Flooded with terror: Identifying existential threat in water crisis communication and exploring gender bias in the depths of water management.

by

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Examining Committee Membership

The following served on the Examining Committee for this thesis. The decision of the Examining Committee is by majority vote.

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Author’s Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

Lauren Smith was the sole author for Chapters One and Five which were written under the supervision of Sarah Wolfe and were not written for publication. Chapters Two to Four were written for publication and were co-authored. Smith was the lead author for all three co-authored manuscripts and was responsible for design conceptualization, data collection and analysis, and preparation of each manuscript. Co-authors provided guidance during each research phase, provided feedback on manuscript drafts, and assistance with data analysis planning. Bibliographic citations for the co-authored chapters have been included below.

Chapter Two

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Chapter Three

Smith, L. K. M. & Wolfe, S. E. (under review). Beyond the watery grave: Death and water reminders as (un)expected ways to increase pro-environmental identity and behaviour. *PsyEcology*.

Chapter Four

Smith, L. K. M., Bergsieker, H., & Wolfe, S. E. Death at the tap: Uncovering gender bias in appraisal of male vs. female water managers.

Abstract

The purpose of this dissertation was to advance understanding of gender inequity in water management and the ways in which threatening water communication may contribute to that inequity. Water crises are increasing with climate change and the communication of potentially fatal outcomes are ever-present via media and ongoing catastrophic climate events. While climate scholars have demonstrated that diverse decision-making groups lead to improved environmental and ethical outcomes – outcomes that include effective solutions to water crises – top-level water management in the Global North remains largely homogenously male. I explored this disconnect through the lens of Terror Management Theory (TMT) to identify how life-threatening water crisis communication may influence environmental attitudes and intergroup relations within water decision-making contexts. Terror Management Theory empirically tests the influence of mortality reminders on human behaviour and has identified predictable and replicable ways in which we respond to reminders of our eventual demise (Chapter One). Climate change has been established as a mortality reminder within Terror Management Theory research, as it evokes existential anxieties in those who consider experiencing climate change or its consequences. Water, however, had not previously been tested as a mortality reminder.

The research within this dissertation was guided by three interconnected objectives: (1) to determine if threatening water messages evoke mortality salience similarly to typical TMT mortality reminders; (2) to identify how pro-environmental worldviews or identities are

influenced by mortality salience and/or life-threatening water reminders; and (3) building on prior objectives, to determine whether judgments about same or different gendered water decision-makers are influenced by mortality salience from a typical and/or water-related mortality reminder.

This dissertation followed social psychology methods as developed and applied within Terror Management Theory to identify the psychosocial responses to threatening water reminders (Chapters Two and Three) and the influence of these responses on gender dynamics within water crisis decision-making (Chapter Four). Findings provided confirmation that some framings of water crises evoked mortality anxieties in American and Canadian populations (Chapter Two) and delivered evidence of environmental identity reinforcement following a typical mortality or life-threatening water reminder (Chapter Three). Findings also illustrated that mortality salience influenced appraisal of male and female water managers, and that these appraisals were also influenced by underlying levels of sexism and, potentially, connected gender role stereotypes.

In addition to academic contributions from this research, outcomes from this dissertation inform water communication campaigns (e.g., when threatening communications might be motivating for pro-environmental change and when might it not) and for guidance regarding equity efforts, particularly among leadership contexts that are presently male-dominated. Understanding how to develop and implement water crisis solutions is necessary in our changing climate. These solutions require recognizing how to best create and foster diverse,

equitable decision-making groups that retain and respect that diversity so all can be meaningfully included.

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Chapter 1. Introduction

1.0 Research challenge and problem rationale

Water crises related to climate change are increasing in severity and frequency across the globe (Beevers et al., 2022; Caretta et al., 2022; He et al., 2021; Schewe et al., 2014) and require diverse teams to identify and implement the most effective, equitable solutions (Ahlers & Zwarteveen, 2009; Cook et al., 2019; Haeffner et al., 2021; Pahl-Wostl et al., 2020; Sultana, 2018; Wilson et al., 2019). Yet, water decision-making and management are homogenously gendered spaces (Elledge et al., 2020; Haeffner et al., 2021; Harris, 2009; International Water Association, 2016; Jalal, 2014; Thompson et al., 2017). Moreover, the way water crises are communicated – within the professional communities – may actually exacerbate this inequity due to psychosocial responses to the existential anxiety induced by potential insecurity of a life-sustaining resource.

In this research, I refer to water crises as issues of quality (e.g., water contamination), quantity (e.g., flooding, droughts), and access (e.g., distribution). Water decision-making refers to the choices and discussion that occurs at various levels of governance and control (e.g., municipal, provincial, federal, private industry, etc.) that determine how water resources are distributed, how water management is funded, and how water resources are maintained as safe and secure. In essence, water decision-making refers to the ways in which organizations make decisions about how water is preserved, managed, treated, and distributed to ensure safe access for present and future generations. This selection of governing bodies may not always successfully implement these decisions, which is all the more reason that they are the present area of focus. I focus on water decision-making in Western contexts, specifically within the USA and Canada, due to the

power and resources this region has both over water security currently and to manage water (and the factors contributing to water insecurity, such as carbon emissions) going forward (Brisbois & de Loë, 2016; Dobbin & Lubell, 2021; Haeffner et al., 2021). One could argue that due to the activities of the Global North and wealthy nations contributing to climate change and related water crises, the responsibility lies with this region to resolve and respond to ongoing and predicted water crises. While I do not delve deeply into power relations at this scale, the specifics of water governance, or what water crisis solutions entail, I focus on the human interactions and psychosocial responses that potentially underpin decisions around water security and management.

Existing environmental decision-making research has clearly established that diverse groups can create more equitable, sustainable, ethical, and successful outcomes (Cleaver & Hamada, 2010; Cook et al., 2019; Dankelman, 2002; Glover et al., 2002; Lacey, 2008; Nadeem et al., 2020; Pearl-Martinez et al., 2012). Diverse teams are those that involve people from various backgrounds, identities, and worldviews. This may involve people of different genders, race, class, education, values, and/or culture. Environmental and management scholars have shown that gender diverse teams make more environmentally responsible decisions (Cook et al., 2019), women make more ethical, justice-based decisions than men (Craft, 2013; Glover et al., 2002), and that organizations with female leaders see improved corporate social responsibility (Orazalin & Baydauletov, 2020; Rao & Tilt, 2016). However, current water management in the Global North is male-dominated (Elledge et al., 2020; International Water Association, 2016; Thompson et al., 2017), potentially hindering outcome efficacy and applicability across different social groups.

It is paramount to identify and implement effective, successful, equitable water solutions given the growing climatic pressures, ensuring the groups responsible for water management decisions are best equipped to design those solutions. A component of that preparation involves confirming diverse voices are active and empowered in the decision-making process. Increasing the presence of underrepresented groups is a first step, but this diversity must also be paired with equity to ensure these voices are heard and valued in decision-making processes. Unfortunately, the way water crises are communicated may make this a particularly difficult task in a homogeneous and conventionally male majority space.

This crisis communication can be problematic because water crisis communication may carry existential, life-threatening reminders that engage predictable, human responses to settle these mortality anxieties. Terror Management Theory (TMT) explains that humans are uniquely aware of our eventual demise, but it is deeply troubling to be reminded of that fact. We, as humans, possess several defense mechanisms to offset or repress our mortality anxieties, described in detail in Section 1.2.2. Of note is that these threatening reminders can increase preference of those that are most similar in worldview, values, lifestyle, and culture as a way to ensure our eternal, symbolic survival through group members, beyond our physical demise. At the same time, we distance ourselves from those who are different. This intergroup bias, often expressed in the form of subtle stereotypes, preferences, and behaviours, can make equity and diversity efforts in homogenous spaces that contain mortality reminders particularly challenging.

