, this procedure showed no significant effects, *F*s < 1, *ns*. In contrast, when PERI was the dependent variable, this procedure yielded a marginal effect in the first step, F_{step1} (3, 54) = 2.49, p = .07, which was characterized by a significant main effect of dummy 1 (*Control* vs. *Threat*), β = .35, p < .05. Notably, the hypothesized interaction was also significant F_{step2} (2, 52) = 3.18, p = .05 (see Figure 2). As in Study 1, this interaction was characterized by a significant simple interaction of self-esteem × dummy2 (*Control* vs. *MS/Threat*), β = -.51, p < .05. Simple slopes tests revealed a significant effect of self-esteem only in the *MS/Threat* condition, β = -.48, p < .05, such that PERI decreased as self-esteem increased.

Author Derogation

Author derogation scores were computed by taking the average of the three derogation items (reverse scored, α = .78). The same analyses as above were

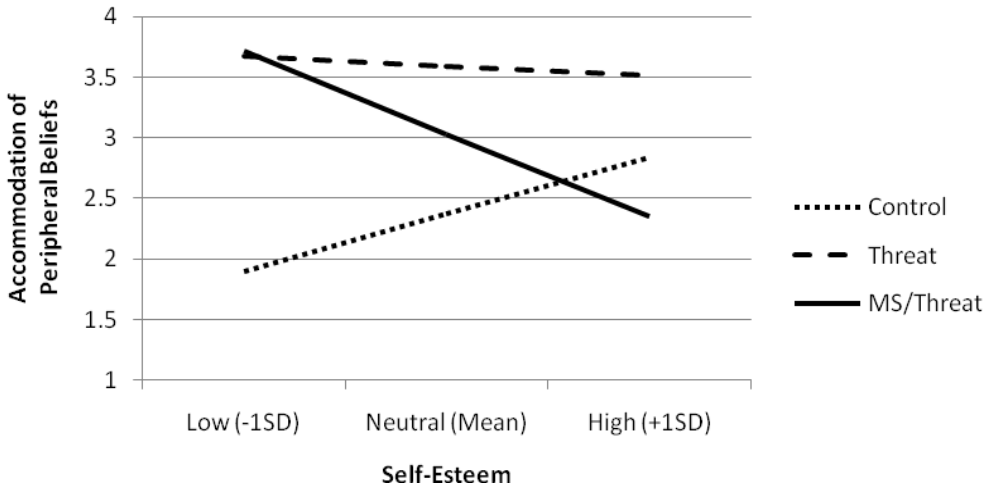


Figure 2. Effect of Self-Esteem by Condition on Accommodation of Peripheral Beliefs in Study 2.

then conducted on the derogation scores, yielding only a significant interaction of self-esteem × condition, F_{step2} (2, 52) = 3.50, $p < .05$ (see Figure 3), which was characterized by a marginally significant simple interaction of self-esteem × dummy2 (*Control* vs. *MS/Threat*), $\beta = .38$, $p < .07$. Simple slopes tests revealed a significant effect of self-esteem on derogation only in the *MS/Threat* condition, $\beta = .45$, $p < .05$, such that derogation increased as self-esteem increased.

Testing for Mediation. As mentioned in the lead-up to this study, the extent of derogation was expected to be contingent on the extent of accommodation. In other words, it was predicted that the interactive effect of condition × self-esteem on derogation would be mediated by accommodation.[2] Using the methods outlined by Muller, Judd, and Yzerbyt (2005), I tested this mediated moderation model with a series of regression equations involving four variables of interest. In this case, the treatment variable refers to the experimental condition (*Control* vs. *Threat* vs. *MS/Threat*) as represented by two dummy codes, the moderating variable is self-esteem, the mediating variable is PERI, and the outcome variable is derogation.

The process for determining mediated moderation is quite similar to that outlined by Baron and Kenny (1986) for determining simple mediation. The main difference between these methods is that simple mediation examines possible mediation of the direct effect of a single variable (the treatment) on the outcome, whereas mediated moderation examines the possible mediation of the direct interaction effect (treatment × moderator) on the outcome. In the first step, the outcome must be predicted by an interaction of the treatment and the mediator. As

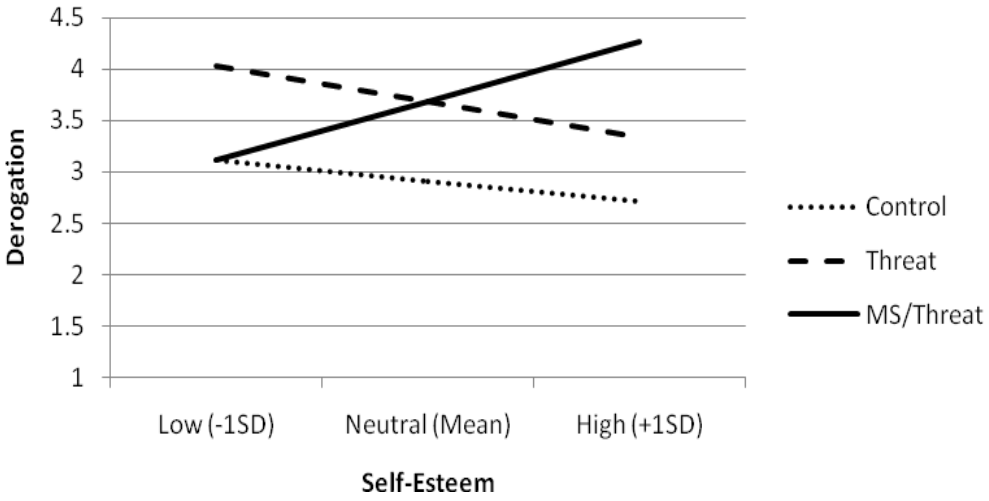


Figure 3. Effect of Self-Esteem by Condition on Derogation of the Essay-Author in Study 2.

shown in Step 1 of Table 3 (and outlined above), the interaction of condition × self-esteem does indeed predict derogation. In the second step, the mediator must be predicted by either a direct effect of the treatment or an interactive effect of treatment × moderator. Again, as previously outlined in the section on accommodation, in this case the interaction of condition × self-esteem predicts PERI (see Step 2 of Table 3). In the third and final step, the mediator (PERI) and the interaction of the mediator and moderator (PERI × self-esteem) are included, and therefore controlled for, in the equation from Step 1. In order for mediated moderation to be supported in this case, PERI must emerge as a significant predictor of derogation and controlling for this effect must significantly reduce the interactive effect of condition × self-esteem on derogation that was observed in Step 1. As shown in Step 3 of Table 3, PERI emerges as a marginally significant predictor of derogation, and the condition × self-esteem interaction is no longer near significant. Taken together, although some of the effects are only marginal, mediated moderation does appear to be supported in these data. Thus, the interaction of condition × self-esteem only affected derogation indirectly, by virtue of influencing accommodation.

Discussion

Study 2 replicates and extends the results of Study 1 in a number of important ways. With regard to replication, when mortality was *not* salient, worldview threat increased accommodation relative to the no-threat control. In addition, when mortality *was* salient, self-esteem moderated the effect of threat on accommodation such that participants with low self-esteem evinced significantly

Table 3

Regression Results for Mediated Moderation in Study 2.

Predictors	Step 1 (DV = DERO) β	Step 1 (DV = DERO) *t*	Step 2 (DV = PERI) β	Step 2 (DV = PERI) *t*	Step 3 (DV = DERO) β	Step 3 (DV = DERO) *t*
D1	.293	1.99^{+}	.407	2.79**	.406	2.55*
D2	.290	1.96^{+}	.218	1.49	.362	2.25*
Self-Esteem	-.156	-0.60	.323	1.25	-.047	-0.17
D1 × Self-Esteem	-.065	-0.33	-.225	-1.14	-.155	-0.66
D2 × Self-Esteem	.383	1.85^{+}	-.507	-2.47*	.226	0.93
PERI					-.262	-1.86^{+}
PERI × Self-Esteem					.040	0.26

Note: D1 = dummy1 of condition (*Control* vs. *Threat*); D2 = dummy2 of condition (*Control* vs. *MS/Threat*); DERO = author derogation; PERI = accommodation of peripheral beliefs.
$^{+}$ $p < .10$ * $p < .05$ ** $p < .01$

more accommodation than participants with high self-esteem. The pattern of results mirrors that observed in Study 1, suggesting that the results of Study 1 were not spurious. Importantly, the observed pattern was found only with regard to peripheral worldview beliefs. Participants were very reluctant to change core worldview beliefs regardless of self-esteem and experimental condition. This lack of effect suggests that core worldview beliefs are relatively impervious to threat. The distinction between core and peripheral worldview beliefs extends the results of Study 1 by showing that people do not merely acquiesce in response to threat by changing their beliefs in the direction advocated in the threat article. Rather, they defensively accommodate their worldview by modifying peripheral worldview beliefs and holding fast to their core beliefs.

Another way in which Study 2 extends the results of Study 1 is by adding derogation to the overall picture and showing that accommodation and derogation are generally alternative defenses against threat. Engaging in one defense precludes the need to engage in the other. In this case, the substitutability of these defenses is most pronounced in the *MS/Threat* condition. Specifically, participants with low self-esteem in this condition, who responded to the threat by accommodating their peripheral beliefs, showed low levels of author-derogation. This result is consistent with the idea that accommodation is a type of defense against threat, showing that those who accommodated were no longer motivated to defend via other means.

Participants with high self-esteem, by contrast, displayed very low levels of accommodation in the *MS/Threat* conditions, which promoted high levels of

derogation thereafter. Thus, not only did high accommodation produce low derogation, but low accommodation also fostered high derogation. This finding seems to refute the idea that participants with high self-esteem did not accommodate following MS in Study 1 because they were insulated against MS and therefore felt little need to defend their worldview by accommodating. On the contrary, people with high self-esteem seem to be equally motivated to defend their worldview as people with low self-esteem, except that they prefer not to defend via accommodation. Rather, consistent with McGregor et al.'s (2007) reasoning, it appears that people with high self-esteem respond to MS with increased conviction in the validity of their protective beliefs, leading them to become more derogatory toward those who threaten these beliefs and less willing to change them by accommodating their worldview. This perspective is discussed further in the introduction of Study 3 below.

CHAPTER 4:

Study 3 – The Accommodation *Reducing* Effect of Self-Affirmation among People with Low Self-Esteem

Study 3 was designed to examine a number of issues raised by Studies 1 and 2. Overall, these studies suggest that people will accommodate their protective beliefs when these beliefs are threatened, but when mortality is salient, high levels of self-esteem inhibit accommodation and promote derogation. These results appear consistent with the *resource model* of self-esteem (Spencer et al., 1993; vanDellen et al., 2011), which maintains that high self-esteem affords the individual with the resources necessary to activate protective beliefs in the face of threat. This reasoning is consistent with McGregor et al.'s (2007) argument that MS leads people with high self-esteem to respond with increased zeal and conviction in the validity of their worldview. Presumably, this increased conviction in their worldview beliefs stems from the fact that these beliefs are being called upon as a way of protecting against death-anxiety. Moreover, zealous reactions to threat (including out-group derogation) represent a self-promotion strategy (McGregor, 2006b), which is more common among people with high (vs. low) self-esteem (Baumeister, Tice, & Hutton, 1989). Thus, people with high self-esteem in Study 2 responded with increased author derogation. By contrast, people with low self-esteem tend to respond to threat in a self-protective manner, as self-promotional strategies are viewed as potentially costly by placing the individual at risk for future threats (Baumeister et al., 1989; Brockner, 1973). Within the context of the current research, insisting that one's prior beliefs are correct in the face of strong evidence to the contrary (and thereby derogating the source of the information) may function to dispel the threat, but it also risks promoting interpersonal conflict. Partially yielding to the worldview threatening

information by accommodating one's worldview, on the other hand, is a somewhat safer alternative, because it reduces the potential for such conflict. Thus, whereas derogation is representative of a self-promoting defensive style (characteristic of people with high self-esteem), accommodation seems to be representative of a self-protective defensive style (characteristic of people with low self-esteem).

From this perspective, low levels of accommodation and high levels of derogation (observed among participants with high self-esteem in Study 2) result from a self-promotion strategy that involves activating positive beliefs about the self in order to buffer the anxiety associated with death-contemplation. In other words, in response to MS, people with high self-esteem are more likely (or better able) to summon the protective beliefs necessary to ward off anxiety (cf. Routledge et al., 2010). If this perspective is correct, then inducing participants with low self-esteem to activate protective beliefs should lead them to become less accommodating and more derogatory following MS and worldview threat. Study 3 was, first and foremost, designed to test this reasoning. Specifically, Study 3 employed a self-affirmation procedure (Steele, 1988) that randomly assigned some participants to activate an important value and to discuss how they have behaved consistently with this value. This procedure should mimic the self-promotion focus that appears to be initiated automatically by people with high self-esteem in response to MS. Since this process seemed only to occur in the *MS/Threat* conditions of Studies 1 and 2, in this study all participants were reminded of mortality and asked to read a worldview threatening article.

Thereafter, worldview accommodation and author derogation were assessed in the same manner as in Study 2. In general, it is predicted that self-affirmation will make participants with low self-esteem respond as though they have high self-esteem. In other words, participants with low self-esteem who affirm an important value should display less accommodation and more derogation than participants with low self-esteem who do not affirm an important value. In contrast, the affirmation manipulation is expected to have little or no impact among participants with high self-esteem, because these people are believed to activate their protective beliefs after MS without the need for prompting.

Another impetus behind Study 3 was to assess more accurately the type of accommodation that seems to be occurring in response to the threat employed in Study 2. In general, the items assessing accommodation of peripheral beliefs were somewhat variable and were not found to have particularly high reliability (α = .61). This is likely due to the fact that there are innumerable ways in which an individual can accommodate a given threat, and the accommodation items employed in Study 2 were designed to capture some of this variability.[3] As such, not all of the items in the PERI composite assessed the same manner of accommodation. Although the majority of these items tapped participants' overall belief that evolution provides the explanation for the origins of life, a couple of items are better understood as open-mindedness toward the issue, or a general uncertainty regarding how life arose. In Study 3, I included additional accommodation items that more specifically assessed this way of accommodating the threat.

Finally, Study 3 was also designed to examine the effectiveness of the accommodation defense at reducing thoughts and concerns regarding death. Extant research shows that worldview defense involving derogation ultimately functions to reduce DTA (see Hayes et al., 2010 for a review). Thus, it is predicted that within the no-affirmation condition higher levels of derogation will lead to lower levels of DTA. Likewise, if accommodation and derogation are truly equivalent defenses, then within the no-affirmation condition, higher levels of accommodation should also lead to lower levels of DTA. Since accommodation involves modifying certain aspects of one's protective beliefs, however, it remains possible that accommodating these beliefs could render them less effective at reducing DTA. If so, one would expect to find the extent of accommodation to be positively related to DTA. Within the affirmation condition, given past research indicating the DTA reducing effect of self-affirmation (e.g., Hayes, Schimel, Faucher, et al., 2008; Schmeichel & Martens, 2005), it is predicted that DTA should remain low within this condition, regardless of the extent of accommodation and derogation.

Method

Participants and Design

Participants were 61 (36 male, 25 female) introductory psychology students at the University of Alberta who received partial course credit for their participation. Two participants were excluded from the data analysis for indicating suspicion of the cover story. Students were made eligible to participate in the study on the basis of the same criteria used in Study 2, and self-esteem

scores were obtained in a mass-testing survey administered at the beginning of the semester (sample $M = 46.0$, $SD = 10.2$). Once in the lab, participants were randomly assigned to one of two affirmation conditions (*affirmation* vs. *no affirmation*).

Procedure

The procedure mirrored that of Studies 1 and 2, and was thus presented as an investigation of personality and reading comprehension. Participants first completed a packet of personality questionnaires, which contained three filler personality questionnaires, a self-affirmation manipulation (vs. control), and a MS induction. Participants in the self-affirmation condition were asked to choose from among a list of values the one that is most important to them. This list included *business/economics/making money*, *art/music/theatre*, *science/pursuit of knowledge*, *social life/relationships*, and *social action/helping others*. Importantly, the list of values did not contain *religion/spirituality*, which was omitted because some participants could have selected this value and chosen to affirm their Atheist beliefs. Affirming one's values in the same domain that is later threatened has been shown to produce different results than affirming an alternative value (see Jacks & O'Brien, 2004). After selecting their most important value, participants were asked to write about how they have behaved consistently with that value in the past, and how they plan to behave consistently with that value in the future (Shrira, & Martin, 2005). This affirmation manipulation was the second questionnaire in the packet, and the MS induction was fourth. Accordingly, the filler questionnaires were in the first, third, and fifth positions in the packet.