Gender role stereotypes inform judgements on who should undertake what forms of work (Eagly & Karau, 2002; Heilman & Eagly, 2008). Due to societal pressures and norms, we hold underlying ‘expectations’ of who is best suited for what types of work. For example, we may presume that women are inherently better at nurturing, communal tasks while men are better at

competitive, assertive work. Likewise, science and technology sectors, where water management often resides, are fields where it is often assumed that men excel (Carli et al., 2016; Marini & Banaji, 2022). Further, previous and likely well-intentioned diversity efforts focused on recruitment but not on retention. Women who enter these homogeneous sectors often do not remain, citing lacking career advancement programs, few challenging meaningful projects, limited work flexibility, and biased promotion practices (Fritz & van Knippenberg, 2018; Hegde, 2020; Hideg & Shen, 2019; International Water Association, 2016; Kossek et al., 2017; Reynolds, 2011). Stereotypes about gender roles are implicit biases created by a patriarchal society that dictates who should perform what types of work. They are certainly biases that can be challenged, but their influence on diversity and equity cannot be ignored. Moreover, these stereotypes and assumptions make increasing women's representation, participation, and retention in water management a daunting task; mortality anxiety defenses – potentially activated by water crisis communications – can increase stereotypes and bias effects (Schimel et al., 1999).

By better understanding just how water crisis communication influences one's mortality anxieties, worldviews, and judgement about others, we will be sufficiently prepared to develop and implement essential water management solutions.

1.1 Dissertation purpose, objective, and major contributions

To more effectively address water quality and quantity concerns in face of increasing climatic pressures, we must understand the implications of both who is involved in the decision-making and how water communication impacts decision-makers and water outcomes. The purpose of my dissertation was to first, understand how life-threatening water communication influences psychosocial responses regarding mortality anxiety and environmental identity and, second,

examine how that communication influences intergroup gender biases among water decision-makers.

Specifically, my research questions were:

> Q1: Do threatening water messages evoke mortality salience similarly to other known mortality reminders, as demonstrated in established TMT research?
>
> Q2: Does mortality salience and/or life-threatening water reminders influence pro-environmental worldview or identity?
>
> Q3: Does mortality salience influence men's decision-making about women and women's ability to make decisions? In other words, to what extent does mortality salience influence gender discrimination?

My overarching, interdisciplinary objective was to identify if TMT insights can improve both water-related sustainable decision-making outcomes and gender equity and inclusion within water management. The primary research objectives were to identify whether (1) threatening water messaging fosters mortality salience and (2) TMT insights can explain some of the gender bias observed in water management spaces. Using a TMT lens, I explained the mortality-related influences of water crisis communication and what that means for water-related decision-making and diversity efforts.

Dissertation results are presented in three related manuscripts written for publication (Chapters Two, Three, and Four), that respond to the above research questions in respective order. A literature review follows below to provide a conceptual and empirical foundation for the dissertation and to connect the subsequent manuscripts. Empirical context and research methodology follow the literature review, concluding with a dissertation structure overview.

1.2 Literature review

Through this dissertation, I combined and contributed to three main bodies of literature: water management and decision-making under climate change, social psychology understandings of human responses to existential threat, and gender dynamics in management and decision-making groups. To deliver better-informed climate and water communication with the goal of more sustainable and equitable water outcomes, I applied TMT methods and insights to understand gender inequity in water crisis management and decision-making. This literature review provided an overview of water's role in climate change, current approaches and recommendations for water solution development and implementation, and a critical view on who is involved in water crisis decision-making. I then summarized the background and development of Terror Management Theory, how TMT informs human response to climate change and water crises, and outline insights from TMT regarding appraisal of others and intergroup biases that emerge in threatening scenarios. Lastly, I discussed gender dynamics within these contexts, explaining diversity and equity concerns, gender role congruity, and gender issues in work and decision-making. In this section I specifically presented gender dynamics in water, work, and group decision-making, justifying the need for intersectional feminist understandings within water solutions.

1.2.1 Water crises, management, and decisions

It is no longer disputable that climate change presents an unavoidable threat to life as we know it; climate scientists state that we are committed to a certain degree of global temperature increase and change due to past and unavoidable near-term carbon emissions (IPCC, 2023). Water quality, quantity, and security are all seriously and negatively impacted by climate change; water crises are predicted to increase in tandem with global warming (Caretta et al.,

2022). These water crises involve increased intensity and variability of flooding, droughts, rainfall, and sea-level rise, impacting water availability, water quality (e.g., from contaminant run-off from flooding), food security (e.g., agricultural loss from drought, fishery impacts), energy (e.g., hydropower unreliability due to fluctuating water availability), biodiversity and ecological resilience (e.g., streamflow or nutrient fluctuations reduce species diversity), migration (e.g., increased climate refugees), and human health (e.g., water-borne illnesses, reduced access to water for sanitation; Caretta et al., 2023). In short, all aspects of human life may be impacted by water crises related to climate change due to water's integral and necessary role in our survival.

Di Baldassere et al. (2019) describe water crises as "the intended and/or unintended consequences of long-term changes (i.e., slow evolution) of social norms and values (or, more broadly, culture), ideology or political systems, which are not typically anticipated or accounted for in coping with water-related issues." This definition encapsulates human contributions to climate change and the related water consequences, in addition to cultural, societal, and psychosocial factors involved in water crises solutions. This combination of water management and human behaviour led to sociohydrology, a relatively new field in which researchers aim to understand human-water interaction to better understand complex water crises (Pande & Sivapalan, 2017). This dissertation contributes to sociohydrology as I considered human psychosocial responses to water crises and how these responses influence water-related decision-making.

Due to the myriad possible water crises, in keeping with the human-water focus, I concentrate on those crises that have direct connection to water (e.g., flooding over irrigation for food security) and impact on human life (e.g., drinking water quality over hydropower). These foci

maintain water's central role in climate crises and connection to its life-sustaining properties. These foci also hold management solutions; we know ways to manage water and protect human life in flooding, drought, and water contamination scenarios (Agrawal et al., 2022; Bosma, 2013; Powell et al., 2017). There are preventative – and reactive – measures available in the urban Global North to manage these water crises. The knowledge and availability of solutions does not mean that they are the only or best options, or that the decisions regarding implementation are straightforward. These decision-making dynamics are central to this dissertation. The decision to implement one solution or another – or any at all – to respond to or prevent a water crisis is complex and multi-faceted. This complexity has led to many water decisions being relegated to various levels of government, be that municipal, provincial/state, federal/national, or a combination, and can also involve private-sector, non-profits, indigenous groups, and other stakeholders. However, the decision-making power typically lies with upper management, often in government.

Water governance generally refers to water's management by various political, economic, and social systems (Rogers & Hall, 2003). While governance itself is not central for this dissertation, decision-making processes within water governance – and other water management – are. Decision-making involves the discussion of the problem at hand – in this case, water crises – and consideration of causes, potential solutions, various stakeholder needs, possible impacts, and resources required to implement solutions. While various tools exist to assist with complex decision-making (e.g., computational models, interactive games; Cunha, 2023; Webber & Samaras, 2022), the ultimate decision remains with our own values, worldviews, beliefs, and biases. Humans are not purely rational decision-makers; we are vulnerable to biases and influenced by emotions, consciously and subconsciously (Andrade & Ariely, 2009; Johnson,

2021; Tversky & Kahneman, 1974; van der Pligt, 2001). Behavioural economists have shown that we do not always make decisions in our best interests and that we can be, at times 'predictably irrational' (Ariely, 2008). One empirically supported way to combat bias in decision-making – and which underpins much of participatory resource governance – is to involve diverse individuals who can speak for those affected by the problem and, perhaps, provide creative, novel solutions (Díaz-García et al., 2013; Galia et al., 2015; Nielsen et al., 2017; Pahl-Wostl et al., 2020; Pettigrew, 1998; Van Assche et al., 2023). Yet despite this knowledge, water management remains homogenously male-dominated. Gender dynamics of water management are discussed further in Section 1.2.3 with applications in Chapter Four. A central component of water crisis decision-making follows below regarding human responses to life-threatening reminders.

1.2.2. Human responses to climate and water threats: Terror Management Theory

Terror Management Theory (TMT) builds on cultural anthropologist, Ernest Becker's work regarding human's unique mortality awareness; we strive to live our lives with meaning despite the ever-present, gnawing truth that we will one day die (Becker, 1973). Social psychologists in the late 1980's sought to build on Becker's ideas and began applying empirical, psychological methods to determine if this mortality anxiety – and behaviours it influences – could be measured (B. L. Burke et al., 2010; Pyszczynski et al., 2015). An overview of that research is provided below, followed by context specific for this dissertation regarding TMT's application to environmental threats (e.g., climate change) and gender bias.

1.2.2.1 Three hypotheses and a dual-process defense model

Over 30 years of TMT research explains that humans around the world, in 30+ nations in differing cultural contexts (B. L. Burke et al., 2010), have predictable, replicable reactions to subtle, subconscious mortality reminders, termed, mortality salience (MS; Greenberg et al., 1990; Pyszczynski et al., 2015; Rosenblatt et al., 1989). While studies predominantly used American university students as participants, responses to mortality salience have been replicated in real-world samples, in differing age groups and varying belief systems (B. L. Burke et al., 2010; Hart, 2019; Pyszczynski et al., 2015). The specific activities that are responses to mortality reminders differ based on individual's and dominant cultural values, but their purpose remains consistent. These reactions serve to distance oneself from mortality thoughts, bolster one's self-esteem, and/or strengthen cultural ties in order to live on symbolically even after one has physically perished (Florian et al., 2002; Greenberg et al., 1990; Pyszczynski et al., 1999; Schimel et al., 2019). Three core hypotheses provide a foundation for TMT, 1) the anxiety-buffer, 2) mortality salience, and 3) death-thought accessibility (Pyszczynski et al., 2015; Schimel et al., 2019). Behaviours influenced by mortality salience can be framed within a dual-process defense model (Kosloff et al., 2019; Pyszczynski et al., 1999), and is described after the hypotheses.

The anxiety-buffer hypothesis states that if a psychological structure (e.g., self-esteem) provides a defense or buffer from mortality-related anxiety, bolstering that structure reduces anxiety when mortality reminders are present (Dechesne et al., 2003; Pyszczynski et al., 2015; Schimel et al., 2019). Self-esteem has long been associated with improved mental health and general happiness; TMT has deepened our understanding behind this connection by positing that self-esteem specifically is an anxiety-buffer, as demonstrated by Greenberg et al. (1993). These

authors found that with higher self-esteem, participants less strongly denied their vulnerability to an early death (Greenberg et al., 1993), thus illustrating a lesser need to offset mortality anxiety when self-esteem was high.

The mortality salience hypothesis states that if a psychological structure (e.g., worldview, self-esteem, close relationships) protects from death thoughts, than mortality reminders increase the need for that structure and the protection it provides (B. L. Burke et al., 2010; Pyszczynski et al., 2015; Schimel et al., 2019). This hypothesis has been the most frequently and widely tested of the three (see B. L. Burke et al., 2010 for a twenty-year review) and informed the dual-process defense model, described below. An early study supporting this hypothesis demonstrated that when reminded of mortality, judges – a position we might assume, or at least hope, to be resilient to bias – more harshly sentenced those who were seen as moral transgressors than judges who were not exposed to a mortality reminder (e.g., prostitutes; Rosenblatt et al., 1989). Mortality reminders, then, lead to higher worldview defense and desire for activities or things that bolster self-esteem and reinforce personal values (Schimel et al., 2019). Importantly, these self-esteem bolstering behaviours are not always life-enhancing. For instance, Routledge et al. (2004) found that when tanned skin was associated with physical attractiveness, participant exposure to mortality reminders increased willingness to tan – an activity that increases likelihood of skin cancer – in order to boost self-esteem for those who valued tanned appearances. I applied this hypothesis in Chapter Three and Four, by examining if a typical mortality and/or life-threatening water reminders increased pro-environmental identity (Chapter Three) and association with gender ingroup (Chapter Four) as ways to bolster self-esteem amongst American and Canadian real-world participants (demographic details are described in respective chapters).

Lastly, the death-thought accessibility (DTA) hypothesis states that if a psychological structure protects us from death thoughts, threats to that structure increase the accessibility of death thoughts (Hayes et al., 2010; Pyszczynski et al., 2015; Schimel et al., 2019). Death-thought accessibility is often measured indirectly via a word-fragment completion task (Cox et al., 2018; Hayes et al., 2010). Word-fragment completion tasks were initially developed to test memory and priming effects – the 'activation' of themes or ideas that are outside of an individual's focal attention, in their subconscious (Tulving et al., 1982). A set of words are shown with some letters removed and the participant completes the blanks with whatever word comes to mind. Some of the words in the set could be completed with either a neutral word or a death-related word. For example, **C _ F F _ _** could be completed as ***coffee*** or ***coffin***. The more word-fragments completed as death-related words, the higher the death-thought accessibility (Cox et al., 2018; Greenberg et al., 1994). Thus, if self-esteem is threatened, for example, via a threat to one's ingroup or worldview, death-thoughts would be more accessible – after a delay, expanded below – in that individual (Cox et al., 2018; Hayes et al., 2010). I applied the DTA hypothesis in Chapter Two, wherein after a typical mortality or life-threatening water reminder or a control, and after a delay, DTA was measured to determine if any of the water threats made mortality salient. Criticism of this hypothesis were also addressed in this chapter.

The dual-process defense model explains how, psychologically, various structures are supported following a mortality threat (Kosloff et al., 2019; Pyszczynski et al., 1999). We can be reminded of our mortality explicitly – by being asked to contemplate our demise directly, as often done in TMT research (Cox et al., 2018), including in this dissertation – or by a subtle reminder, such as the word 'death' flashing imperceptibly on a screen. The former elicits *proximal* defenses and the latter *distal* (Kosloff et al., 2019; Pyszczynski et al., 1999). Distal

defenses also occur after a delay following explicit mortality threats (Kosloff et al., 2019; Pyszczynski et al., 1999; Steinman & Updegraff, 2015).

Immediately after an explicit mortality reminder, we evoke proximal defenses that distance ourselves from the threat, rationalize our vulnerability away, or distract ourselves from the threat (Kosloff et al., 2019; Pyszczynski et al., 1999; L. K. M. Smith et al., 2022). These defenses arise when mortality is cognitively accessible and in our focal attention – we are aware we have been reminded of our mortality, and proximal defenses activate to push that threat away so that we are not consumed by the related death anxiety (Pyszczynski et al., 1999). After a delay, or a subtle mortality reminder, *distal* defenses engage (Pyszczynski et al., 1999; Steinman & Updegraff, 2015). At this point, death thoughts are no longer cognitively accessible – though they can be measured by the DTA tasks described above (Cox et al., 2018; Kosloff et al., 2019; Pyszczynski et al., 1999). Distal defenses include worldview reinforcement, self-esteem striving, and ingroup preference and outgroup derogation (Kosloff et al., 2019; Pyszczynski et al., 1999; L. K. M. Smith et al., 2022). This may look like greater support for one's ingroup, increased commitment to one's values, or dedication to a 'hero-project' – all structures that will provide symbolic immortality (Dechesne et al., 2003; Kosloff et al., 2019).