After completing the personality packet, participants read the same text used in Study 2, which argued that evolution fails to explain the origins of life and proposed intelligent design as the only answer. Next, after participants answered 10 reading comprehension questions, they proceeded to the main dependent measure consisting of a number of questions assessing accommodation of core and peripheral worldview beliefs, followed by questions assessing author-derogation. Many of these items were identical to those used in Study 2. However, three of the original items were dropped in favour of seven new items. Two of these items were designed to assess more specifically beliefs regarding the role of God in the origins of life (i.e., the core of the Atheist worldview); three were designed to assess beliefs regarding the role of science and evolution in this process (i.e., the periphery of the Atheist worldview); and the two remaining new items were designed to assess author derogation. In total, the revised list consisted of 18 items: six assessing CORE, seven assessing PERI, and five assessing author-derogation (see Table 4).

Finally, after completing the accommodation and derogation items, participants were given a word-fragment completion task composed of 20 word-fragments, which served as a measure of DTA (e.g., Schimel et al., 2007). Six of these fragments were potentially death-related (e.g., COFF_ _, which can be completed as either *coffee* or *coffin*), while the remaining 14 could only be completed in a non-death related manner (e.g., PLA _ _, *place* or *plaza*, etc.). Upon completion, all participants were probed for suspicion and fully debriefed.

Table 4

Factor Loadings for Accommodation and Derogation Items used in Study 3.

Item	Factor Loading 1	2	3
Factor 1: Items Assessing Core Worldview Beliefs:			
1. Life on earth is the result of a combination of both creation and evolution.	.87	.10	-.10
2. I believe both that life was created (by an intelligent being) and that life has evolved.	.86	.09	-.04
3. The existence of life on earth is adequately explained by a creator alone.	.80	.08	.25
4. Life was created by an intelligent being who then played no further role in the evolution of life forms.	.69	.15	-.12
5. The creation of life on earth was not by design. (R)	-.67	-.01	-.05
6. God does not exist and therefore had nothing to do with the existence of life. (R)	-.52	.16	.07
*Factor 2**: Items Assessing Author Derogation:			
1. The author of this article is well informed. (R)	.04	.88	-.11
2. The author of this article has misrepresented the facts.	.05	-.85	.12
3. The author of this article is intelligent. (R)	.07	.83	-.26
4. The author of this article has ignored evidence that contradicts his position.	-.16	-.67	.12
5. I agree with the author of this article. (R)	.04	.58	-.45
*Factor 3**: Items Assessing Peripheral Worldview Beliefs:			
1. I am unsure as to how life arose on earth.	-.21	.13	-.83
2. The theory of evolution cannot explain the origin of life.	.02	.22	-.69
3. The existence of life on earth is adequately explained by evolution alone. (R)	-.19	.06	.66
4. The origins of life must be the result of more than simply evolution.	.11	.37	-.60
5. Science will never explain the origin of life.	.05	.02	-.54
6. Evolution and the idea of a creator are fundamentally inconsistent with each other. (R)	-.10	.25	.43
7. It is possible that life on earth is the result of some sort of supernatural force. (see footnote 4)	.54	-.01	-.36
Percentage of explained variance	*34.28*	*14.36*	*10.18*

Note. Participants were asked to rate their agreement with each item on a 7-point scale (1=completely disagree, 7=completely agree). Items followed by (R) are reverse scored.

* The meaning of Factors 2 and 3 are reversed in the factor solution. Thus, items that are reverse scored appear with positive factor loadings and vice versa. For the purpose of data analysis, these factors are scored such that higher numbers indicated more author derogation for Factor 2 and more accommodation of peripheral worldview beliefs for Factor 3.

Results

Factor Structure of Items Assessing Accommodation and Derogation

As in Study 2, I began by factor analyzing the accommodation and derogation items. Given that I expect the items to tap three distinct factors, I forced a three-factor solution. Moreover, since I again expected some correlation between the factors, I used an oblique rotation (direct oblimin, delta = 0) to allow for this possibility. Overall, the items converged in much the same way that they did in Study 2. Item loadings and percentage of variance explained by each factor are displayed in Table 4.[4] Factor 1 (eigenvalue = 6.17) once again consisted of items revolving around the belief in the existence of God, and therefore represented CORE; factor 2 (eigenvalue = 2.58) consisted of the items assessing attitudes toward the essay-author, and therefore represented author derogation; and factor 3 (eigenvalue = 1.83) consisted largely of items assessing the role of science and evolution in the creation process, and therefore represented PERI. Again consistent with Study 2, a moderate correlation was found between the factors represented CORE and PERI (r = .32). In contrast to Study 2, however, correlations were also observed between these factors and the one represented author-derogation ($r_{core\text{-}derogation}$ = -.16; $r_{peri\text{-}derogation}$ = -.19). The discrepancy between studies in this matter is likely due to the fact that all participants in the present study were exposed to the worldview threat article (which made the author-derogation items relevant to the accommodation items), while a third of participants in Study 2 were exposed to a non-threatening control article.

Accommodation of Core and Peripheral Worldview Beliefs

Accommodation scores were created by computing the mean of the items representing core ($\alpha = .83$) and peripheral ($\alpha = .74$) worldview beliefs (reverse scored where appropriate). These scores were then subjected to the same type of multiple regression analyses used in Studies 1 and 2. In this case, affirmation was dummy coded (0 = no-affirmation, 1 = affirmation), self-esteem was centered at the mean, and a cross-product of self-esteem × affirmation was computed by multiplying these variables.

Following Aiken and West (1991), these variables were then entered into a step-wise regression equation with the main effects of affirmation and self-esteem in the first step, and the interaction of these variables in the second step. When CORE was entered as the dependent variable, this procedure showed only a marginal interaction of self-esteem × affirmation, $F_{step2}(1, 56) = 3.70$, $p = .06$ (see Figure 4). Simple slopes tests revealed a significant effect of self-esteem on CORE in the affirmation condition, $\beta = .44$, $p < .05$, but not in the no-affirmation condition, $\beta = -.04$, *ns*. Thus, within the affirmation condition, higher levels of self-esteem predicted higher levels of CORE.

When PERI was entered as the dependent variable, this procedure showed only the predicted interaction of self-esteem × affirmation, $F_{step2}(1, 56) = 4.09$, $p < .05$ (see Figure 5). As expected, simple slopes tests revealed an effect of self-esteem on PERI in the no-affirmation condition, $\beta = -.35$, $p < .06$. No such effect was observed in the affirmation condition, $\beta = .17$, $p > .35$. Consistent with Studies 1 and 2, within the no-affirmation condition, higher levels of self-esteem predicted lower levels of PERI.

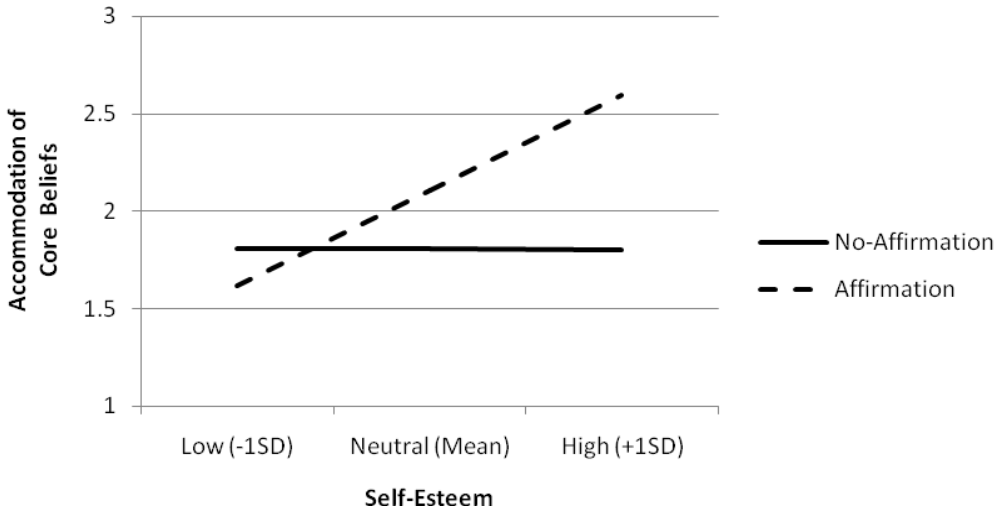


Figure 4. Effect of Self-Esteem by Affirmation on Accommodation of Core Worldview Beliefs in Study 3.

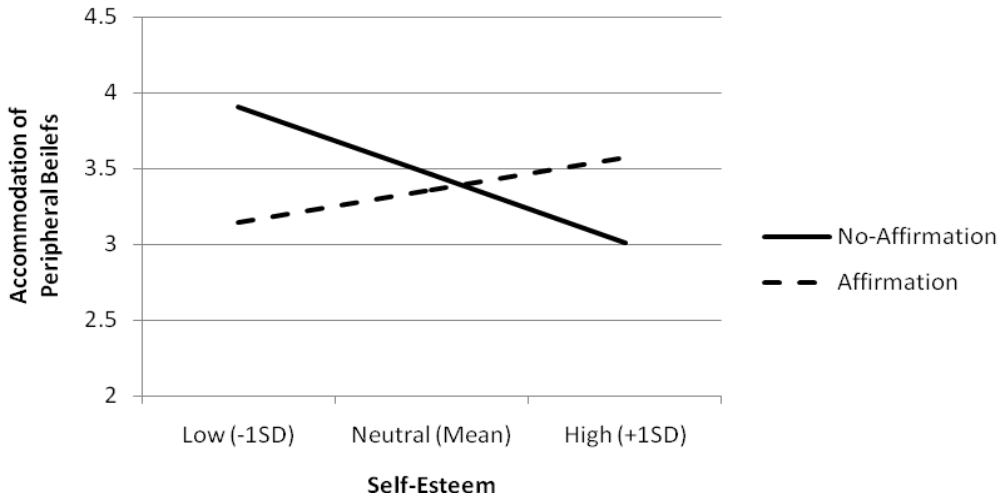


Figure 5. Effect of Self-Esteem by Affirmation on Accommodation of Peripheral Worldview Beliefs in Study 3.

Author Derogation

Author derogation scores were computed by taking the average of the derogation items (reverse scored were appropriate, $\alpha = .87$). The same analyses as above were then conducted on the derogation scores, yielding only the predicted interaction of self-esteem × affirmation, $F_{step2}(1, 56) = 4.21$, $p < .05$ (see Figure 6). Simple slopes tests revealed a significant effect of self-esteem within the no-affirmation condition, $\beta = .35$, $p = .05$, but not within the affirmation condition, $\beta = -.18$, $p > .34$. Consistent with Studies 1 and 2, within the no-affirmation condition, higher levels of self-esteem predicted higher levels of derogation.

Testing for Mediation. To examine whether the effect of self-esteem × affirmation on derogation was mediated by PERI, I conducted the same three step process outlined by Muller et al. (2005) that I did in Study 2. In this case, the treatment variable refers to the affirmation condition, the moderating variable is self-esteem, the mediating variable is PERI, and the outcome variable is derogation. The first two steps are outlined in the above sections showing the effect of self-esteem × affirmation on derogation and PERI, respectively (see also Steps 1 and 2 of Table 5). In the third and critical step, only PERI emerged as a significant predictor of derogation and the interaction of self-esteem × affirmation was now no longer significant (see Step 3 of Table 5). Thus, consistent with Study 2, the effect of self-esteem × affirmation appears to be mediated by PERI, indicating that self-esteem increases derogation within the no-affirmation condition by virtue of reducing accommodation.

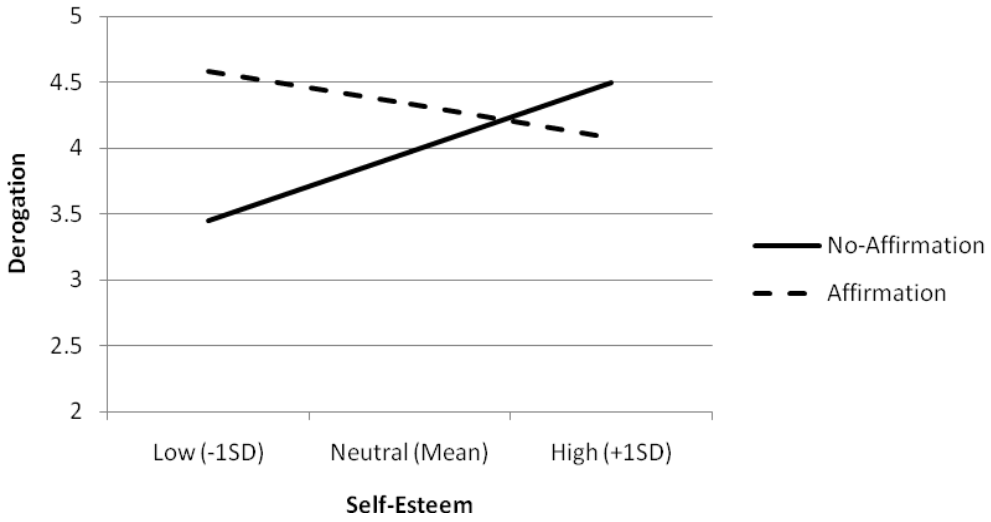


Figure 6. Effect of Self-Esteem by Affirmation on Derogation of the Essay-Author in Study 3.

Table 5

Regression Results for Mediated Moderation in Study 3.

Predictors	Step 1 (DV = DERO) β	Step 1 (DV = DERO) *t*	Step 2 (DV = PERI) β	Step 2 (DV = PERI) *t*	Step 3 (DV = DERO) β	Step 3 (DV = DERO) *t*
Affirmation	.123	0.95	-.027	-0.21	.098	0.78
Self-Esteem	.352	1.99^{+}	-.352	-1.97^{+}	.210	1.22
Affirm. × Self-Esteem	-.362	-2.05*	.260	2.02*	-.216	-1.26
PERI					-.401	-3.12**
PERI × Self-Esteem					.057	0.42

Note: DERO = author derogation; PERI = accommodation of peripheral beliefs.
$^{+}$ $p < .10$ * $p < .05$ ** $p < .01$

Death-Thought Accessibility

To examine the DTA results, I computed DTA scores by summing the number of fragments completed with the death-related response for each participant. I then conducted three separate stepwise regression analyses on these scores. For each analysis, I examined the effects of self-esteem, affirmation, and accommodation or derogation on DTA. In the first analysis I examined CORE. Accordingly, in the first step I entered the main effects of self-esteem, affirmation, and CORE as predictors. All possible two-way interactions of these variables were entered in the second step, and the three-way interaction was entered in the third step. This analysis yielded only a significant effect in the second step, $F_{step2}(3, 53) = 4.78$, $p < .01$, which was characterized by a two-way interaction of affirmation × CORE, $\beta = -.71$, $p < .01$. Simple slopes tests revealed that among participant in the no-affirmation condition, higher levels of CORE predicted higher DTA, $\beta = .50$, $p < .05$, while the reverse was true within the affirmation condition: higher levels of CORE predicted lower DTA, $\beta = -.34$, $p < .05$ (see Figure 7).

Next I examined the effects of self-esteem, affirmation, and PERI on DTA using the same stepwise regression procedure described above. This analysis revealed no significant effects (all *p*s > .20), and was therefore not probed any further.