With this theoretical foundation, attention is now turned to TMT research within climate change specifically before moving to TMT and gender studies.

1.2.2.2 Terror Management Theory and climate change

As climate change has become a familiar and unavoidable part of daily life, TMT scholars have begun to examine its influence on human psychology (for an extensive review of this research,

please see Smith et al., 2022[1]). Climate change has been explored to determine if it evokes existential anxiety similar to typical mortality threats (Barth et al., 2018; Fritsche et al., 2012; Pyszczynski et al., 2012) and also how MS influences pro-environmental attitudes or worldviews, among other behaviours (Fritsche et al., 2010; Fritsche & Häfner, 2012; Koole & Van Den Berg, 2005; Rahimah et al., 2018, 2020; Vess & Arndt, 2008). Additional scholars have applied TMT insights in media analyses, for example, within bottled water campaigns (Cote & Wolfe, 2018), water speeches (Wolfe, 2017), water infrastructure as hero-projects (Ross & Wolfe, 2016), and within communications following a water contamination disaster (Cote et al., 2017).

A consensus is emerging that climate change can serve as a mortality reminder, influencing human behaviour in similar ways as typical mortality threats (Skurka et al., 2023; L. K. M. Smith et al., 2022; Wolfe & Tubi, 2019). Climate change and/or environmental reminders have been found to increase MS or death-thought accessibility (Atalay & Meloy, 2020), increase ingroup preference and outgroup derogation (Barth et al., 2018; Fritsche et al., 2012; Uhl et al., 2018), increase worldview support (e.g., increased consumerism, Akil et al., 2018; increased resource consumption, Fritsche & Häfner, 2012; Kasser & Sheldon, 2000), and increase pro-environmental behaviour when salient (Fritsche et al., 2010) or already valued (Harrison & Mallett, 2013; Rahimah et al., 2018).

Importantly, while water-related climate events were occasionally included in the above authors' operationalizations of climate change, water crises themselves have not been examined

[1] Smith, L., Ross, H., Shouldice, S. and Wolfe, S. (2022) "Mortality management and climate action: A review and reference for using Terror Management Theory methods in interdisciplinary environmental research." *WIREs Climate Change*. https://doi.org/10.1002/wcc.776

as separate mortality reminders. This is explicitly explored in Chapter Two and throughout the dissertation. To note for Chapter Three, those who did not gain self-esteem from pro-environmental behaviour, such behaviours decreased after a mortality reminder (Vess & Arndt, 2008). Lastly, and important for Chapter Four, environmental reminders were found to, at times, remind participants of their animal-nature (Koole & Van Den Berg, 2005) – explained in detail in the following section.

1.2.2.3 Terror Management Theory and gender

Existential terror defenses exist to help keep our anxiety from mortality at bay. We are reminded of our mortality by our own bodily experiences – our physical form deteriorates with age, we witness other humans decline (and decay and die), and we observe animal deaths not infrequently – from cherished Fido the family dog to the squirrel on the road (Fritsche & Hoppe, 2019; Goldenberg et al., 2001). At the same time, we understand animals' purpose is also to feed, fight, and fornicate (Fritsche & Hoppe, 2019; Goldenberg et al., 2001). As we too, hopefully (asexual individuals aside), fornicate, our similarity to animals is made clear (Goldenberg et al., 2019). This human-animal similarity is termed creatureliness by TMT scholars and the tension between being an animal but striving to deny mortality has been studied at length (Goldenberg et al., 2001, 2019). Humans are just another animal species but accepting that we are animals means recognizing that we are vulnerable to mortality. This awareness is unacceptable in the day-to-day of our existence – we seek to distance ourselves from creaturely reminders that make mortality salient (Cox, Goldenberg, Arndt, et al., 2007; Fritsche & Hoppe, 2019; Goldenberg et al., 2001).

This cognitive tension directly connects to gender studies within TMT as female physical characteristics further remind us of our animal nature – those animals with uteruses become pregnant and are subjected to a messy birth process, akin to the creatures around us (Goldenberg et al., 2019; Goldenberg & Roberts, 2000). Due to tensions between sexual and reproductive desires and the seemingly unavoidable associated creaturely reminders, humans (at least heterosexual humans[2]) experience heightened death anxiety responses in association with sex and gender.

Gender-TMT scholars have found that after mortality reminders, human bodily products such as breast milk or feces are viewed as more disgusting to American participants (Cox, Goldenberg, Arndt, et al., 2007; Goldenberg et al., 2001) and physical – but not symbolic – sex characteristics are less appealing (Goldenberg et al., 1999, 2002). In one American study, researchers found that the mere presence of menstruation products – a tampon dropped by a female confederate – resulted in participants distancing themselves from the female who dropped it (compared to those who witnessed a confederate dropping a hair clip) and participants rated the women as less competent and favorable (Roberts et al., 2002). Concerningly, other scholars also found that when mortality was salient in heterosexual men, they managed their anxieties by preferring images of women who were literally objectified (e.g., partially obscured or melded with an object; Morris & Goldenberg, 2015) and in another study, when mortality salience was paired with a creatureliness prime – a reminder of one's similarity to animals – men were more accepting of violence against women (Landau et al., 2006). Finally, researchers have established

[2] A limitation of many TMT studies is an absence of comparison across nonheteronormative sexual- or gender-identities. Those that consider homosexuality often do so regarding increased prejudice to homosexual groups (particularly towards gay men; Webster & Saucier, 2011) following mortality reminders (Fairlamb et al., 2022; Grover et al., 2010).

that MS increases intergroup biases as a distal defense (Barth et al., 2018; Castano, 2004; Castano et al., 2002; Fritsche et al., 2012; Giannakakis & Fritsche, 2011; Harmon-Jones et al., 1996; Uhl et al., 2018), so it is possible that ingroup gender preferences may likewise increase following mortality reminders. Moreover, TMT scholars have shown that MS increases stereotypes and ingroup biases (Schimel et al., 1999), potentially further fueling gender disparity in existentially threatening, male-dominated spaces such as water crisis decision-making.

Before discussing gender dynamics within water management specifically, common criticisms of TMT are addressed below.

1.2.2.4 Terror Management Theory critiques

Since TMT's emergence as an explanation for some human behaviour, there have been critics within psychology and beyond. Frequent critiques include replicability issues, effect size inconsistencies, and alternate explanations other than fear of death (such as uncertainty or need for meaning). These are discussed in order below.

Psychology – and other fields – have faced growing concerns about replicability of findings (Aarts et al., 2015; Ioannidis, 2005). This is concerning as to be certain knowledge has been gained and findings are reliable, they must be repeatable. This concern is compounded by publication biases where null effects are less likely to be published (Ioannidis, 2005). Fortunately, knowledge of this problem means there are scholars working to revise this issue, such as the Many Labs project, which seeks collaboration across many institutions to replicate seminal psychological findings to determine confidence in those findings (Many Labs, 2023). The 4th Many Labs project sought to replicate worldview defense as a distal defense among Americans regarding appraisal of a pro- or anti-US author (replicating Greenberg et al.'s 1994

study; R. A. Klein et al., 2022). In addition to pre-registering study design – a recent practice to promote open and transparent data collection and analysis to prevent *p-hacking*[3] – six of the 17 university labs involved had original authors advise to help ensure consistency and best practices. However, similar MS effects were not found by any replications: original effects were large and replications found no to small effects (R. A. Klein et al., 2022). A potential explanation could be that pro-US attitudes are less important to positive American identities as when the original study occurred. A second explanation involves another TMT criticism: effect size inconsistencies.

Prior TMT meta-analysis regarding distal defenses found medium effect sizes for studies published over a 20 year period (B. L. Burke et al., 2010). In tandem with effect size critiques is that of power and sample size – too small a sample, particularly when expecting small effects, will lead to low power, or low confidence in one's findings (Aarts et al., 2015; Ioannidis, 2005). A forthcoming publication from Chen et al. involves a meta-analysis to assess power, effect size, and publication bias potential in TMT literature (L. Chen et al., 2022). They note that many past TMT studies are underpowered (a reason I sought large sample sizes for this dissertation) but that there is evidence of TMT value and effect – though it may be smaller than past publications indicate (L. Chen et al., 2022). Overall, these two criticisms seem to indicate that MS effects might be smaller than originally thought – perhaps due to research design or to changing attitudes in Western cultures where the bulk of TMT research exists. In effort to address these concerns, I sought to ensure highly powered studies that were pre-registered and followed TMT

[3] P-hacking is biased data collection or analysis conducted in effort to find significant effects, and may involve diverging from original study design or running additional tests until a significant *p* value is obtained (Head et al., 2015).

methods closely, including multiple delays in attempt to ensure detectable effects. I have discussed these choices in more detail in study design sections.

The final critique to briefly address is that of alternate explanations for MS effects; most often presented are that uncertainty or need for meaning are actually behind TMT findings, rather than death anxiety (McGregor, 2006; Pyszczynski et al., 2015; Van Den Bos & Miedema, 2000). Regarding uncertainty, this explanation is insufficient as, first, death is one of the most certain things in life and, second, people at times prefer uncertainty to certainty (see Weinstein & Klein, 1996), so anxiety from the *uncertainty* about death is unlikely to be the stronger motivator than death anxiety itself (Pyszczynski et al., 2015). Other scholars argue death anxiety is troubling because it undermines meaning, and that meaning maintenance (Heine et al., 2006) is what explains behaviour and the anxieties, not mortality salience. In response, TMT scholars argue that death is not feared because it challenges meaning but that we *require life to contain meaning*, and reinforce things that provide us meaning (such as worldviews and cultural values), as a way to protect from death anxiety and assuage death fears (Pyszczynski et al., 2015).

Terror Management Theory is a relatively modern field, and has gone through several changes and adjustments in understanding since its origin over 30 years ago. There will likely be further alterations in TMT understandings going forward, as with any area of knowledge. I have briefly covered common criticisms, and have strived to address concerns within study design and research approach. With this basis addressed, gender dynamics in water management are now discussed.

1.2.3 Gender dynamics in water management and decision-making

This section begins with some necessary definitions before discussing gender role congruity and gender in water management.

1.2.3.1 Equity, equality, diversity, gender, sex

Gender equity has been mentioned and its definition hinted at but deserves defining before going forward. Equality implies everyone receives the same resources and opportunities, regardless of starting point, whereas equity takes into consideration structural imbalances and systemic issues that influence people in different ways (Espinoza, 2007). For example, two employees may hold the same position in a water management organization, but if one is of a different class, gender, or race, they may have had a different experience reaching that point – especially if their identity is one that is uncommon in that space. Just as diversity alone is insufficient – increasing the number of different identities present without addressing different needs and culture is unlikely to create lasting change – equality does not suffice (Haine-Bennett et al., 2020; Lacey, 2008). Inclusion, then, involves making people feel welcome, heard, and valued. As discussed in Chapter Four, and briefly below, equity and inclusion are important in creating management and decision-making groups where diverse voices are not only present, but are empowered, valued, heard, and are more likely to stay.

A final definition to note is that of gender. While sex refers to an individual's biological attributes (e.g., female, male), gender refers to socio-cultural definitions one identifies with (e.g., non-binary, feminine, masculine; CIHR, 2020; Wood & Eagly, 2015). Gender is a component of one's identity and how we view and understand ourselves (Wood & Eagly, 2015). By most feminist understandings, gender is no longer understood as a binary concept (Butler, 1988); like

water, gender is fluid, with performances across the spectrum. However, few studies in the fields I draw from have explicitly focused on non-binary gender identities and, in my own participant groups, few identified other than woman or man (<1%). As my research questions concentrate on how individuals are viewed by others and as others are (at least implicitly due to societal stereotypes explained below) often assumed to perform one of two binary gender identities, I focus on women and men in this dissertation. I also concentrate on gender to allow for depth in analysis and to have sample sizes of sufficient power. As discussed in Chapter Five, further research with different identity intersections would be meaningful and worthwhile.

1.2.3.2 Gender roles, stereotypes, and biases

Gender role theory posits that women and men tend to adopt particular roles, behaviours, and/or positions based on cultural and social expectations (Kray et al., 2017) and stems from social role theory (Eagly & Steffen, 1984). How an individual performs their gender (Butler, 1988) is judged by society in general as to whether that performance fits their ascribed gender role, as established by historical norms (Kray et al., 2017). Those appearing masculine are expected to be more agentic – assertive, competitive, and independent – while those appearing feminine are expected to be more communal – collaborative, compassionate, and nurturing (Eagly & Karau, 2002; Wood & Eagly, 2015).

These expectations and assumptions represent stereotypic thinking; we generalize based on past experiences and societal standards to connect new people and experiences to past encounters (Eagly & Karau, 2002; Tversky & Kahneman, 1974). When someone behaves in ways that match their presumed gender, it is said that they are gender congruent; when someone behaves opposing to their presumed gender, they are gender incongruent (Eagly & Karau, 2002). For

example, when someone who appears stereotypically feminine acts assertively, they may be described as gender incongruent (Eagly & Karau, 2002). Likewise, if a woman is in a stereotypically masculine role – science, engineering, or leadership – or a man is in a stereotypically feminine role – nursing, teaching, or at-home-parent – they display gender role incongruity (Eagly & Karau, 2002). This incongruity can lead to harsh evaluations from others as the incongruent individual violates implicit social and cultural beliefs about what makes – or who can be – a 'good' leader, nurse, or decision-maker (Carli et al., 2016; Heilman, 2001; Hoyt & Burnette, 2013; Klutsey, 2020; Paustian-Underdahl et al., 2014). Within water management or leadership, female gender role stereotypes do not match the stereotypical traits that are assumed to be necessary for success in these male-dominated spaces (Eagly & Karau, 2002; Heilman & Eagly, 2008; Koenig et al., 2011).

Yet, water management was not always male-dominated or masculine. This transition and reasons why women are absent from water decision-making are described below.

1.2.3.3 Gendered water management and decision-making

Historically, water has been highly connected with women, as evidenced through ancient water goddesses (Neimanis, 2012; Strang, 2014). As water became a commodity to be controlled, managed, and extracted, men became priority water managers in the Global North (Laurie, 2005; Strang, 2014) in formal, paid contexts, in comparison to water stewards, who are often women in volunteer roles (Caretta, 2020; Chiblow (Ogamauh annag qwe), 2019; Kim et al., 2013).

Contemporary water management is a highly technical field dominated by engineering and the physical sciences (Elledge et al., 2020; Lofrano & Brown, 2010); perhaps this technology association contributes to water management's gendered nature (Blake & Hanson, 2005; Massey,

1995; Nähllinder et al., 2015; Zwarteveen, 2017). Science, technology, engineering, and math (STEM) fields carry masculine connotations and are highly associated with one another (Diekman et al., 2015; Rap & Oré, 2017), creating both implicit and explicit societal stereotypes about who is inherently 'good' at science and what scientists 'should' look like (Carli et al., 2016). For example, scholars have repeatedly shown that people more quickly associate STEM-related words to men than they do to women (Marini & Banaji, 2022; Nosek et al., 2009). This has implications for who appears to be a better candidate for STEM work or a better fit for leadership in STEM organizations.