Finally, I examined the effects of self-esteem, affirmation, and derogation on DTA. Once again, only the second step approached significance, $F_{step2}(3, 53) = 2.42$, $p < .08$, and was characterized by a significant two-way interaction of

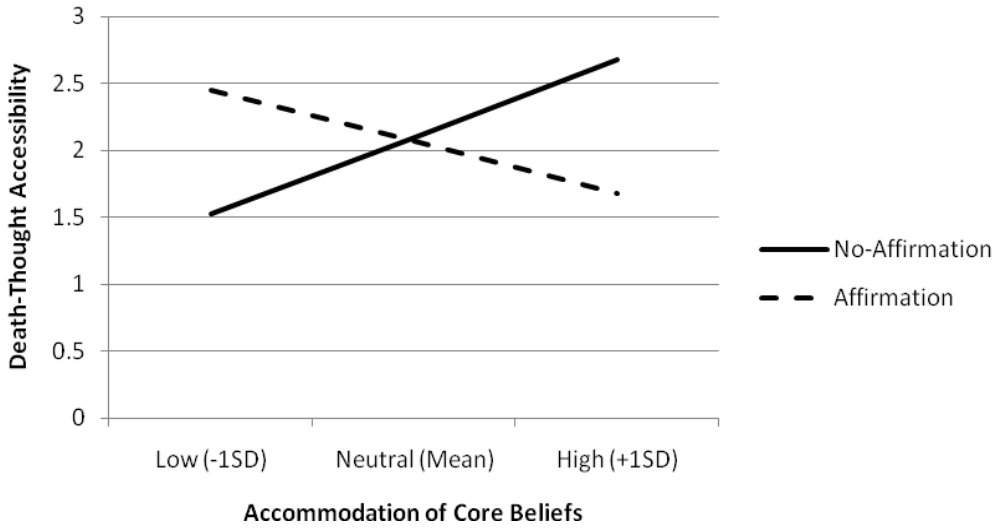


Figure 7. Effect of Affirmation by Accommodation of Core Worldview Beliefs on Death-Thought Accessibility in Study 3.

affirmation × derogation, $\beta = .43$, $p < .05$. Simple slopes tests showed that within the no-affirmation condition, higher levels of derogation predicted lower levels of DTA, $\beta = -.43$, $p < .05$, while derogation did not significantly predict DTA within the affirmation condition, $\beta = .21$, $p > .24$ (see Figure 8).

Discussion

The results of Study 3 are consistent with Studies 1 and 2 with regard to the moderating effect of self-esteem on accommodation under conditions of *MS/Threat*. First, within the no-affirmation condition (which is equivalent to the *MS/Threat* conditions in Studies 1 and 2), self-esteem was again shown to negatively predict accommodation; and consistent with Study 2, this effect was only observed for peripheral, not core worldview beliefs. Second, self-esteem was also found to positively predict derogation within the no-affirmation condition. Moreover, as in Study 2, the effect of self-esteem on derogation within the no-affirmation condition was mediated by the extent of accommodation. In other words, self-esteem only affected derogation indirectly, by virtue of affecting accommodation. This relationship is supported by the mediated moderation analysis.

In addition to replicating, Study 3 also extends the results of Studies 1 and 2 in a number of important ways. First, as predicted, inducing participants to affirm an important value reduced accommodation among participants with low self-esteem. Much like their high self-esteem counterparts who did not affirm, participants with low self-esteem in the affirmation condition displayed low levels of accommodation. Moreover, given that accommodation is shown to affect

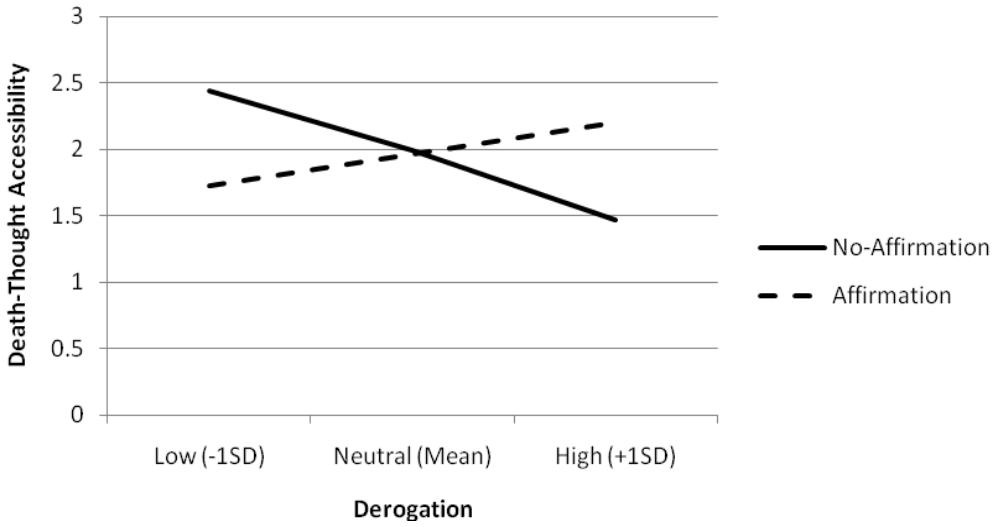


Figure 8. Effect of Affirmation by Author Derogation on Death-Thought Accessibility in Study 3.

derogation, self-affirmation was actually found to increase derogation among participants with low self-esteem by virtue of reducing accommodation. It appears that inducing a self-promotion focus by having participants affirm an important value and write about how they behave consistently with this value gave low self-esteem participants the fortitude to resist accommodating their protective beliefs in response to threat. And this resistance, in turn, lead them to be more derogatory toward the essay author.

By contrast, self-affirmation appeared to have an opposite effect among participants with high self-esteem. Indeed, these participants tended to accommodate their peripheral beliefs slightly more following affirmation (vs. no-affirmation), and were significantly more likely than participants with low self-esteem to accommodate even their core worldview beliefs when affirmed. It thus appears that the affirmation procedure affected participants with high vs. low self-esteem in different ways (cf. Wood, Anthony, & Foddis, 2006). While affirmation made participants with low self-esteem confident enough in themselves to resist accommodation (thereby increasing derogation), it simultaneously gave participants with high self-esteem the sense of security necessary to modify even their most cherished protective beliefs.

The inclusion of the DTA measure at the end of Study 3 also provided useful insights into how the processes of accommodation and derogation impact DTA. Overall, the results suggest one way in which DTA is increased, and two ways in which it can be reduced following MS and threat. Specifically, within the no-affirmation condition, accommodating core aspects of one's protective

worldview beliefs in response to threat was found to increase DTA. This adds to our knowledge of the conditions under which worldview threats will increase DTA, suggesting that DTA is especially aroused when a potent threat forces the individual to change their core worldview beliefs. Conversely, derogating the source of the threat within the no-affirmation condition was found to decrease DTA. This is consistent with previous research showing that providing people with the opportunity for defense following threat reduces DTA (e.g., Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997; Hayes, Schimel, & Williams, 2008), and provides additional support for the notion that worldview defenses are initiated in the service of reducing concerns about death. Notably, accommodation of peripheral beliefs did not affect DTA, regardless of affirmation condition. Thus, defending against threat with accommodation may not be as effective as derogation at reducing DTA (at least not in the short-term). Nevertheless, although accommodating peripheral aspects of the worldview did not *reduce* DTA, it did not appear to *increase* it either.

The results of Study 3 also provide insight into how self-affirmation impacts DTA. In contrast to the no-affirmation condition in which accommodating core worldview beliefs was found to increase DTA, accommodating these beliefs after self-affirmation was found to decrease DTA. It therefore appears that the ability to let go of a protective belief when it is under attack can help reduce DTA, as long as an alternative protective belief has been activated (through self-affirmation). Taken together, the results suggest that when mortality is salient and our protective beliefs are under attack, one can reduce

DTA either by derogating the source of the threat or by affirming an alternative value and becoming more flexible (i.e., accommodating) with regard to the core beliefs under attack. Flexibly modifying core beliefs that are under attack without affirming an alternative value, however, results in higher levels of DTA.

Before proceeding to the next study, it should be noted that the effect of self-affirmation in this study may appear inconsistent with past research. Specifically, the idea that self-affirmation will increase defensive derogation is at odds with a host of studies showing that self-affirmation generally decreases defensiveness (e.g., Schmeichel & Martens, 2005; Steele & Liu, 1983). Moreover, previous research has shown that self-affirmation increases openness to counter-attitudinal information (e.g., Cohen, Aronson, & Steele, 2000; Cohen et al., 2007; Sherman & Cohen, 2002; Sherman, Nelson, & Steele, 2000). Thus, the reduction of accommodation among participants with low self-esteem in the present study may also appear inconsistent with this literature.

Despite the apparent inconsistencies, the current study may not be directly comparable to prior self-affirmation research. First, whereas the above-mentioned studies investigated the effect of self-affirmation on defensive resistance to persuasion, the present research investigated belief-change as itself a type of defensive process. As stated at several points in this dissertation, accommodation is not equivalent to acquiescence. Rather, accommodating certain peripheral beliefs in response to threat is posited to occur as a way of defending core beliefs. To the extent that accommodation is a type of defense, the observed reduction in accommodation is perfectly consistent with previous research on self-affirmation.

Second, consistent with the notion that self-affirmation reduces defensive resistance to persuasion, the present results showed that core worldview beliefs were indeed more likely to be changed in response to threat, but this effect only emerged among participants with high self-esteem. Thus, self-affirmation did not produce the same effect among participants with high vs. low self-esteem in this study. Whereas participants with low self-esteem responded with reduced accommodation and increased derogation, those with high self-esteem displayed something of a reverse effect, wherein they tended to be somewhat less derogatory (albeit non-significantly) and were even willing to change their core worldview beliefs. Finally, the current study assessed two distinct types of defenses and the overall relationship between these two defenses. For participants with low self-esteem, rather than reducing defensiveness altogether, self-affirmation merely shifted their defense tendency from accommodation to derogation. The tendency for increased open-mindedness and reduced defensiveness following self-affirmation was only observed among participants with high self-esteem. Thus, although the results appear on the surface to be inconsistent with previous research on self-affirmation, upon closer inspection they are generally consistent with this research.

In a related vein, it may also be worth noting that the fact that self-affirmation did not altogether increase accommodation lends support to the idea that accommodation is a type of defensive response to threat. If the accommodation effects observed in Studies 1 and 2 were entirely representative of non-defensive agreement with the arguments put forth in the threat article, then

we should have expected to see increased accommodation across the board in response to self-affirmation. The fact that this was not observed suggests that accommodation is indeed a mode of defense against threat.

CHAPTER 5:

Study 4 – The role of DTA in Accommodation vs. Derogation Following Worldview Threat

Although Study 3 provides additional information about the effect of self-esteem on accommodation within the *MS/Threat* condition, it provides little explanation for why accommodation was observed to be generally high within the *Threat* condition of Study 1 and 2. From the perspective of the MS hypothesis, if a certain response to worldview threat serves to defend the worldview against that threat, then this response should be augmented following MS. This reasoning follows from the TMT notion that worldviews function to provide protection against thoughts about death, and must therefore be defended in order for them to maintain this function. In Studies 1 and 2, MS was not found to *increase* accommodation for anyone, and moreover, it only *decreased* accommodation for participants with high self-esteem. One possibility for this effect follows from the fact that potent worldview threats can often increase the accessibility of death-related thought (e.g., Schimel et al., 2007). In fact, the threat manipulation used in Study 1 has previously been used by Schimel et al., (2007, Study 5) as evidence for this effect. This is significant because TMT maintains that worldview defenses are initiated when DTA is high – regardless of whether the heightened DTA is due to a MS induction or an anxiety-buffer threat (see Hayes et al., 2010). Thus, worldview accommodation may be high in the *Threat* conditions of Studies 1 and 2 because the threats used in these studies are sufficient to increase DTA on their own. Although evidence already exists for the DTA arousing effect of the threat used in Study 1, it can only be assumed on the basis of the pattern of results in Study 2. One purpose of Study 4 was therefore to assess DTA following the threat manipulation used in Studies 2 and 3, to ensure that this threat does indeed

increase DTA. Accordingly, Study 4 employed the DTA paradigm (e.g., Schimel et al., 2007) wherein participants are exposed to a worldview threat (vs. no threat) and DTA is assessed immediately afterward. It was hypothesized that exposure to the threat material would increase DTA relative to the no-threat control. Moreover, if DTA is implicated in the activation of accommodation following threat, then it should emerge as a significant moderator of the effect of threat on accommodation. In other words, threat should be most likely to increase accommodation following threat when DTA is high.

Another way in which Study 4 was designed to expand upon the previous studies was by manipulating the order of defenses. In other words, half of participants were given the opportunity to accommodate their worldview prior to derogating the source of the threat (as in Studies 1-3), whereas the other half was first provided with the opportunity to derogate the source and then to accommodate their worldview beliefs. Although somewhat exploratory, the decision to include this manipulation was made with the following considerations in mind. First, given the outcome of the mediated moderation analysis, it seems that derogation in Studies 2 and 3 was influenced by the extent to which participants accommodated. As such, it is important to gage the extent to which participants will derogate the source of the threat without first having been asked to report how much they are willing to accommodate. Second, although the alternativeness of accommodation and derogation was most pronounced within the *MS/Threat* conditions of Studies 2-3, this effect was nevertheless present (to some extent) within the *Threat* condition of Study 2 as well. Thus, I expected that

the extent to which participants engaged in the first available defense would reduce the extent to which they would engage in the second available defense. After all, if accommodation and derogation are both methods of defense against threat, then enacting one of the two should suffice. Third, if worldview defenses are initiated in response to high levels of DTA (Hayes et al., 2010), and accommodation is a form of defense roughly comparable to derogation, then DTA should be positively associated with whichever defense is first available following threat. Specifically, when the opportunity for derogation appears first, high levels of DTA following threat should predict high levels of derogation. Similarly, when the opportunity for accommodation appears first, high DTA following threat should predict high levels of accommodation.

Finally, although self-esteem was found to be a significant moderator of the effects in Studies 1-3, the impact of this variable was only observed when mortality was salient. Given that the present study does not include a MS manipulation, I did not expect self-esteem to play a significant role in the present study. Nevertheless, I include this variable as a potential moderator in my presentation of the results.

Method

Participants and Design

Participants were 93 (45 male, 48 female) introductory psychology students at the University of Alberta who received partial course credit for their participation. Three participants were excluded from the data analysis for indicating suspicion of the cover story. Students were made eligible to participate

in the study on the basis of the same criteria used in Study 2, and self-esteem scores were obtained in a mass-testing survey administered at the beginning of the academic term (sample $M = 42.6$, $SD = 10.0$). Once in the lab, participants were randomly assigned to one of four conditions in a 2 (Control vs. Threat) × 2 (Order of Defense: accommodation first vs. derogation first) between subjects × 2 (Type of Defense: accommodation vs. derogation) within subjects mixed factorial design.

Procedure

The study procedure was very similar to that used in Studies 1-3, but followed the DTA paradigm outlined by Schimel et al., (2007) and used a memory cover story. Participants were informed that they would read a sample of text and then, following a short distraction task, answer some memory questions about what they read. The samples of text were identical to those used in Study 2. Specifically, participants in the Control condition read a historical account of attitude measurement techniques (Ajzen & Fishbein, 1980), whereas those in the threat condition read an article that criticized the evolutionary account of life's origins and argued in favour of intelligent design.

After reading the article, participants completed two word tasks (a word-fragment completion task and a word-search puzzle) that were ostensibly included to provide distraction between reading and remembering. In fact, the word-fragment completion task was used to measure DTA – one of the main dependent variables. The task contained 20 word fragments, 6 of which could be completed using a death-related word. For example, the fragment DE_ _ can be completed as

dead or several non-death-related words such as *desk*. The possible death-completions were *bur__ied__, de__ad__, gra__ve__, ki__ll__ed, sk__ull__*, and *coff__in__*. The remaining 14 fragments could only be completed in non-death related manners. The second word task (the word-search puzzle) was provided as filler and contained no death-related words.

After completing the word tasks, participants answered 10 memory questions pertaining to the text they had read, followed by the same 18 items used to assess accommodation and derogation in Study 3. Importantly, the order of the items assessing accommodation and derogation were reversed for half of the participants. In other words, some participants responded to the 13 accommodation items before the five derogation items, whereas other participants responded to the five derogation items before the 13 accommodation items. Upon completion, all participants were probed for suspicion and fully debriefed.

Results

Death-Thought Accessibility

My first hypothesis was that relative to participants in the *Control* condition, those in the *Threat* condition would evince higher levels of DTA. To assess this hypothesis, DTA scores were computed by summing the total number of word-fragments completed in the death-related manner for each participant. These scores were then submitted to an independent samples t-test with threat condition as the independent variable. This procedure yielded a significant effect, $t(88) = 2.84$, $p < .01$, such that DTA was higher in the *Threat* condition ($M = 2.26$, $SD = 0.98$) than in the *Control* condition ($M = 1.68$, $SD = 0.96$).

Factor Structure of Items Assessing Accommodation and Derogation

As in Studies 2 and 3, I began by factor analyzing the accommodation and derogation items. Given that I expect the items to tap three distinct factors with some inter-correlation, I forced a three-factor solution and used an oblique rotation solution (direct oblimin, delta = 0). Overall, the items converged in much the same way that they did in Studies 2 and 3. Item loadings and percentage of variance explained by each factor are displayed in Table 6. As in Studies 2 and 3, Factor 1 (eigenvalue = 4.60) consisted of items revolving around the belief in the existence of God, and therefore represented CORE; factor 2 (eigenvalue = 3.54) consisted of the items assessing attitudes toward the essay-author, and therefore represented author derogation; and factor 3 (eigenvalue = 1.51) consisted largely of items assessing the role of science and evolution in the creation process, and therefore represented PERI. Again consistent with Studies 2 and 3, a moderate to high correlation was found between the factors represented CORE and PERI (r = .43), but little or no correlation between these factors and the one representing author derogation ($r_{core\text{-}derogation}$ = .00; $r_{peri\text{-}derogation}$ = -.02).