As water management often falls under STEM labels, these implications apply for water crisis decision-making and leadership. When people consider who would be a good leader, implicit biases often show that men are more often assumed to perform more successfully in leadership roles than women (Eagly et al., 1992; Eagly & Karau, 2002; Heilman & Eagly, 2008; Hoyt & Burnette, 2013; Koenig et al., 2011; Paustian-Underdahl et al., 2014; Scott & Brown, 2006). Thus, there is a barrier to diversifying decision-makers – those in management and leadership – in water fields related to implicitly held biases and norms around who is assumed to be best suited for this work. Even without these biases, additional factors make it difficult for women to enter management and leadership roles, described below.

Workplace culture – the ideas, norms, and standards in an organization – provide descriptive informal guidance of what is valued and encouraged by colleagues, peers, and leaders (Hall, Schmader, Cyr, & Bergsieker, 2022). As women are often responsible for the majority of care work (e.g., childcare, eldercare, household responsibilities; Fritz & van Knippenberg, 2018; Macgregor et al., 2022; McCarthy, 2018), inflexible work policies, lacking childcare or feminine hygiene requirements, and poor work-life balance all contribute to attrition among women

employees (Galea & Chappell, 2022; Glass et al., 2013; Hall, Schmader, Inness, & Croft, 2022). Absent role models, lacking mentorship and training opportunities, and poor sexual harassment policies are additional attrition reasons given by women in water sectors, specifically (Das, 2017; World Bank Group & Global Water and Sanitation Partnership, 2019). Lacking equity and inclusion strategies for entry-level positions contributes to poor representation in the management and leadership pipeline; if underrepresented employees leave due to lack-of-fit or low sense of belonging, it is an additional burden for diversity and inclusion in managerial, decision-making roles (Carli et al., 2016; Das, 2017; Galea & Chappell, 2022; Hall, Schmader, Inness, & Croft, 2022; Klutsey, 2020; Kossek et al., 2017). Diversity and equity inclusion are increasingly recognized as important within management contexts, particularly for their connection to improved outcomes – whether regarding employee retainment, happiness, productivity, or solution creation (Cleaver & Hamada, 2010; Cook & Glass, 2015; Galia et al., 2015; Grant et al., 2017; Haine-Bennett et al., 2020; Hall, Schmader, Inness, & Croft, 2022; Hannagan & Larimer, 2010).

Of particular concern for aims to increase equity and efficacy of water crisis outcomes is the context of water-related decision-making in existentially threatening scenarios. As explicated above, humans respond in predictable, at times irrational, ways to life-threatening messages. Specifically, MS has been shown to exacerbate biases and stereotypes (Schimel et al., 1999). Due to water's life-sustaining properties and necessity for survival, water crisis scenarios may increase mortality threats, increasing biases about gender and leadership, and ultimately making equity in water management more difficult as women would be viewed more negatively in these male-dominated spaces.

1.3 Empirical context

The empirical context for this research is described in both geographical and societal lenses.

As described in Section 1.2, the empirical context for this research is the Global North, specifically within the USA and Canada. This region is important to consider for several reasons – proximity to water and freshwater resources, climate impacts felt relative to climate contributions, and power.

These two countries have extensive coastlines, bordering three oceans (Pacific, Atlantic, and Arctic), and co-manage the Great Lakes, which includes the third largest (by volume) freshwater lake in the world, Lake Superior (Sterner et al., 2020). This access – and vulnerability – to water means these nations could be more secure with greater freshwater relatively easily available, but more at risk to sea-level rise or flooding due to extensive coast- and shorelines or at risk to conflict as global water resources become increasingly threatened. This makes understanding equitable and sustainable water management essential for this large and complex region.

The American and Canadian populations also generally, rightly or wrongly, feel water secure (Meehan et al., 2020) and, despite large per capita carbon emissions, have not felt climate change effects as drastically as those in sea-level island nations or with less moderate year-round temperatures (Beevers et al., 2022; Gosling & Arnell, 2016; Neelin et al., 2022; Schewe et al., 2014). While people here may not feel immediately at risk or vulnerable to climate change, that could change as consequences continue and as climate communications increase (Meehan et al., 2020). This tension between presumed or accustomed water security and the growing threat to that security makes this study region particularly compelling.

Moreover, this area is important to consider regarding improving water management given climate change as the Global North possesses significant resources (e.g., wealth and power) that can actualize, if they chose to do so, water crisis solutions (Brisbois & de Loë, 2016; Meehan et al., 2020).

Through this dissertation, I examined how water crises communications could influence water management and gender biases within water decision-making, in effort to better understand gender inequity in this space and to provide recommendations for achieving improved water outcomes. I applied social psychology insights to water communication and decision-making dynamics. I aimed to answer a previously unexplored portion of why women are absent in water decision-making and sought to provide psychosocial insight into how this absence could be improved. I chose to address the complex interdisciplinary issues of gendered water management in a neoliberal, capitalist society by applying methods largely from social psychology, described below.

1.4 Research approach and methods

This section briefly describes the overall research approach and methods involved in the dissertation, as each chapter describes specific methods in detail.

A quantitative methodology was applied throughout as I sought to empirically test the influence of water crises communication on human psychosocial responses (Chapter Two) and pro-environmental worldview (Chapter Three), and appraisal of female versus male water decision-makers (Chapter Four). The work described in Chapter Two determined if and what form of water crisis communication creates human mortality anxieties similar to those from typical mortality reminders. In Chapter Three, I examined the influence of those water and

mortality reminders on pro-environmental worldviews. Lastly, in Chapter Four I tested the strongest water threats and typical mortality threat to explore influence on gender biases impacting water managers.

A qualitative approach would not allow for the correlational understandings that were sought but would have allowed for deeper exploration of individuals' feelings, motivations, and pressures, for example, via semi-structured interviews (Hammarberg et al., 2016). However, as the psychosocial features of interest were subconscious activations and evaluations, this would be difficult to explore via traditional qualitative methods. While I adopted a quantitative, behavioural approach in my methodology, this does not automatically imply the research is purely objective or without bias. The choice of various tools, scales, and data analyses all involve interpretation by a human, with their own values and worldviews; determining the meaningfulness of research findings and connections beyond academia is not without subjectivity (Westmarland, 2001). Just as the decision-making processes that are of interest in this dissertation are not without bias or human subjectivity, neither is any research methodology as all involve choices and interpretation.

The methods in this research contribute to behavioural understandings, which is just one component of the human experience. Intersectional feminist scholars describe how we must also consider systemic, structural issues in research if we seek fulsome understandings of human life and knowledge useful for an equitable, just society (Anderson, 1995; Crenshaw, 1989; DeFelice & Diller, 2019). While behavioural, quantitative methods have been applied, findings are discussed in relation to structural, systemic concerns within water management and decision-making as much as possible given constraints within manuscript format. As such, deeper interpretations that could not fit with specific journal boundaries are provided in Chapter Five.

This tension between qualitative and quantitative methods, objective and subjective interpretations, is central within interdisciplinary research, the core of this doctoral program (University of Waterloo, n.d.). In my dissertation, I combined theories and disciplines to explore the human in water management, and to provide real-world applications for findings.

1.4.1 Positionality

To avoid bias and to also acknowledge my own motivations within the research process, I have chosen to include the following positionality statement to recognize where I am in relation to my research and my participants (Rose, 1997). I believe it is important for all to consider what influences how we interpret the world around us and how that may be similar or different from others. My research direction was certainly influenced by who I am, what I am interested in, and the experiences I have had. To be transparent about these choices and influences is to be clear about my own influence on my research, results, and interpretation.