Worldview Defense

Accommodation and derogation scores were created by computing the mean of the items (reverse scored where appropriate) representing each construct (CORE α = .76; PERI α = .57; derogation α = .86). It was hypothesized that worldview threat would increase both derogation and accommodation of peripheral beliefs, but not core beliefs. Moreover, DTA and the order in which participants were induced to defend (accommodation first vs. derogation first)

Table 6

Factor Loadings for Accommodation and Derogation Items used in Study 4.

Item	Factor Loading 1	2	3
Factor 1: Items Assessing Core Worldview Beliefs:			
1. I believe both that life was created (by an intelligent being) and that life has evolved.	.89	.10	.04
2. Life was created by an intelligent being who then played no further role in the evolution of life forms.	.76	.04	.05
3. Life on earth is the result of a combination of both creation and evolution.	.71	.10	-.10
4. The creation of life on earth was not by design. (R)	-.68	-.08	.09
5. The existence of life on earth is adequately explained by a creator alone.	.51	-.12	.02
6. God does not exist and therefore had nothing to do with the existence of life. (R)	-.42	.20	.05
*Factor 2**: Items Assessing Author Derogation:			
1. The author of this article is well informed. (R)	.13	.87	.08
2. The author of this article has misrepresented the facts.	.07	-.86	.07
3. I agree with the author of this article. (R)	.12	.80	-.07
4. The author of this article is intelligent. (R)	-.14	.75	-.12
5. The author of this article has ignored evidence that contradicts his position.	-.06	-.68	-.02
*Factor 3**: Items Assessing Peripheral Worldview Beliefs:			
1. The theory of evolution cannot explain the origin of life.	-.00	.11	-.79
2. I am unsure as to how life arose on earth.	.04	-.14	-.75
3. The origins of life must be the result of more than simply evolution.	-.01	.14	-.73
4. The existence of life on earth is adequately explained by evolution alone. (R)	-.02	-.03	.72
5. Evolution and the idea of a creator are fundamentally inconsistent with each other. (R)	.05	.48	.53
6. It is possible that life on earth is the result of some sort of supernatural force.	.33	-.02	-.47
7. Science will never explain the origin of life.	.21	.17	-.29
Percentage of explained variance	*25.57*	*19.68*	*8.41*

Note. Participants were asked to rate their agreement with each item on a 7-point scale (1=completely disagree, 7=completely agree). Items followed by (R) are reverse scored.

* The meaning of Factors 2 and 3 are reversed in the factor solution. Thus, items that are reverse scored appear with positive factor loadings and vice versa. For the purpose of data analysis, these factors are scored such that higher numbers indicated more author derogation for Factor 2 and more accommodation of peripheral worldview beliefs for Factor 3.

were expected to moderate the results such that high DTA in response to threat should increase the first defense which should, in turn, decrease the second defense. To test this hypothesis, multiple regression techniques were used to first examine the omnibus interaction. Accordingly, threat condition was dummy coded (0 = no threat, 1 = threat), as was the order of defense (0 = accommodation first, 1 = derogation first), and the DTA scores were centred at the mean. Given that self-esteem affected the results in Studies 1-3, these scores were also centred at the sample mean and included in the analyses. All higher order interactions between these variables were computed by multiplying the variables in question. Following Aiken and West (1991), these variables were then entered into a step-wise regression equation (with the main effects in the first step, two-way interactions in the second step, three-way interactions in the third step, and the four-way interaction in the fourth step) to examine each of the dependent variables.

Accommodation of Core Beliefs. When CORE was entered as the dependent variable, this procedure produced no main effects or interactions. Thus, as in Studies 2 and 3, core worldview beliefs regarding the non-existence of God remained unaffected.

Accommodation of Peripheral Beliefs and Author Derogation. Accommodation of peripheral beliefs and author derogation were hypothesized to be alternative response to threat, so these defenses were first analysed together. In order to facilitate the comparative analysis of PERI and derogation, a defense composite was created by subtracting the PERI scores from the derogation scores.

Positive numbers on this composite therefore represent more derogation than accommodation while negative numbers represent more accommodation than derogation. When this variable was entered as the dependent variable, the multiple regression procedure yielded only the predicted three-way interaction of threat × DTA × order of defense, $\beta = .59$, $p < .01$.[5] To ensure that this interaction was not due to movement on only one of the defenses, additional analyses were conducted on each of the defense-variables separately, showing a significant three-way interaction on both PERI, $\beta = -.44$, $p < .05$, and derogation, $\beta = .43$, $p < .05$. The main hypothesis was that high DTA in response to threat would promote the first available defense. To assess this hypothesis, I analyzed the simple interaction of DTA × order of defense on PERI within the threat condition.[6] This interaction emerged significant, $\beta = -.53$, $p < .01$ (see Figure 9), and was characterized by the predicted significant simple effect of DTA on PERI when accommodation was presented as the first available defense, $\beta = .36$, $p < .05$. Interestingly, the simple effect of DTA on PERI was also significant and in the opposite direction when derogation was presented as the first available defense, $\beta = -.53$, $p < .05$. Next, I analyzed the simple interaction of DTA × order of defense on derogation within the threat condition. This interaction was also significant, $\beta = .54$, $p < .01$ (see Figure 10), and was characterized by a significant simple effect of DTA on derogation when this defense was offered first, $\beta = .76$, $p < .01$, but not when it was offered second, $\beta = -.16$, $p > .35$.

Testing for Mediation. It was hypothesized that DTA would promote the first available defense, which would in turn reduce the second available defense.

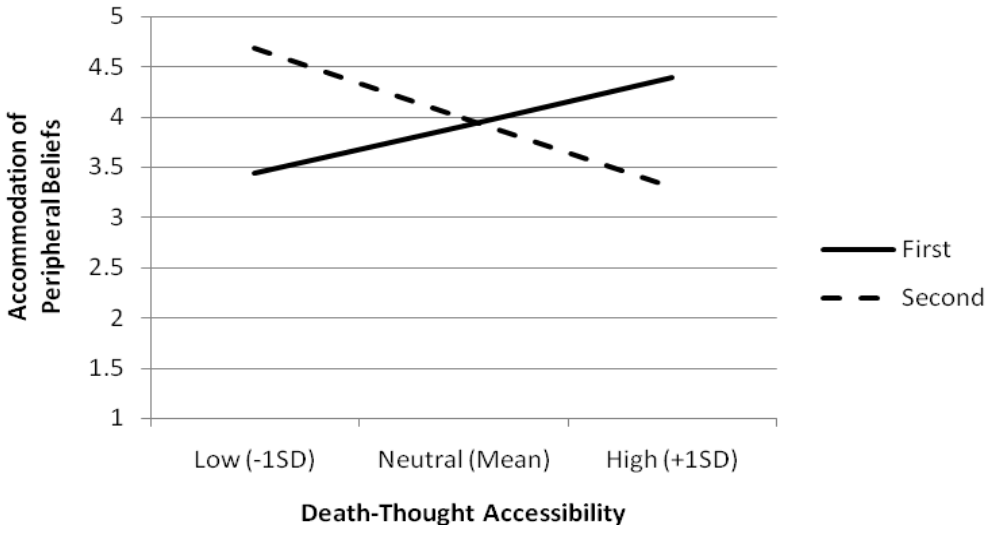


Figure 9. Effect of Death-Thought Accessibility by Order of Defense on Accommodation of Peripheral Beliefs in Study 4.

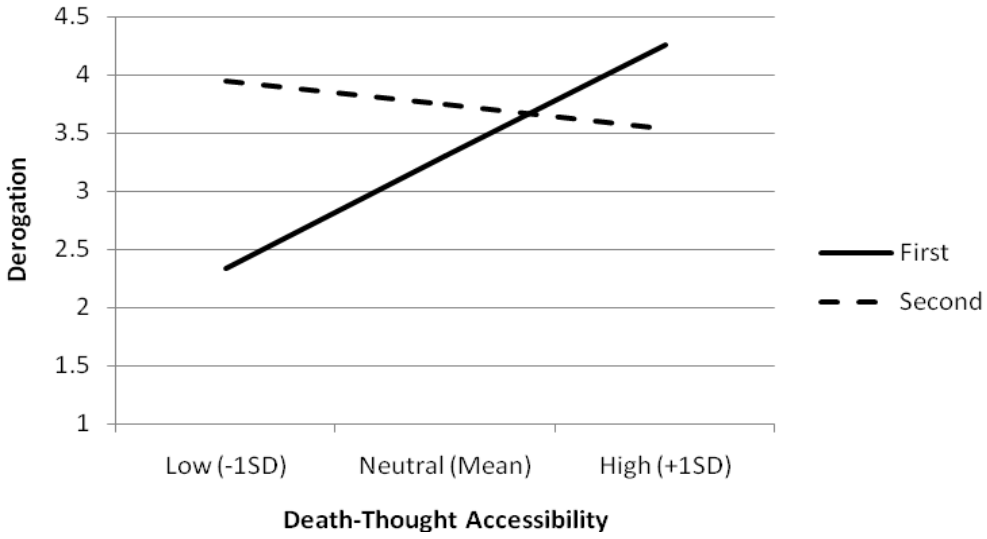
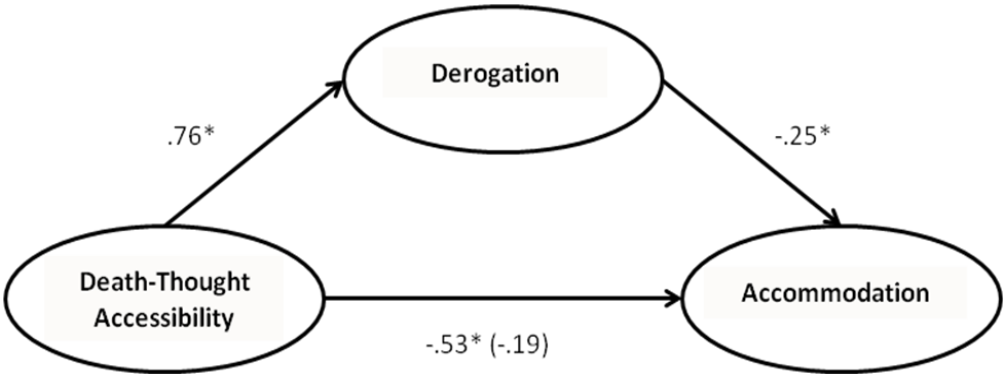


Figure 10. Effect of Death-Thought Accessibility by Order of Defense on Derogation of the Essay Author in Study 4.

In the present case, DTA affected the second available defense only when this defense was accommodation. To test if this effect was mediated by the first available defense (i.e., derogation), a meditational analysis was conducted. As shown above, when derogation was the first available defense, DTA predicted both derogation, $\beta = .76$, $p < .01$, and accommodation, $\beta = -.53$, $p < .05$. To assess whether or not the effect of DTA on accommodation within this condition was mediated by derogation, the accommodation scores were regressed on DTA together with the derogation scores (Baron & Kenny, 1986). This procedure showed a significant effect of derogation, $\beta = -.25$, $p < .05$, and the effect of DTA was now no longer significant, $\beta = -.19$, $p > .45$ (see Figure 11, Panel A). Thus, when derogation was provided to participants as the first available defense following threat, DTA increased derogation which in turn reduced accommodation. With regard to the opposite order of defense, given that DTA did not affect derogation when it was the second available defense, meditation is not a possibility here. As shown above, however, DTA did promote accommodation as the first available defense. Moreover, when derogation was regressed on DTA together with accommodation, accommodation did emerge as the stronger predictor, and tended to reduce derogation as predicted. However, this effect was not quite significant, $\beta = -.17$, $p > .20$ (see Figure 11, Panel B). Taken together, it appears that derogating the source of the threat significantly reduces one's tendency to accommodate the threat, but accommodating the threat does not seem to reduce completely the motivation to derogate its source.

(a) Derogation First



(b) Accommodation First

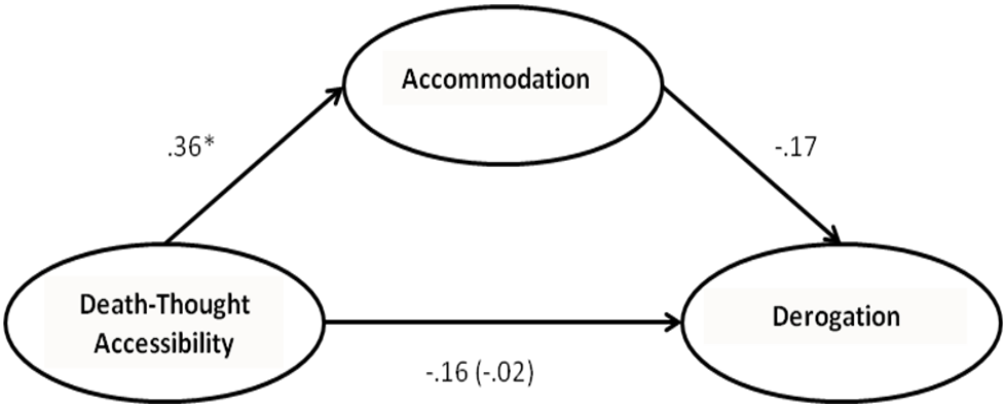


Figure 11. Mediational Analyses of the First Available Defense on the Second Available Defense when (a) Derogation was First and (b) Accommodation was First in Study 4.

Discussion

The results of Study 4 provide insights into why worldview threat (without MS) produced relatively high levels of accommodation in Studies 1 and 2. By using the DTA paradigm, it was shown that the worldview threat material employed in Study 2 was sufficient to increase DTA, which provided the requisite motivation for participants to defend their worldview against threat. Indeed, the extent of DTA was found to be predictive of the extent of defense following threat. Specifically, when the first available defense was accommodation, high levels of DTA predicted high levels of accommodation. Likewise, when the first available defense was derogation, high DTA produced high derogation. The finding that both accommodation and derogation resulted from high DTA provides additional evidence that accommodation is indeed a form a defense against threat.

It is interesting to note, however, that DTA was a stronger predictor of derogation as a first defense (β = .76) than it was of accommodation as a first defense (β = .36). Moreover, derogation as a first defense was also more effective at reducing accommodation as a second defense than the other way around. Although the fact that accommodation did not significantly reduce derogation may appear inconsistent with the results of Studies 2 and 3, it is important to note that in these studies the derogation-reducing effect of accommodation was most pronounced in the *MS/Threat* condition. Thus, the relatively weak derogation-reducing effect observed in the present study is, in fact, perfectly consistent with the results of Studies 2 and 3. What's interesting, however, is that derogation

significantly reduced subsequent accommodation, even in the absence of MS in the current study. Taken together with the fact that derogation was shown to reduce DTA in Study 3 (while accommodation of peripheral beliefs did not), these findings suggest that accommodation and derogation may not provide entirely equivalent levels of defense against threat. Rather, it would appear that derogation may be somewhat more effective in this regard. I provide a more thorough comparison of these two types of defense in the general discussion.

One interesting question that emerges from the present study pertains to the difference in results between the worldview threat condition when it is present with vs. without MS. Specifically, in Studies 1-3, self-esteem was found to moderate the effect of threat on accommodation (and derogation in Studies 2 and 3) when mortality *was* salient, but not when it *was not* salient. Given that the threat manipulations used in these studies have been shown to increase DTA in and of themselves, one might wonder why there is any difference at all between these conditions. In other words, since MS is posited to promote worldview defense by virtue of increasing DTA (see Hayes et al., 2010) and the threat conditions also increase DTA, why is self-esteem not a significant moderator of accommodation (and derogation) following the threat alone (without MS)? I suspect the reason that self-esteem moderates the effects in the *MS/Threat* conditions but not in the *Threat* conditions (i.e., the threatening article alone), has to do with (1) the degree of DTA or (2) the timing of high DTA. Both of these factors were likely different between these two conditions. First, although the threat conditions in these studies are enough to increase DTA without MS, this

effect was likely more effective for some participants than others. Indeed, not all participants evinced high DTA following threat. Under MS, however, given that all participants have been asked to explicitly contemplate their mortality, death concerns have been aroused for everyone in this condition. Thus, the extent to which they will defend against the threat in their preferred manner (i.e., low self-esteem = accommodation; high self-esteem = derogation) may have been exaggerated by MS by virtue of arousing death concerns for all participants. Consistent with this idea, in both Studies 1 and 2, there was a slightly negative relationship between self-esteem and accommodation in the *Threat* condition, and this relationship became strong (and significant) in the *MS/Threat* condition. Regarding the second possibility, participants in the *MS/Threat* conditions would have experienced high DTA *prior to reading* the threat materials, whereas those in the *Threat* conditions experienced high DTA *as a result of reading* the threat materials. This difference may have affected the way in which they processed the article, which may account for the exaggerated defense tendencies as a function of self-esteem. Although these are just two possibilities, and several other explanations remain possible, on the basis of the available evidence I cannot say for sure why these two conditions appear to be producing different results despite the fact that they both yield high DTA. Future research will certainly need to investigate the differences between DTA aroused by worldview and self-esteem threats and that aroused by MS.

The above-mentioned issue notwithstanding, Study 4 provides additional support for the notion that accommodation is a viable defense against threat. By

comparing accommodation to derogation in a between subjects design, Study 4 showed that the conditions under which people will accommodate their worldview are the same as those in which they will derogate the source of the worldview threat. This provides the strongest support thus far that accommodation is indeed a type of defense. Importantly, the present results were obtained from the perspective of the DTA hypothesis, thereby providing methodological convergence for the effects observed from the perspective of the MS hypothesis in Studies 1-3. Although the broader picture of results from these four studies can now be seen, I conducted a fifth and final study to investigate whether or not the circumstances observed to produce accommodation in response to *worldview* threat would also hold with regard to *self-esteem* threat.

CHAPTER 6:

Study 5 – Accommodating Beliefs about the Self in Response to Self-Esteem Threat

The forgoing analysis has thus far shown that potent threats to the cultural worldview increase the tendency for people to accommodate their worldview beliefs. Study 5 sought to extend the results of Studies 1-4 from beliefs about the world (i.e., cultural worldview) to beliefs about the self (i.e., self-esteem). From the perspective of TMT, cultural worldviews and self-esteem are the central means through which we buffer death-anxiety. To date, no research has shown a substantial difference between the functioning of these buffering mechanisms. For instance, MS has been shown to increase both worldview defense (e.g., Greenberg et al., 1990) and self-esteem defense (e.g., Mikulincer & Florian, 2002). Similarly, activating either of the mechanisms (e.g., through self-affirmation) has been shown to reduce the effects of MS (on both worldview defense and DTA). Finally, both worldview and self-esteem threat have been shown to increase DTA (Hayes et al., 2008; Schimel et al., 2007; Study 4 of the present research). Thus, if the conditions highlighted in Studies 1-4 determine when people will accommodate their beliefs about the world, it follows that the same conditions might determine when people will accommodate their beliefs about the self. In other words, threats to self-esteem, or to the overall integrity of the self, should produce self-concept accommodation. As with beliefs about the world, beliefs about the self should be amenable to accommodation following threat regardless of self-esteem when mortality is *not* salient. When mortality *is* salient, however, self-esteem should moderate the effect of the threat, such that people with low self-esteem will be more likely to accommodate their self-beliefs than people with high self-esteem.

Study 5 was designed to test the reasoning outlined above by inducing participants to contemplate their mortality (vs. control) and exposing them to information that threatens (vs. does not threaten) their self-concept. In this case, beliefs about the self were threatened by having participants take an implicit association test (IAT, Greenwald, McGhee, & Schwartz, 1998) that assessed implicit prejudice toward Arabs (relative to Canadians). After taking the test, participants were randomly assigned to feedback indicating that they possessed either high or low amounts of prejudice. Given that feedback indicating low amounts of prejudice could be affirming to participants, a third group of participants were made privy to the purpose of the IAT (i.e., to measure prejudice), but received no feedback. I reasoned that most students do not believe that they are prejudiced, or at least would not report being prejudiced if explicitly asked. Thus, participants were not preselected on the basis of prior attitudes as they were in Studies 1-4. Given the social sanctions associated with prejudice in our Western society, however, receiving feedback indicating high levels of prejudice toward Arabs should constitute a threat to the self-esteem of nearly all students in the introductory participant pool. Nevertheless, administering a real IAT to provide the backdrop to the feedback manipulation also provided an opportunity to assess prejudice toward Arabs implicitly. Implicit prejudice, as measured by the IAT, was therefore included as a potential moderating variable in the data analysis.

After receiving the feedback, participants were given the opportunity to accommodate the notion that they are prejudiced into their self-concept. In

keeping with the notion that accommodation impacts derogation, participants were also provided with the opportunity to derogate the source of the threat – in this case, the IAT. Finally, participants completed a lexical-decision-task measure of DTA.

It was predicted that when mortality is not salient, participants who receive feedback indicating that they are prejudiced should be more likely to report having prejudiced attitudes toward Arabs than participants who receive no feedback or feedback indicating that they are not prejudiced. When mortality *is* salient, however, I expected this effect only among participants with low self-esteem. Participants with high self-esteem, by contrast, should respond with low levels of accommodation, which should in turn result in high levels of derogation. With regard to DTA, given the results of Study 3, it was predicted that high levels of accommodation following MS and threat should either increase DTA or have no impact, while high levels of derogation should decrease DTA.

Method

Participants and Design

Participants consisted of 118 introductory psychology students at the University of Alberta. Given that the threat manipulation involved taking a Canadian vs. Arab IAT, only students of North-American/European descent were selected to participate in the study. This information was gathered in a mass-testing session at the beginning of the academic term, which also contained the Rosenberg self-esteem scale (sample $M = 45.1$, $SD = 8.3$). Once in the laboratory, participants were randomly assigned to one of six conditions in a 2(Salience: MS

vs. dental pain) × 3(Feedback: prejudiced vs. not-prejudiced vs. none) between-subjects factorial design. Three participants were excluded from the sample after expressing suspicion of the cover story, leaving 115 participants (81 female) for the data analysis.

Procedure

The study was presented as an investigation of people's perceptions of various personality measurement procedures. Participants were asked to complete four personality measures (two on paper and two on the computer) and thereafter provide their opinions of the measures regarding perceived accuracy and validity. They were informed that, for the computer measures, their score will be computed in some cases and they may be allowed to see this score prior to providing their assessment of the measure. Participants were led to believe that whether or not they received this information was to be randomly assigned by the computer.

The paper personality measures consisted of (1) the same mortality salience (vs. dental pain) induction used in Studies 1-3, and (2) a need for cognition questionnaire (Cacioppo, Petty, & Kao, 1984), which was included to provide delay following MS (see Greenberg et al., 1994). In keeping with the cover story, after completing each of these measures participants were asked several questions regarding their perceptions of the questionnaire (e.g., "*I enjoyed answering the questions included in this measure*"; "*I believe this measure will assess important aspects of my personality*").

The personality measures taking place on the computer consisted of (1) an Implicit Association Test (IAT; Greenwald et al., 1998), and (2) a lexical decision

task. The IAT assessed the extent to which participants were implicitly biased against Arabs, and provided the basis of the self-esteem threat manipulation. The task consisted of seven trial-blocks that involved sorting words and/or names into two categories. The first block involved sorting between Canadian names (e.g., Marie, John) and Arab names (e.g., Fatima, Muhammad). The second block involved sorting between positive words (happy, beauty) and negative words (sad, terror). The third and fourth blocks involved sorting the words used in the first and second blocks together. Critically, participants were instructed to press one key if the word/name was Canadian or positive and another key if the word/name was Arab or negative. For the final three blocks, the keys are reversed and the categories are reassigned. Thus, in the final two blocks, participants are instructed to press one key if the word/name was Canadian or negative and another key if the word/name was Arab or positive. Implicit prejudice is assessed by comparing response latencies and accuracy for blocks in which Arab is paired with negative relative to when it is paired with positive (see Greenwarld, Nosek, & Banaji, 2003, for a more extensive explanation). Regardless of how participants responded to the test, however, they were randomly assigned to one of three feedback conditions. In the *Negative* feedback condition, participants were told that they possess moderate to high levels of prejudice against Arabs. In the *Positive* feedback condition, they were told that they possess low levels of prejudice against Arabs. In the *No-Feedback* condition, participants received no feedback regarding their level of prejudice toward Arabs.

After receiving their feedback, participants answered 12 questions assessing the extent to which they would accommodate the idea that they are prejudiced, followed by five questions assessing derogation of the IAT. Since the researcher remained ensure about how participant might attempt to accommodate the prejudice feedback, the accommodation items were designed to capture a number of possible ways of incorporating the idea of prejudice into the self-concept. With the goal of carrying the distinction between core and peripheral protective beliefs into the present context, it was reasoned that the core aspect of one's beliefs about the self may consist of beliefs regarding the overall value of the self: that one is, despite any possible feelings of prejudice toward Arabs, nevertheless a good person. Given that Studies 2-4 showed accommodation effects mainly with regard to peripheral beliefs, the majority of the accommodation items were designed to assess ways of minimizing the implications of being prejudiced with regard to one's overall self-worth (e.g., "Sometimes I'm a bit prejudiced, even though I don't want to be" and "It is easy to see Arabs in a negative light given all the bad things that they do"). To assess accommodation of core beliefs, a few additional items assessed more explicit, non-excused forms of prejudice that made no pretence toward minimizing the implications of being prejudiced (e.g., "I don't really like Arabs"). Finally, the derogation items assessed ways of dismissing the feedback by questioning the validity of the IAT (e.g., "The implicit prejudice test is fundamentally flawed"). See Table 7 for a full list of the accommodation and derogation items used in this study.

Table 7

Factor Loadings for Accommodation and Derogation Items used in Study 5.

Item	Factor Loading 1	2
Factor 1: Items Assessing Accommodation:		
1. I don't really like Arabs.	.77	.01
2. I try hard not to be prejudiced against Arabs, but sometimes my true feelings slip out.	.73	-.10
3. Deep down, I associate Arabs with many negative things.	.73	-.04
4. I don't like Arab people and I think I am right in not liking them.	.71	.07
5. I dislike some Arabs, but not all of them.	.67	.07
6. A lot of Arabs really are bad people.	.66	-.02
7. Movies and news stories about Arabs have led me to be somewhat prejudiced against them.	.62	-.13
8. I have prejudice toward Arabs, but that doesn't affect how I treat them.	.61	-.07
9. It is easy to see Arabs in a negative light given all the bad things that they do.	.60	-.10
10. Sometimes I'm a bit prejudiced, even though I don't want to be.	.58	-.06
11. I don't believe that I am at all prejudiced. (R)	-.45	-.06
12. I'm not prejudiced in any way, shape, or form. (R)	-.45	-.07
Factor 2: Items Assessing Derogation:		
1. The implicit prejudice test is a good test of whether or not a person is prejudiced. (R)	.06	-.86
2. The implicit prejudice test is fundamentally flawed.	.08	.85
3. The implicit prejudice test does not measure what it claims to measure.	.08	.84
4. The implicit prejudice test is an accurate measure of how I feel toward Arabs. (R)	.09	-.82
5. The implicit prejudice test will detect people's prejudices, regardless of how hard they try to hide them. (R)	.11	-.75
Percentage of Explained Variance	*36.33*	*14.19*

Note. Participants were asked to rate their agreement with each item on a 7-point scale (1=completely disagree, 7=completely agree). Items followed by (R) are reverse scored.

Following completion of the above mentioned items, participants proceeded to the final computer personality measure, which consisted of a lexical decision task used to measure DTA. This method has been used in prior investigations of this nature (Hayes, Schimel, Faucher, et al., 2008, Studies 1 and 2; Schimel et al., 2007, Study 3), and has yielded similar results to the word-fragment procedure (see Hayes et al. 2010 for a review of various DTA measures). Participants are presented with a series of words or non-words on the computer screen and instructed to press one key when the string of letters forms a word and another key when it forms a non-word. The task contained six death-related words, embedded among 18 non-death-related words and 36 non-words. Participants were instructed to proceed through the task as quickly as possible. Accuracy and reaction time were assessed for each response. DTA is measured by comparing response for the death vs. non-death words. Faster and more accurate responses to the death words (relative to the non-death words), are interpreted to indicate high levels of DTA.

Results

Implicit Prejudice toward Arabs

Implicit prejudice scores were computed using the *improved algorithm* outlined by Greenwald et al. (2003). Before proceeding with the primary analyses, these scores were subjected to an independent samples t-test to examine the possible effect of MS on implicit prejudice toward Arabs. Given that MS has been repeatedly been found to increase negative reactions to out-group members (e.g., Greenberg et al., 1990), it seemed reasonable that it may also have affected

participants implicit attitudes toward Arabs. However, this analysis revealed no significant effect of salience on the D-scores (MS: Mean = 2.41, SD = 1.1; Control: Mean = 2.39, SD = 1.3), $t(113) = 0.09$, *ns*.

Factor Structure of the Accommodation and Derogation Items

As in Studies 2 and 3, we began by factor analyzing the accommodation and derogation items. An initial principle components analysis, using an oblique rotation (direct oblimin, delta = 0) to allow for possible correlations between the factors, yielded four factors with eigenvalues greater than 1. Inspection of the screeplot, however, suggested that a two factor solution was likely the most parsimonious. Factor 2 accounted for much more of the overall variance of the items than did Factor 3 (difference = 5.57%), whereas the difference between the variance explained by Factors 3 and 4 (difference = 1.15%) was similar to that observed between Factors 4 and 5 (difference = 2.49%). As such, a second principle components analysis was conducted forcing a two factor solution. Results from this analysis yielded two relatively clean factors with a moderate negative correlation ($r = -.36$). Item loadings and percentage of variance explained by each factor are displayed in Table 7. Factor 1 (eigenvalue = 6.18) consisted of all 12 accommodation items, while factor 2 (eigenvalue = 2.41) consisted of all 5 derogation items.

Self-Concept Accommodation

Accommodation scores were computed by taking the mean of the items assessing this construct (reverse scored where appropriate, $\alpha = .86$). These scores where then analyzed using the same multiple regression techniques used in

Studies 1-4. Accordingly, salience condition was dummy coded (MS = 1, Dental Pain = 0), and two additional dummy codes were created to represent the feedback condition. To facilitate comparisons between the *Negative* feedback condition and each of the other two conditions, the former was made the referent by assigning it a code of 0 for both dummy codes. In other words, Dummy 1 represented the contrast between the *Negative* and *Positive* conditions, while Dummy 2 represented the contrast between the *Negative* and *No-Feedback* conditions. Self-esteem scores were centred at the sample mean, and all possible interactions of these variables were created by multiplying the variables in question. These variables were then regressed on the accommodation scores in a step-wise regression equation. Step 1 contained all of the main effects, Step 2 contained all of the two-way interactions, and Step 3 contained the two three-way interaction terms. This analysis yielded no significant effects at any of the steps (all *p*s > .35), and no simple interactions were significant either (all *p*s > .20).