I am a queer, white, cisgendered, neurodivergent, and able-bodied woman, born to Scottish parents who immigrated to Canada before I was born, and I was raised in an upper middle-class household. This identity brings privileges and challenges, and I try to use my privileged position to, at least in a small way, make things better where I can. This identity allowed me easier, more direct access to academia than others, while also presenting a view and experience with certain vulnerabilities.

Eighteen years ago, I moved to Waterloo as a settler on traditional territory of the Neutral, Anishinaabeg, and Haudenosaunee peoples, to begin my postsecondary education. I have had privileged access to knowledge resources since, studying psychology and philosophy, ecology and biology, then a masters in sustainability management. My academic background has been

largely qualitative as, despite some dabbling in quantitative methods, strong math anxieties posed a challenge. I often witnessed the narrative that quantitative methods and natural sciences were somehow superior, better, or more rigorous. While at times difficult to challenge that belief, there is value in both approaches, especially for any research claiming to be interdisciplinary (Lach, 2014). Both methods reveal essential knowledge – or at least pieces contributing to knowledge – that is needed to fully understand and address the most pressing problems we face. Considering climate change and water crises in particular, we need a technical understanding as much as a sociocultural one to understand what solutions might be best for what areas and what types of people (Molina-Azorin & Fetters, 2019). So, despite my fear, anxiety, and distant memory of psychology statistics, I decided to broaden my skillset with the PhD and use quantitative methods from Terror Management Theory to explore the questions of interest.

I explored water crises and related gender bias in decision-making within this doctoral research as it was something I had personal experience. An earlier version of my research objectives focused on gender equity in entrepreneurship, and although objectives diverged, the dismissiveness experienced by women in both fields – entrepreneurship and water management – was something I could relate to. Prior to the PhD, I founded a cleantech start-up and struggled to be taken seriously as someone outside the stereotypical 'norm' for tech spaces – as a queer woman, as someone prioritizing climate over profit, as a social scientist and not an engineer. The stereotypical founder and water manager of the Global North share many traits. This research will hopefully be useful for those entering spaces where they may not be the norm, and for those already in these settings who want to promote and foster more diverse representation and inclusion.

For Chapters Two and Three, I sought participants that were as close to general population as possible – and to the target group in Chapter Four regarding water managers – to increase generalizability, rather than rely on undergraduate student samples that could be more abstract than the average Canadian or American. I collected demographic data relevant for my research and aimed to avoid collecting additional information that could be unnecessarily revealing or at all a risk should that data be compromised (an unavoidable risk in any human research). For example, I asked about gender identity, sex, education, age, and location, but not sexual preference or race as examining those traits were beyond what I could examine meaningfully in this dissertation. McMaster's Research Ethics Board (MREB, n.d.) recommends respecting participants' privacy by not asking for information that will not be used. It is entirely possible that race and sexual preference could reveal differences between participants on variables I collected, but with limited resources I knew I would not be able to meaningfully incorporate these traits so did not need to request participants to disclose. Disclosure may or may not have been troubling to those involved in my research, but it was a choice made to avoid unnecessary discomfort. Relatedly, in effort to avoid harm and recognize the imbalance between researcher and subject, and to recognize my participants as humans with needs and of value, I aimed to reimburse my participants for their time aligned with minimum wage rates. Some crowdsourced research pays far less (e.g., $0.10/task) and, while the minimum wage is far below a living wage, the former was what I had capacity to fund within my research budget.

Lastly, this dissertation contains my perspective of what the data, statistics, and tests chosen mean for people that are similar to those involved in my studies. Some of that could be generalizable to others, some not. The methods largely draw from social psychology, though I have attempted to consider multiple disciplines with interpretations and discussion from the

results. I do not consider myself or this dissertation to fit neatly into one field, rather, much like water's shifting boundaries, instead ebb and flow between disciplinary margins.

With personal context described, an outline for the dissertation follows below.

1.5 Dissertation structure

In addition to the co-authored Smith et al. (2022) manuscript, I chose to complete my dissertation according to the three manuscript structure. This dissertation form contains an introductory chapter, three empirical manuscripts written for peer-reviewed journals, and a concluding chapter designed to synthesize findings and applications. The introductory chapter described the research challenge and rationale, provided background literature overviews, the empirical context, and research methodology.

Chapter (Manuscript) Two addressed my first research question regarding threatening water messaging and mortality salience. In this chapter, three water crises were compared against a typical mortality reminder and a control to determine their similarity and difference regarding death-thought accessibility. This manuscript has been published in *People & Nature*.

Chapter (Manuscript) Three examined research question two regarding threatening water messaging and its influence on pro-environmental worldviews and identity. The same three water crises were again compared against a typical mortality reminder and a control in this manuscript and used to compare their influence on participants' environmental identity. This manuscript received revisions via *PsyEcology*.

Chapter (Manuscript) Four built on the previous two chapters to examine the influence of the most potent of the three water crisis compared to a typical mortality reminder and a control regarding their influence on the appraisal of female and male water decision-makers. This

chapter explored gender biases in water decision-making and the role mortality salience may play, addressing the third research question. This manuscript will be submitted to *The Leadership Quarterly* this year.

Combined, the three manuscripts addressed the research goals regarding identifying mortality salience within water messaging and TMT's role in gender bias in water management. Chapter Five summarized and synthesized research findings and detailed the contributions of this dissertation to academia and practice. The chapter concluded with reflections on the doctoral journey.

Chapter 2. Dead in the water: Mortality messaging in water crisis communication and implications for pro-environmental outcomes

2.0 Chapter Summary

This chapter empirically tests the extent to which life-threatening water messaging activates death anxiety in comparison to a typical mortality reminder and a control. All nature relies on water, yet climate change threatens water availability to the highest degree – from too much (e.g., extreme weather; flooding) to too little (e.g., droughts; wildfires). These water shifts threaten all life on earth. Societies' safe and reliable water accessibility faces growing uncertainty from climate change, however water crisis communication may inadvertently remind audiences of their mortality. According to Terror Management Theory, these mortality reminders can hinder pro-environmental efforts in humans and even increase intergroup biases – a significant challenge for developing environmental solutions. While climate change has been examined as a mortality reminder, water remains untested. This chapter addresses this gap.

I presented participants with either a mortality-laden message, an aversive but not-life-threatening message, or one of three threatening water-related messages – experiencing drowning, dehydration, or contaminated water consumption – to determine if the water-related messages function similarly to the mortality message. Some (e.g., drowning; contaminated water), but not all (e.g., dehydration), water messages increased death-thought accessibility, which could lead to paradoxical environmental behaviours, depending on the audience. Our research findings should inform policymakers, non-profit organizations, and other water correspondents' communication strategies. As some threatening water messages elicit similar responses to known mortality reminders, the way water crises are framed is important for water-related decision-making and ensuring equitable, successful pro-environmental outcomes.