An additional analysis was conducted to examine whether the implicit prejudice scores may have moderated accommodation. Accordingly, the D-scores were centred at the sample mean, and multiplied with the MS and dummy vectors representing feedback condition to create interaction terms.[7] As in the self-esteem analysis, these variables where then regressed on the accommodation scores. Step 1 contained all of the main effects, Step 2 contained all possible two-way interactions, and Step 3 contained the two three-way interaction terms. Although steps 1 and 2 emerged non-significant in this analysis (*p*s > .45), the effect of step 3 was significant, F_{step3} (2, 103) = 3.06, p = .05 (see Figure 12). This interaction

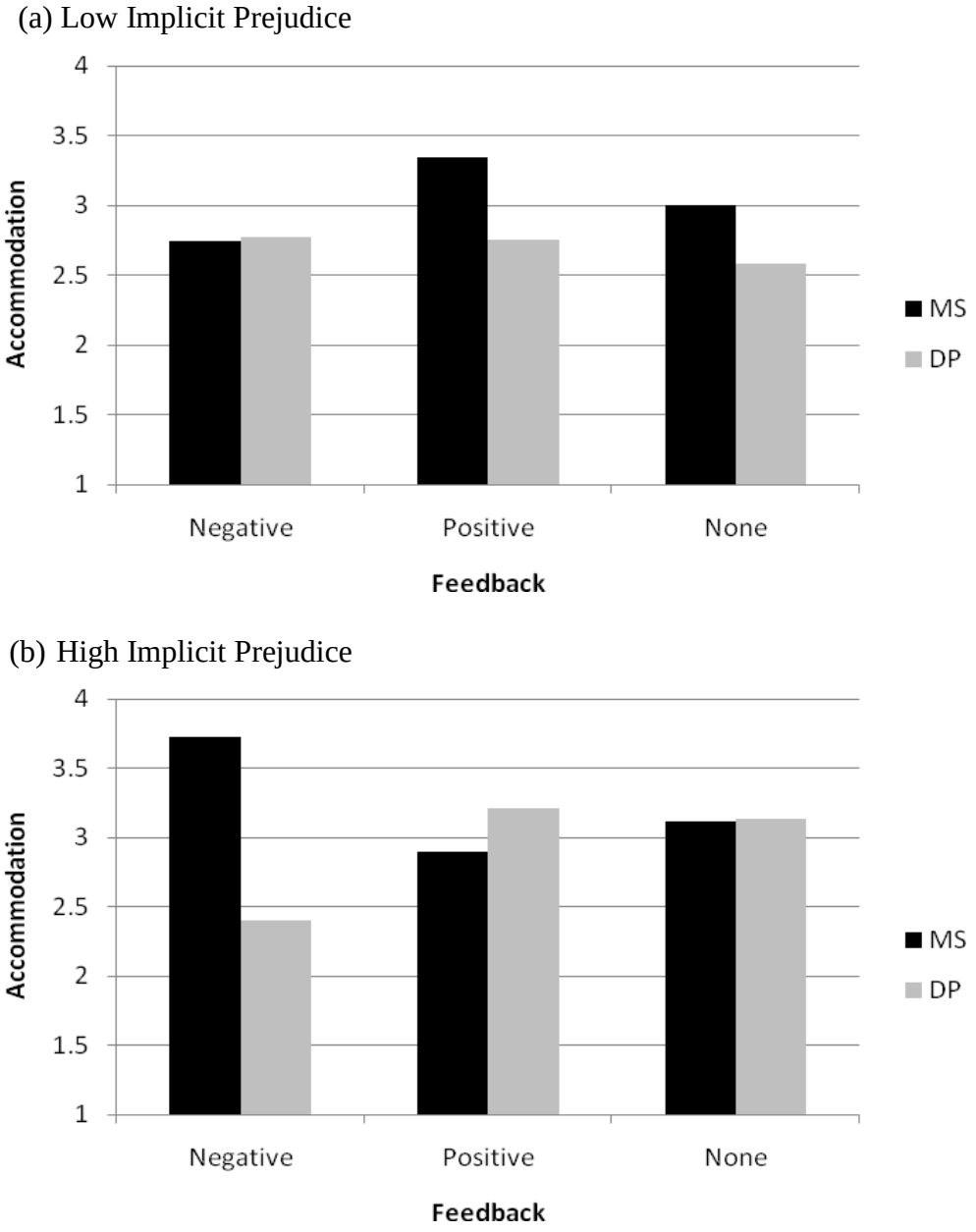


Figure 12. Effect of MS by Feedback on Accommodation among Participants with (a) Low Implicit Prejudice and (b) High Implicit Prejudice in Study 5.

was characterized by a significant simple interaction of MS × implicit prejudice × dummy 1 (*Negative* vs. *Positive*), β = -.50, $p < .05$, and a marginally significant simple interaction of MS × implicit prejudice × dummy 2 (*Negative* vs. *No-Feedback*), β = -.31, $p < .07$.

To probe the nature of these interactions, all two-way interactions were examined after centering the implicit prejudice scores at 1SD above and below the mean, and re-computing all of the interaction terms. When implicit prejudice was centred at -1SD, no significant effects were observed (all *p*s > .25). When implicit prejudice was centred at +1SD, however, the simple interaction of MS × dummy 1 was significant, β = -.64, $p < .02$, and the simple interaction of MS × dummy 2 was marginally significant, β = -.50, $p < .06$. These simple interactions were then followed-up with simple slopes tests, revealing a significant effect of MS in the *Negative* feedback condition, β = .68, $p < .01$, but not in the *Positive* feedback condition, β = -.16, $p > .45$, nor in the *No-Feedback* condition, β = -.01, *ns*. Overall, this effect indicates that among participants with high implicit prejudice scores, MS increased accommodation within the *Negative* feedback condition, but had no effect within the other feedback conditions.

Derogation of the IAT

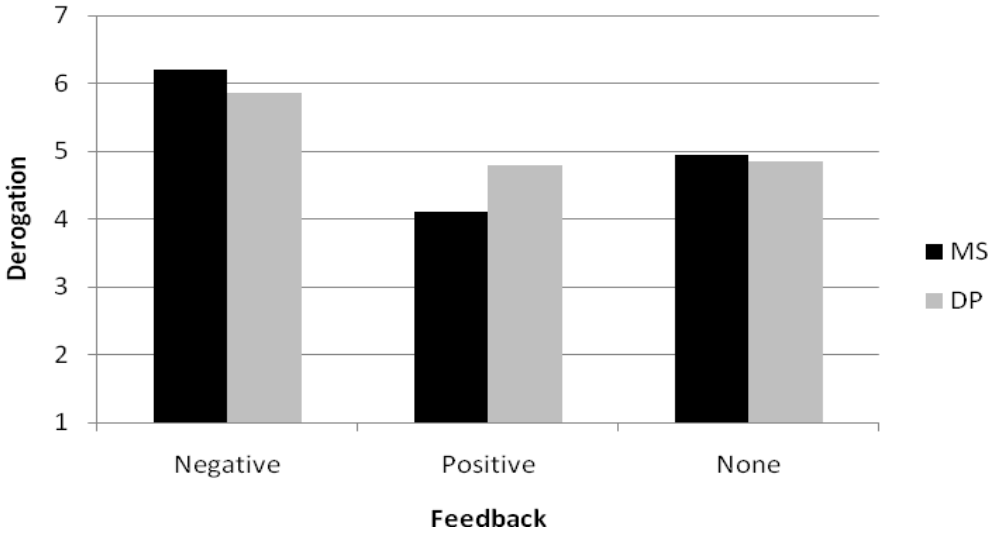
Derogation scores were computed by taking the mean of the items assessing this construct (reverse scored where appropriate, α = .89). These scores were then analysed using the same procedure that was used to examine the accommodation scores. Given that implicit prejudice (and not self-esteem) was found to be a significant moderator of the effects of MS and feedback on

accommodation, this variable was also included as a predictor in the derogation analyses.[8] Step 1 emerged significant in this analysis, F_{step1} (4, 110) = 9.85, p < .001, showing significant main effects of dummy 1 (Negative vs. Positive), β = -.57, p < .001, and dummy 2 (Negative vs. No-Feedback), β = -.29, p < .01. In addition, although Step 2 was not significant in this analysis (F < 1), Step 3 was significant, F_{step3} (2, 103) = 4.01, p < .05 (see Figure 13), and was characterized by a significant simple interaction of MS × implicit prejudice × dummy 1 (*Negative* vs. *Positive*), β = .53, p < .01, and a marginally significant simple interaction of MS × implicit prejudice × dummy 2 (*Negative* vs. *No-Feedback*), β = .24, p < .10.

To probe the nature of these interactions, all two-way interactions were examined at high (+1SD) and low (-1SD) levels of implicit prejudice. At low implicit prejudice, no significant effects were observed. At high implicit prejudice, however, both the simple interaction of MS × dummy 1, β = .67, p < .01, and that of MS × dummy 2 were significant, β = .45, p < .05. These simple interactions were then followed-up with simple slopes tests, revealing a significant effect of MS in the *Positive* feedback condition, β = .58, p < .01, but only weak and non-significant effects in the *Negative* feedback, β = -.31, p > .13, and *No-Feedback* conditions, β = .32, p > .16 (see Figure 13). Notably, although MS increased derogation of the IAT following positive and no feedback, MS actually decreased derogation following negative feedback.

Testing for Mediation. Given that Studies 2 and 3 found accommodation to mediate the effects of threat on derogation, the same analyses were conducted

(a) Low Implicit Prejudice



(b) High Implicit Prejudice

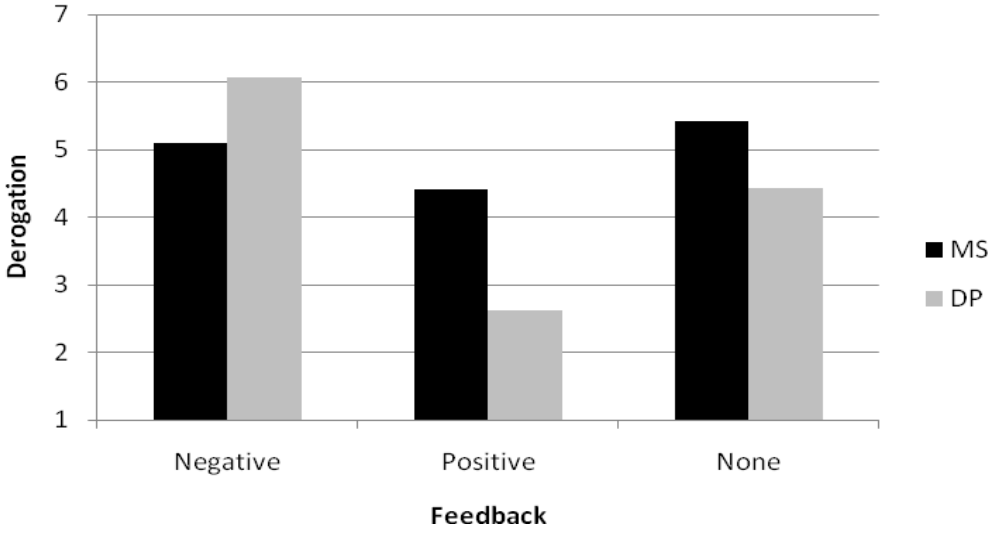


Figure 13. Effect of MS by Feedback on Derogation among Participants with (a) Low Implicit Prejudice and (b) High Implicit Prejudice in Study 5.

to examine whether or not the same mediated process is operating in the present study. Accordingly, the same three step procedure outlined by Muller et al. (2005) was again used to examine mediated moderation. In the present case, the effects of MS and feedback seemed only to be affecting participants with high implicit prejudice. Thus, the mediated moderation analyses were conducted with implicit prejudice centred at one standard deviation above the mean. The treatment variable for this analysis refers to the feedback condition (as represented by the two dummy variables), the moderating variable is MS, the mediating variable is accommodation, and the outcome variable is derogation. The first two steps are outlined above in the sections showing a MS × feedback interaction on derogation and accommodation respectively (see also Steps 1 and 2 of Table 8). In this case, both the D1 × MS and D2 × MS interactions are significant (or nearly so) for both derogation and accommodation. In the third, critical step, accommodation emerged as a highly significant predictor of derogation. Moreover, when controlling for the impact of accommodation on derogation, the D2 × MS interaction was no longer significant, and the D1 × MS was still significant but reduced in magnitude. Thus, accommodation did mediate the interaction of MS × feedback on derogation, but unlike in Studies 2 and 3, the effect appears to be only partially mediated. Nevertheless, the notion that MS decreased derogation within the negative feedback condition (albeit non-significantly) by virtue of increasing accommodation is supported by the present analysis.

Table 8

Regression Results for Mediated Moderation among Participants with High Implicit Prejudice in Study 5.

Predictors	Step 1 (DV = DERO)		Step 2 (DV = ACMO)		Step 3 (DV = DERO)	
	β	*t*	*β*	*t*	*β*	*t*
D1	-1.050	5.73***	.394	1.85^{+}	-.871	5.06***
D2	-.491	2.77**	.350	1.70^{+}	-.332	2.01*
MS	-.308	-1.50	.677	2.84**	-.078	-0.40
D1 × MS	.672	3.13**	-.637	-2.55*	.445	2.21*
D2 × MS	.454	2.05*	-.497	-1.92^{+}	.272	1.32
ACMO					-.453	-4.19***
ACMO × MS					.134	1.25

Note: ACMO = accommodation; D1 = dummy1 of feedback condition (*Negative* vs. *Positive*); D2 = dummy2 of feedback condition (*Negative* vs. *No-Feedback*); DERO = derogation of the Implicit Association Test; MS = Mortality Salience
$^{+}$ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

Death-Thought Accessibility

In this study, DTA was measured using reaction time (RT) data within the context of a lexical decision task. Since RT data often violate assumptions of normality and therefore require several minor transformations before data analysis. In keeping with previous work (see Hayes et al., 2008; Schimel et al., 2007) that followed the recommendations of Bargh and Chartrand (2000), RTs that were greater than 2,000 ms were recoded to 2,000 ms, and all incorrect responses were excluded from the analysis. Mean RTs were then computed for death and neutral words and DTA scores were computed by subtracting the mean death-RT from the mean neutral-RT for each participant. Thus, positive scores on this metric represent faster responding to the death words relative to the neutral words, making higher numbers indicative of higher DTA.[9] The DTA scores were submitted to the same multiple regression procedures used to analyze the accommodation and derogation scores. To investigate the impact of accommodation and derogation on DTA, these variables (as well as their interactions with MS, feedback condition, and implicit prejudice score) were included in the regression analyses, but neither accommodation nor derogation emerged as significant predictors of DTA. Only the interaction of MS × feedback × implicit prejudice reached significance. When these variables were included in a stepwise regression equation (with main effects in step 1, two-way interactions in step 2, and the three-way interaction vectors in step 3), Step 1 was non-significant, $F_{step1}(4, 110) = 1.19$, $p > .30$, Step 2 was significant, $F_{step2}(5, 105) = 2.30$, $p = .05$, and Step 3 approached significance, $F_{step3}(2, 103) = 2.65$, $p < .08$

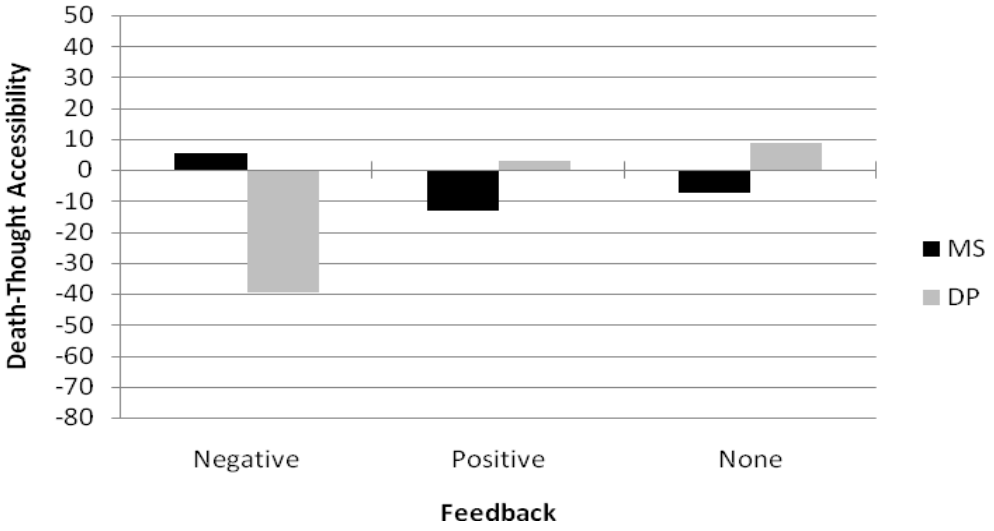
(see Figure 14). This final Step was characterized by a significant simple interaction of MS × implicit prejudice × D2 (negative vs. no feedback), $\beta = .35$, $p < .05$.

To probe the nature of this interaction, all two-way interactions were examined at high (+1SD) and low (-1SD) levels of implicit prejudice. At low implicit prejudice, no significant effects were observed. At high implicit prejudice, however, the simple interaction of MS × D2 (negative vs. no feedback) approached significance, $\beta = .44$, $p < .08$. Simple slopes tests revealed a significant effect of MS only within the positive feedback condition, $\beta = -.48$, $p < .05$, such that MS reduced DTA. All other effects were non-significant (ps < .15).

Discussion

The results of Study 5 show that MS and feedback condition interacted with participants' level of implicit prejudice toward Arabs (as assessed by the Canada-Arab IAT) to predict all three dependent variables. With regard to accommodation, MS increased accommodation among participants with high implicit prejudice in the negative feedback condition. Receiving feedback indicating that they possessed moderate to high levels of prejudice toward Arabs effectively exposed these participants, who tended to deny it when mortality was not salient but tended to admit it when mortality was salient. This effect then had downstream effects on derogation of the IAT. Consistent with Studies 1-3, high levels of accommodation within the MS condition lead to low levels of derogation. Thus, in accommodating the feedback by admitting they were prejudiced toward Arabs, participants felt little need to derogate the IAT as the

(a) Low Implicit Prejudice



(b) High Implicit Prejudice

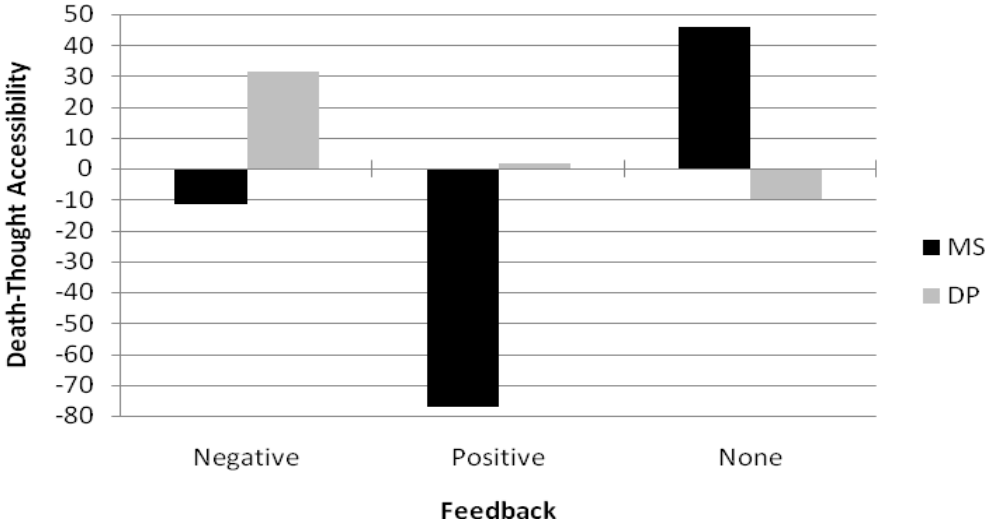


Figure 14. Effect of MS by Feedback on DTA among Participants with (a) Low Implicit Prejudice and (b) High Implicit Prejudice in Study 5.

source of threat. Indeed, in response to the negative feedback manipulation, MS reduced derogation of the IAT (albeit not quite significantly) by virtue of increasing accommodation. Thus, Study 5 is consistent with Studies 2 and 3 (and to a lesser extent, Study 4) in indicating that derogation (when assessed after accommodation) is mediated by the extent of accommodation in response to threat.

Mortality salience and feedback condition also interacted with implicit prejudice to predict DTA. Unlike Study 3, however, this effect was not particularly informative. Whereas Study 3 found that the extent of accommodation (of core beliefs) and derogation affected DTA, these variables did not affect DTA in the Study 5. The nature of the interaction was a reduction of DTA following positive feedback in the MS condition. This result is consistent with the idea that activating protective beliefs, such as positive beliefs about the self, serve to insulate the individual from concerns about death. One reason for the lack of consistency between Studies 3 and 5 in this regard may pertain to the nature of accommodation in these studies. Accommodation in Study 3 involved changing peripheral beliefs while retaining core beliefs, whereas in Study 5, accommodation seemed to involve attributing the cause of prejudice to the bad behaviour among Arabs. This latter type of accommodation seems akin to "blaming the victim" (Lerner, 1980), wherein fault for the negative outcome (i.e., prejudice) lies with the victim rather than the perpetrator. This type of accommodation may have been a more effective form of defense than the

accommodation observed in Studies 2-4. I return to this issue in the general discussion.

Although the results of Study 5 are generally consistent with Studies 1-4, there are important areas in which the results may appear inconsistent. Most importantly, unlike Studies 1-3, self-esteem appeared to play no role in the results of Study 5. There may be many reasons for this result; however, perhaps the most obvious explanation pertains to the fact that the former studies examined worldview accommodation whereas the present study examined self-concept accommodation. If so, then it would appear that self-esteem only moderates the effects of MS on worldview accommodation in response to worldview threat. In response to self-esteem threat, by contrast, trait self-esteem might play no role, regardless of whether mortality is salient or not. Future research will certainly be needed to test this assumption.

Another way in which the present study differed somewhat from the previous studies involves the lack of differentiation between core and peripheral worldview beliefs. My original thinking on this matter was that the core of a person's self-concept likely consists of beliefs regarding the overall value of the self. Thus, although people may be willing to accept negative feedback at times, most people will attempt to minimize the implications of the feedback to their sense of self-worth. In retrospect, the accommodation items included in this study did not adequately assess this aspect of the accommodation process. An item reading something along the lines of "*I am prejudiced against Arabs, and this makes me a bad person*" may have been more appropriate for assessing such core

beliefs. Moreover, given the difference between people with high vs. low self-esteem regarding self-verification processes (Swann, Griffin, Predmore, & Gaines, 1987), it may be reasonable to assume that a self-esteem difference could have emerged from such items. Future research will need to consider this possibility.

Finally, although self-esteem failed to predict the current results, implicit prejudice toward Arabs, as assessed by the Canada-Arab IAT, did emerge as a significant predictor. Even so, I believe a cautious consideration of the meaning of this effect may be in order before any definitive conclusions are drawn. In my discussion above, I imply that the high implicit prejudice scores affected the way in which participants responded to the accommodation items, because these scores are indicative of real implicit prejudice toward Arabs. It remains possible, however, that high implicit prejudice scores moderated the accommodation results because participants who made a number of errors, or responded more slowly, in the critical trials of the IAT were explicitly aware of their troubles with the test. As such, when they received negative feedback indicating that they are prejudiced, they understood the reason for this feedback, which made it more difficult to outright deny. Thus, rather than representing truly negative attitudes toward Arabs, the moderating effect of implicit prejudice scores may have merely made the feedback more believable and therefore more difficult to dismiss, thereby making accommodation the only plausible form of defense. Future research should attempt to disentangle these alternative explanations for the observed effects.

CHAPTER 7:

General Discussion

The present report describes five studies showing the effects of threat on accommodation. Study 1-4 showed worldview accommodation in response to worldview threat, whereas Study 5 showed self-concept accommodation in response to self-esteem threat. The worldview accommodation studies yielded comparable effects using two different worldview groups and exposing them to two different worldview threats. Study 1 employed participants who believed in creationism and lead them to accommodate aspects of evolution into their worldview. Studies 2-4 examined the opposing side of the issue, employing atheist participants and leading them to accommodate the notion that evolution cannot provide the explanation for the origins of life. Importantly, however, these participants did not modify their core position that God does not exist and therefore was not involved in the process of creation. Study 4 demonstrated that high DTA following worldview threat was directly responsible for the increased level of accommodation in this condition. In Studies 1-3, when participants' worldview was threatened following MS, self-esteem was found to moderate the results such that participants with low self-esteem showed high accommodation whereas participants with high self-esteem showed low accommodation. Studies 2-5 examined accommodation in relation to derogation, showing that accommodating threat generally reduced the tendency to derogate the source of the threat. However, this effect was most pronounced following MS. Studies 2 and 3, which showed that people with high self-esteem resisted accommodating their worldview following threat, also showed that these participants were more likely to derogate the source of the threat. It was argued that people with high

self-esteem respond to MS by activating their protective beliefs as a way of defending against the potential for anxiety. This activation, in turn, produced increased certainty in the validity of their beliefs, thereby decreasing accommodation in response to threat and increasing source-derogation. In support of this reasoning, Study 3 found that inducing participants with low self-esteem to activate their protective beliefs by affirming an important value subsequently reduced the tendency to accommodate threat and increased the tendency to derogate the source of the threat.

Accommodation as a Defense against Threat

Throughout this dissertation I have argued that the accommodation results, observed in response to threat, act as a type of defense against that threat. This hypothesis was derived from previous theorizing regarding the various ways in which people can defend against worldview threats (e.g., Greenberg, Solomon, & Pyszczynksi, 1997; Pyszczynksi et al., 2003; Solomon et al., 1991). Support for the idea that accommodation serves as a type of defense was found in several aspects of the present research. First, accommodation was found to significantly reduce subsequent derogation in Studies 2, 3, and 5, and to a lesser extent in Study 4. If accommodation did not provide defense against threat in these studies, then participants should have displayed higher levels of derogation (which is known to provide defense against threat). Second, accommodation was found to result from increased DTA following threat in Study 4. Moreover, high DTA was also found to increase derogation. The current reasoning among TMT theorists is that worldview and self-esteem defensiveness results from high levels of DTA

(see Hayes et al., 2010). This reasoning was therefore supported in the current research, and shows that both accommodation and derogation are motivated by high DTA following threat. Third, self-affirmation was found to decrease accommodation among participants with low self-esteem in Study 3. A long-standing method of determining that a particular response to threat is enacted as a way of defending against that threat has been to observe decreased levels of such responding following self-affirmation (e.g., Steele & Liu, 1983). Since self-affirmation serves to activate alternative protective beliefs to the one under threat, this procedure precludes the need to defend the threatened beliefs by trivializing the threat. Taken together, the current research provides strong evidence that accommodation does indeed provide defense against threat.

Are all ways of Accommodating Threat Equal?

The current research may have, at times, suggested that accommodation is a unitary concept. However, there is good reason to believe that not all forms of accommodation are the same. First of all, it is important to note that there are likely an infinite number of ways in which any given threat can be accommodated. The way in which accommodation will proceed will likely depend to a large extent on the specific contents of the existing beliefs-structure. Regardless of the specific beliefs contained within the belief-system, however, the structure of accommodation should be relatively homogenous. In general, attempts at accommodation will likely first involve modifying the most peripheral aspects of the belief-system. It is only when such attempts prove ineffective at reducing the threat that the modification of more central beliefs will be

considered. Thus, ideally, the process of accommodation is as conservative as possible. The extent to which one must cut into relatively central aspects of the belief-system to accommodate a given threat will likely determine how effectively this process provides defense against the threat. Accommodations that involve modifying only very peripheral beliefs should provide the most effective defense. When accommodation requires modifying central beliefs, this process will likely provide less effective defense. When accommodation cuts too deeply into the core of one's worldview, one may experience difficulty managing existential concerns. It may also be interesting to consider that some people are better at this process than others. It would certainly not be adaptive to cut into one's belief-system more deeply than is absolutely necessary to accommodate a threat. People with low self-esteem, for instance, may suffer from low self-regard precisely because they are too quick to carry the implications of threat to core aspects of their self-concept. Future research could investigate this possibility.

In addition to the degree of accommodation, there may also be different qualities of accommodation, which also differ with respect to the amount of defense that they offer. The type of accommodation observed in Study 5 appears somewhat different from that observed in Studies 1-4. Specifically, Study 5 involved admitting that one holds negative attitudes toward Arabs while simultaneously blaming Arabs for the negativity of the attitudes. This type of defense seems akin to projection (Freud, 1966) or blaming the victim (Lerner, 1980). This type of accommodation may have provided more effective defense than that assessed in Studies 1-4, which does not seem to have contained the same

deflective character. Given that accommodation often involves admitting personal limitation of some sort, accommodations that simultaneously provide an external source for such limitations will likely provide better defense than those that do not. This difference may underlie, at least in part, the inconsistency between these studies regarding the moderating effect of self-esteem. It may be, for instance, that the type of accommodation assessed in Study 5 was one that both people with high and low self-esteem were willing to endorse.

Finally, although the results suggest that accommodation serves a defensive function in response to threat, it seems reasonable to assume that not all types of accommodation are necessarily defensive. Indeed, even in the studies presented here, it seems likely that some of the variability observed in the accommodation scores was not defensively motivated. In some cases, high levels of accommodation may have simply represented agreement with the information presented in the threat. I feel that this is perhaps most likely the case in Studies 2-4, which investigated accommodation in the form of limiting the implications of the threat to peripheral beliefs in order to protect core beliefs. Some of the participants in these studies may have simply agreed (non-defensively) that evolution cannot provide the explanation for the origins of life. Indeed, although the vast majority of participants were completely unwilling to accommodate core aspects of their worldview, a small minority were even willing to accept that God may exist – a tendency that was increased for people with high self-esteem who had affirmed an alternative value. Future research should therefore attempt to differentiate between defensive and non-defensive forms of accommodation.

Accommodation vs. Derogation: Similarities and Differences

The research outlined in this dissertation has shown that accommodation and derogation are largely alternative modes of defense against threat. However, there are also important differences between these processes that deserve consideration. Most notably, derogation is a form of defense that does not require one to change one's belief-system. Indeed, this method of defense is likely initiated first precisely for this reason. Rather than accommodating the belief-system to incorporate belief-inconsistent information, derogation of the source of this information allows the individual to discard the information outright. As argued from the outset of this dissertation, it is precisely when the belief-inconsistent information is highly compelling that simple derogation becomes more difficult and accommodation becomes more likely. With this said, however, to the extent that derogation remains viable, it appears that this form of defense may be more effective at providing defense against threat. As shown in Study 3, derogating the source of the threat was found to reduce DTA, whereas accommodating peripheral beliefs did not appear to significantly impact DTA, and modifying core beliefs *increased* DTA.

Accommodation and derogation also seem to be distinctive styles of defense against threat. Whereas accommodation appears to represent a self-protective form of defense, derogation is self-promoting (Baumeister et al., 1989). This distinction may, in part, underlie the difference in the effectiveness of these defenses. According to McGregor (2006a), worldview defense involving derogation is associated with activation of the behavioural activation system

(BAS; see Gray & McNaughton, 2000), which is characterized by relative left frontal cortical activity (see Harmon-Jones, Lueck, Fearn, & Harmon-Jones, 2006). A number of relatively recent neurological studies have implicated relative left frontal cortical activity in the regulation of negative emotions (e.g., Jackson et al., 2003). Moreover, trait self-esteem appears to be a moderator of BAS activation (Heimpel, Elliot, & Wood, 2006). Future research should investigate the neurological substrates of accommodation in addition to derogation. This research could lead to insights into the affective consequences of accommodating threats.

The Role of Self-Esteem in Terror Management Theory

Finally, given the observed effect of self-esteem on accommodation vs. derogation in Studies 1-3 of the present research, the role of self-esteem in TMT deserves discussion. TMT generally maintains that self-esteem provides defense against concerns about death by imbuing the individual with meaning and value, thereby providing a sense of symbolic immortality that buffers the individual from death-anxiety. At times, the theory suggests that people with high self-esteem have less need to defend their protective beliefs when mortality is salient, because they are already insulated against death-anxiety (e.g., Harmon-Jones et al., 1997). The present research does not support this model of self-esteem in TMT. Rather, the results of Studies 1-3 suggest that self-esteem acts as a buffer against death-anxiety by virtue equipping the individual with the resources necessary to deal with threats when they arise. In the face of threat, people with high self-esteem activate their protective beliefs, which functions to reduce (or prevent) the

experience of anxiety. Often times, these manoeuvres promote rather than preclude psychological defensiveness.

With this said, the current research does not suggest that only people with high self-esteem defend against threats. On the contrary, people with low self-esteem are equally likely to defend against threats as people with high self-esteem. The difference lies in the *type of defense* that is most often initiated by people with high vs. low self-esteem. Whereas people with high self-esteem prefer self-promoting defenses involving increased certainty in their protective beliefs and a tendency to derogate those who oppose them, people with low self-esteem prefer self-protective defenses involving accommodation and the general avoidance of conflict. Both strategies provide defense against threat, but do so in different ways.

Conclusion

Since its inception in 1986, TMT has led to a number of novel hypotheses and generated hundreds of studies in support of its theoretical postulates. One such postulate, however – that self-esteem buffers against death-anxiety by providing insulation and thereby reducing the need for worldview defense – has yielded mixed results. A number of recent studies, including the present research, have shown that high self-esteem can in some cases produce more, rather than less, defensiveness. In the spirit of the primary focus of this dissertation, I feel that it may be time for terror management theorists to *accommodate* the theory to take stock of this inconsistency. Rather than providing insulation against threat, I propose that self-esteem buffers against death-anxiety by equipping the individual

with the resources necessary to defend against death-anxiety. Thus, depending on the type of defense assessed, people with high self-esteem may be seen as more defensive. This accommodation would bring TMT closer in line with a growing body of research supporting the resource model of self-esteem (see vanDellen, 2011).

Endnotes

[1]Although there is good reason to posit accommodation as a type of defense against threat, there may also be reason to view it in terms of non-defensiveness. Modifying one's beliefs in the face of alternative perspectives or inconsistent information involves a certain willingness to understand that one's current beliefs are inadequate. Thus, in some cases (or to a certain degree), accommodating one's worldview in response to threat may be partly defensive, but also party non-defensive. I return to this issue again as the paper unfolds.

[2]Given that only PERI was affected by the independent variables in this study, we only examine mediation with regard to PERI, not CORE.

[3]Incidentally, this may also have contributed to the weakness of the some of the statistical results.

[4]One item (*It is possible that life on earth is the result of some supernatural force*) had moderate to high loadings on the factors representing both CORE and PERI. This should not be surprising given that it seems to contain both elements of belief in God *(...some supernatural force*) and open-mindedness (*It is possible...*). Rather than excluding this item, given that it loaded highly with PERI in Study 2 and does so again in Study 4, I chose to include it as part of the PERI composite in the current study as well.

[5]The four-way interaction involving self-esteem was non-significant. Moreover, excluding self-esteem from the list of independent variables did not eliminate the three-way interaction of threat × DTA × order of defense (β = .61, *p*

< .01). Given that self-esteem was not expected to significantly predict the results in this study, it is not discussed further.

[6]Before proceeding with these analyses, I first re-centred the DTA scores at the mean within the threat condition. Since I am interested in the effect of DTA on each defense (depending on order of defense) *following threat*, and DTA was observed to be significantly higher in the threat condition relative to the control condition, re-centring the variable will more accurately capture the range of DTA within the condition of interest.

[7]Self-esteem was not included in this analysis to minimize multicollinearity issues. The analysis with all four variables (MS × feedback condition × self-esteem × implicit prejudice) entered at once did not produce a four-way interaction, and self-esteem did not interact with any variables at any level of the analysis.

[8]Just to be thorough, an analysis was conducted using self-esteem as an independent variable revealing no main effects or interactive effects of self-esteem on derogation.

[9]For the sake of completeness, MS and feedback together with self-esteem were regressed on the DTA scores. This analysis yielded only a significant effect of MS × self-esteem, $\beta = -.39$, $p < .05$, such that higher self-esteem predicted lower DTA within the MS condition, $\beta = -.37$, $p < .05$. All other effects and interactions were non-significant. This effect is somewhat difficult to interpret because it is collapsed across feedback conditions. In general though, it appears that people with high self-esteem may be better able to reduce DTA after MS,

which is generally consistent with previous research (Harmon-Jones et al., 1997), and likely due to the fact that these people have more affirmational resources at their disposal to reduce concerns about death.

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Appendix A

Anti-creationist (pro-evolution) worldview threat material employed in Study 1

Hooking Leviathan by Its Past

Three major groups of mammals have returned to the ways of distant ancestors in their seafaring modes of life, the suborder Pinnepedia (seals, seal lions, and walruses) within the order Carnivora (dogs, cats, and Darwin's bears among others); and two entire orders-the Sirenia (dugongs and manatees) and Cetacea (whales and dolphins). I confess that I have never quite grasped the creationists' point about inconceivability of transition-because a good structural (though admittedly not a phylogenetic) series of intermediate anatomies may be extracted from these groups. Otters have remarkable aquatic abilities, but retain fully functioning limbs for land. Sea lions are clearly adapted for water, but can still flop about on land with sufficient dexterity to negotiate ice floes, breeding grounds, and circus rings.

But I admit, of course, that the transition to manatees and whales represents no trivial extension, for these fully aquatic mammals propel themselves by powerful, horizontal tail flukes and have no visible hind limbs at all – and how can a lineage both develop a flat propulsive tail equipment of back feet so completely? (Sirenians have lost every vestige of back legs; whales often retain tiny, splintlike pelvic and leg bones, but no foot or finger bones, embedded in musculature of the body wall, but with no visible expression in external anatomy).

The loss of back legs, and the development of flukes, fins, and flippers by whales, therefore stands as a classic case of a supposed cardinal problem in evolutionary theory-the failure to find intermediary fossils for major anatomical transitions, or even to imagine how such a bridging form might look or work. Darwin acknowledged the issue by constructing a much-criticized fable about swimming bears, instead of presenting any direct evidence at all, when he tried to conceptualize the evolution of whales. Modern creationists continue to use this example and stress the absence of intermediary forms in this supposed (they would say impossible) transition from land to sea.

Goethe told us to "love those who yearn for the impossible." But Pliny the Elder, before dying of curiosity by straying too close to Mount Vesuvius at the worst of all possible moments, urged us to treat impossibility as a relative claim: "How many things, too, are looked upon as quite impossible until they have been actually effected." Armed with such wisdom of human ages, I am absolutely delighted to report that our usually recalcitrant fossil record has come through in exemplary fashion. During the past fifteen years, new discoveries in Africa and Pakistan have greatly added to our paleontological knowledge of the earliest history of whales. The embarrassment of past absence has been replaced by a bounty of new evidence-and by the sweetest series of transitional fossils an evolutionist could ever hope to find. Truly, we have met the enemy and he is now ours. Moreover, to add blessed insult to the creationists' injury, these discoveries have arrived in a gradual and sequential fashion-a little bit at a time, step by step, from a tentative hint fifteen years ago to a remarkable smoking gun early in 1994. Intellectual history has matched life's genealogy by spanning gaps in sequential steps. Consider the four main events in chronological order.

CASE ONE: *Discovery of the oldest whale*. Paleontologists have been fairly confident, since Leigh Van Valen's demonstration in 1966, that whales descended from mesonychids, an early group of primarily carnivorous running mammals that spanned a great range of sizes and habits, from eating fishes at river edges to crushing bones of carrion. Whales must have evolved during the Eocene epoch, some 50 million years ago, because Late Eocene and Oligocene rocks already contain fully marine cetaceans, well past any point of intermediacy.

In 1983, my colleague Phil Gingerich from the University of Michigan, along with N.A. Wells, D. E. Russell, and S. M. Ibrahim Shah, reported their discovery of the oldest whale, named *Pakicetus* to honor its country of present residence, from Middle Eocene sediments some 52 million years old in Pakistan. In terms of intermediacy, one could hardly have hoped for more from the limited material available, for only the skull of *Pakicetus* has been found. The teeth strongly resemble those of terrestrial

mesonychids, as anticipated, but the skull, in feature after feature, clearly belongs to the developing lineage of whales.

Verdict: In terms of intermediacy, one could hardly hope for more from the limited material of skull bones alone. But the limit remains severe, and the results therefore inconclusive. We know nothing of the limbs, tail, or body form of *Pakicetus*, and therefore cannot judge transitional status in these key features of anyone's ordinary conception of a whale.

CASE TWO: *Discovery of the first complete hind limb in a fossil whale*. In the most famous mistake of early American paleontology, Thomas Jefferson, while not engaged in other pursuits usually judged more important, misidentified the claw of a fossil ground sloth as a lion. My prize for second worst error must go to R. Harlan, who, in 1834, named a marine fossil vertebrate *Basilosaurus* in the *Transactions of the American Philosophical Society. Basilosaurus* means "king lizard," but Harlan's creature is an early whale. Richard Owen, England's greatest anatomist, corrected Mr. Harlan before the decade's end, but the name sticks-and must be retained by the official rules of zoological nomenclature.

Basilosaurus, represented by two species, one from the United States and the other from Egypt, is the "standard" and best-known early whale. A few fragments of pelvic and leg bones had been found before, but not enough to know whether *Basilosaurus* bore working hind legs – the crucial feature for our usual concept of a satisfying intermediate form in both anatomical and functional senses.

In 1990, Phil Gingerich, B. H. Smith, and E. L. Simons reported their excavation and study of several hundred partial skeletons of the Egyptian species *Basilosaurus isis*, which lived some 5 to 10 million years after Pakicetus. In an exciting discovery, they reported the first complete hind limb skeleton found in any whale – a lovely and elegant structure, including all pelvic bones, all leg bones (femur, tibia, fibula, and even the patella, or kneecap), and nearly all foot and finger bones, right down to the phalanges (finger bones) of the three preserved digits.

Verdict: Terrific and exciting, but no cigar, and no bag-packer for the creationists. The limbs, though complete, are too small to work as true intermediates must-that is, for locomotion on both land and sea. I intend no criticism of *Basilosaurus*, but merely point out that this creature had already crossed the bridge (while retaining a most informative remnant of the other side). We must search for an earlier inhabitant of the bridge itself.

CASE THREE: *Hind limb bones of appropriate size*. *Indocetus ramani* is an early whale, found in shallow-water marine deposits of India and Pakistan, and intermediate in age between *Pakicetus* skull and the *Basilosaurus* hind legs (cases one and two above). In 1993, P. D. Gingerich, S. M. Raza, M. Arif, M. Anwar, and X. Zhou reported the discovery of leg bones of substantial size from this species.

Gingerich and colleagues found pelvic bones, and insufficient evidence for reconstructing the full limb and its articulations. The leg bones are large and presumably functional on both land and sea. The authors conclude: "The pelvis has a large and deep acetabulum [the socket for articulation of the femur, or thighbone], the proximal femur is robust, the tibia is long…All these features, taken together, indicate the *Indocetus* was probably able to support its weight on land, and it was almost certainly amphibious, as early Eocene *Pakicetus* is interpreted to have been…We speculate that *Indocetus*, like *Pakicetus*, entered the sea to feed on fish, but returned to land to rest and to birth and raise its young."

Verdict: Almost there, but not quite. We need better material. All the right features are now in place – primarily leg bones of sufficient size and complexity – but we need more and better-preserved fossils.

CASE FOUR: *Large, complete, and functional hind legs for land and sea: finding the smoking gun.* The first three cases, all discovered within ten years, surely indicate an increasingly successful paleontological assault upon an old and classic problem. Once you know where to look, and once high interest spurs great attention, full satisfaction often follows in short order. I was therefore delighted to read, in the January 14, 1994, issue of *Science*, an article by J. G. M. Thewissen, S. T. Hussain, and M. Arif, titled "Fossil evidence for the origin of aquatic locomotion in archaeocete whales."

In Pakistan, in sediments 120 meters above the beds that yielded *Pakicetus* (and therefore a bit younger in age), Thewissen and collegues collected a remarkable skeleton of a new whale – not complete, but far better preserved than anything previously found of this age, and with crucial parts in place to illustrate a truly transitional status between land and sea. The chosen, *Ambulocetus natans* (literally, the swimming walking-whale) advertises the excitement of this discovery.

Ambulocetus natans weighed some 650 pounds, the size of a hefty sea lion. The preserved tail vertebra is elongated, indicating that *Ambulocetus* still retained the long, thin mammalian tail, and had not yet transmitted this structure to a locomotory blade (as modern whales do in shortening the tail and evolving a prominent horizontal fluke as the animal's major means of propulsion). Unfortunately, no pelvic bones have been found, but most elements of a large and powerful hind leg were recovered-including a complete femur, parts of the tibia and fibula, an astragalus (ankle bone), three metatarsals (foot bones), and several phalanges (finger bones). To quote the authors: "The feet are enormous." The fourth metatarsal, for example, is nearly six inches long, and the associated toe almost seven inches in length. Interestingly, the last phalanx of each toe ends in a small hoof, as in terrestrial mesonychid ancestors.

Modern whales move through the water by powerful beats of their horizontal tail flukes-a motion made possible by strong undulation of a flexible rear spinal column. *Ambulocetus* had not yet evolved a tail fluke, but the spine had requisite flexibility. Thewissen et al. write: "*Ambulocetus* swam by means of dorsoventral [back-to-belly] undulations of its vertebral column, as evidenced by the shape of the lumbar [lower back] vertebra." These undulations then functioned with (and powered) the paddling of the *Ambulocetus's* large feet-and these feet provided the major propulsive force for swimming.

Ambulocetus was no ballet dancer on land, but we have no reason to judge this creature as any less efficient than modern sea lions, which do manage, however inelegantly. Forelimbs may have extended out to the sides, largely for stability, with forward motion mostly supplied by extension of the back and consequent flexing of the hind limbs-again, rather like sea lions.

Verdict: Greedy paleontologists, used to working with fragments in reconstructing whales, always want more (some pelvic bones would be nice, for starters), but if you had given me both a blank sheet of paper and a blank check, I could not have drawn you a theoretical intermediate any better or more convincing than *Ambulocetus.* Those dogmatists who can make white black, and black white, by verbal trickery will never be convinced by anything, but *Ambulocetus* is the very animal that creationists proclaimed impossible in theory.

Appendix B

Anti-evolution (pro-creationism) worldview threat material employed in Studies 2-4

The Big Bang, Evolution and the Origins of Life on Earth

Questions regarding the origin of living organisms on earth have been the topic of hot debate since Charles Darwin proposed his theory of evolution by natural selection. Prior to Darwin, the common view on origins came from Theology. Specifically, it was believed that God was the creator of life on earth, and that any other theory was heresy. But all this changed with Darwin... or did it?

According to Dean Kenyon, a respected biochemist at the University of San Francisco and author of several biochemistry textbooks, the evolutionary explanation ultimately fails to account for the origins of life on earth. Indeed, doubts about evolution as the explanation for the occurrence of life have been brewing in the scientific community since the discovery of DNA.

DNA is a double-helix structure that contains a wealth of information in the form of precisely sequenced chemicals that scientists represent with the letters, A, C, T, and G, for Adenine, Cytosine, Thymine, and Guanine.

In written language, information is communicated by a precise arrangement of letters. In the same way, the instructions necessary to assemble amino acids into proteins (which is the *stuff* of living substances), are conveyed by the sequences of proteins arranged along the spine of the DNA. This chemical code has been called the *language of life*, and it is the most densely packed and elaborately detailed assembly of information in the known universe.

Without the instructions conveyed through DNA, amino acids cannot be transformed into proteins, and so there can be no life. Upon the discovery of DNA, scientists working on the origin of life therefore had to turn their attention to the origin of the complex information conveyed by DNA. The trouble is that in order to explain how amino acids are transformed into proteins, you need to assume the existence of DNA, but DNA is composed of proteins.

The evolutionary account holds that millions of years ago in something referred to as the "primeval soup", amino acids were somehow able to organize themselves into proteins. But the probability that this was somehow able to happen is, by all accounts, null. To many biochemists, the chemical evolution account of the origin of life on earth is simply impossible. Experiment after experiment shows that amino acids have absolutely no way of ordering themselves into biologically meaningful sequences without the prior existence of DNA.

For the same reason, natural selection could not have functioned before the existence of the first living cell. It can only act upon organisms capable of replicating themselves – cells equipped with DNA that pass on their genetic changes to future generations. Without DNA there is no self-replication. But without self-replication there is no natural selection. So you cannot use natural selection to explain the origin of DNA without assuming the existence of the very thing you are trying to explain. Thus, for biochemists this account of the origin of life is highly problematic because it rests on the assumption that life emerged from nothing into something.

The same problem arises for physicists trying to explain the origin of the universe. Most physicists agree that the universe was the result of a big bang, in which all the matter and energy in the universe expanded from a hot, dense physical mass at some finite time in the past and continues to expand to this day. The framework for the theory relies on Albert Einstein's General Relativity and is supported by a number of observations and experiments showing that the universe is indeed still expanding. Although the big bang theory describes and explains the general development of the universe since the instant of the "big bang", according to leading physicists such as Alan Guth (MIT), the theory cannot and does not provide any explanation for "what caused the bang, what banged, or what happened before the bang". In fact, the most well supported model of particle physics, referred to as the *Standard Model*, breaks down (i.e., doesn't make sense) when you condense all the matter and energy in the universe into a tiny, hot mass. If there is no explanation for the big bang, then we are once again left with the problematic assumption that everything in the universe emerged from nothing into something.

Natural selection, chance, and theories of self-organization have all failed to explain the origin of genetic information just as theories of physics have failed to explain the origin of the universe. Scientists like Kenyon argue that there is really only one option that remains. Some form of creator, must have created the universe (perhaps through an event like the big bang) and engineered the first set of instructions (DNA) necessary for a self-replicating cycle to begin. There is just no way around it.

As scientists turn their attention to the origins of life and the universe, they can provide no solid answers. Many believe that they never will. At this point there are only theories, and none can be tested by any known scientific method. Some believe that we were created by a transcendent being, who put the world and life into place and then set in it motion, but traditional scientists reject this idea as nonsense and insist that science must somehow be able to account for the origin of the universe and of life on earth. At this stage, all scientific theories addressing these issues are completely speculative and untestable. Thus, whichever way you look at it, whether you believe that everything was created or that it arose naturally and accidentally, you are accepting it on the basis of faith, not evidence.