2.1 Introduction

Water is essential; climatic changes will intensify pressures on water availability, access, and management (IPCC, 2022). The emblematic “Day Zero” 2018 event in Cape Town, South Africa, where a multi-year drought severely depleted drinking water availability, and the drought-induced wildfires in western USA and Canada are exemplary of future global water crises (Pascale et al., 2020; Robinne et al., 2021). Meanwhile, extreme flooding frequency and intensity will also increase, illustrating the diverse and geographically varied impact climate change has on water supplies (Hirabayashi et al., 2008; Milly et al., 2002). Water quality is likewise at risk from climate changes via increased runoff events, soil erosion, algal blooms, salt water intrusion, and air temperature increases (Delpla et al., 2009; Schiedek et al., 2007; US Environmental Protection Agency, 2021; Whitehead et al., 2009), creating concerns for human safety and biodiversity. These varied global water crises will impact populations differently but definitively (IPCC, 2022; Dankelman, 2002; Sultana, 2018; Parish et al., 2012). While the USA and Canada, the geographic focus of this study, may not be the most immediately vulnerable regarding water-related human mortalities, these nations consume water at high per capita rates (Agrawal et al., 2022; Wongso et al., 2020). Unreliable water access may be a new experience to many here, threatening food security and agricultural sectors, endangering aquatic environments, and increasing wildfire risk; both human and nature face unparalleled shifts from climate-induced water catastrophes (Murdoch et al., 2020; Robinne et al., 2021; Schindler & Donohue, 2006; Trudel et al., 2016). These changes will be impossible to ignore, whether via direct experience or through ever increasing climate media (Boykoff et al., 2022).

We investigated whether water crisis communication could be existentially threatening, potentially influencing human responses due to psychosocial defense mechanisms identified via

over 30 years of empirical research in Terror Management Theory (TMT; B. L. Burke et al., 2010; Greenberg et al., 1990; Pyszczynski et al., 2015; Rosenblatt et al., 1989). We considered implications for water crisis solutions and water-related decision-making or behaviour. Our results and recommendations for future research are discussed in comparison with relevant academic literatures and implications for water – and environmental – communication, with suggestions for practitioners.

2.1.1 Climate change and water crisis communication

In 2021, the Media and Climate Change Observatory found the greatest climate change media discussion since these global conversations were first tracked in 2004 (Boykoff et al., 2022). While climate change media is most easily seen in nature documentary form (Nolan et al., 2022), climate communication now permeates pop culture, including music (Billie Eilish's song *all the good girls go to hell* (2019, track 5)), film (Adam McKay's *Don't Look Up* (McKay, 2021)), and video games (Nintendo's *Animal Crossing* (Fisher et al., 2021)). While climate change communication has received decades of substantial focus – see Yale's program on Climate Change Communication (est. 2005) or George Mason University's Centre for Climate Change Communication (est. 2007) – research on water communication is lacking (Mayeda et al., 2019; Nisbet, 2009; Weathers & Kendall, 2016). Yet water is integral to human existence, so it is essential we effectively convey water's risks, opportunities, trade-offs, and vulnerabilities broadly and clearly. If the goal is to increase pro-environmental outcomes, we must deeply understand how water communications influence human behaviour. Whether aimed at influential decision-makers, stakeholders, informed non-governmental activists, or a distracted public, these

communication approaches are important because they influence what people think, and do, about water problems.

2.1.1.1 Pro-environmental communication

Pro-environmental communication efforts have been largely information-focused, communicating climate-relevant facts to change behaviour (Mildenberger et al., 2013; Rademaekers & Johnson-Sheehan, 2014). However, humans are not simply rational machines: we make decisions based on more than information alone; we are influenced by emotions, values, worldviews, and social roles (Davidson & Kecinski, 2021; de Groot & Thøgersen, 2018; McCormack et al., 2021; Rademaekers & Johnson-Sheehan, 2014; Reynolds-Tylus et al., 2019; Steg et al., 2014; Vesely et al., 2021; Vestergren et al., 2018). 'Wicked' environmental and water problems are complex and require more than facts to generate pro-environmental behaviour and decisions (McCormack et al., 2021; Powell et al., 2017). Messaging must match audiences' values, worldview, or identity, using frames that help the public and/or decision-makers connect with the message (Greenaway & Fielding, 2020; Ma & Hmielowski, 2021; Rademaekers & Johnson-Sheehan, 2014; Vesely et al., 2021). Yet when messages contain life-threatening themes, caution is needed due to the potential psychosocial consequences (Ma & Hmielowski, 2021; O'Neill & Nicholson-Cole, 2009; Uhl et al., 2018; Wolfe & Tubi, 2019).

2.1.1.2 Threatening communication

Environmental communications frequently capitalize on fear messaging; fear appeals are assumed to draw people in, capture attention quickly, potentially go viral across social media, and, ideally, lead to broad-scale awareness and behaviour change (Maloney et al., 2011; Reser & Bradley, 2017). However, these threatening messages can have unintended consequences.

Beyond legitimate debates on fear-based messaging ethics, communicating climate change in threatening ways has been shown to evoke audiences' existential mortality anxieties (Cote & Wolfe, 2018; Fritsche et al., 2010; Fritsche & Häfner, 2012; Ma & Hmielowski, 2021; L. K. M. Smith et al., 2022; Uhl et al., 2018; Wolfe & Tubi, 2019). Again, threatening messages in water communications have not previously been explored explicitly but have been included in some climate communication studies (Cote & Wolfe, 2018; Fritsche et al., 2012; Mann & Wolfe, 2016; Pyszczynski et al., 2012; Uhl et al., 2018). Given water's necessity for life and symbolic importance to human culture (Neimanis, 2012; Strang, 2014), *can* water problems be communicated in non-life-threatening ways? To answer this question, we considered how humans respond to similar existentially threatening messages. We investigated the psychosocial consequences of threatening water communication via TMT applications before connecting these responses to water crisis communication and decision-making.

2.1.2 Terror Management Theory and mortality salience

Terror Management Theory (TMT) helps explain human psychosocial responses to existential threats, such as climate change. Empirical TMT researchers have explored and defined existential threat responses, the greatest threat being inevitable mortality (Pyszczynski et al., 2015). Building on Becker's *The Denial of Death* (1973), TMT researchers posit that this uniquely human anxiety comes from awareness of one's demise, termed mortality salience (MS) within clinical contexts and mortality awareness outside social psychology (Wolfe & Tubi, 2019).

Mortality reminders may be explicit, taking up focal attention and cognitively accessible (Greenberg et al., 1994, 2000; Pyszczynski et al., 1999). These reminders could involve asking

someone to think about their own death, attending a funeral, or viewing a catastrophic loss of life. Mortality reminders can alternatively be subtle, outside of focal attention, for example, when the word 'death' flashes subliminally on a screen or after a time delay following an explicit mortality reminder (B. L. Burke et al., 2010; Schimel et al., 2019). These subtle reminders activate death-thoughts at a subconscious level.

Terror management scholars have explored and tested the cognitive accessibility of mortality awareness via *death-thought accessibility* (DTA), one of three hypotheses underpinning TMT (Hayes et al., 2010; Schimel et al., 2019). Briefly, the other hypotheses include the *anxiety-buffer* hypothesis – where defenses, or certain self-esteem bolstering psychological structures, serve to buffer anxiety that arises from mortality awareness (Greenberg et al., 1992; Harmon-Jones et al., 1996) – and the *mortality salience* hypothesis – should a defense or psychological structure provide death-thought protection, when mortality awareness increases, so should need for that structure (see Pyszcyznski et al., 2015 and Schimel et al., 2019).

Burke et al.'s 2010 meta-analysis summarized two decades of MS research, considering various dependent variables, and noted overall moderately sized effects. While later studies have had some replication difficulty (R. A. Klein et al., 2019; Maxwell et al., 2015), scholars have found flaws within Klein et al.'s study and, upon further analysis, found the data support earlier TMT findings (Chatard et al., 2020). However, more recent work has found smaller MS effects than Burke et al.'s meta-analysis (Chen et al., 2022).

It should be noted that MS was often operationalized via worldview reinforcement in these studies, whereas we measured DTA– further described in the Methods section – and, in the Discussion, we deliberate these recent findings in context of our results. In the next section, we

review human responses to MS and discuss how these responses relate to threatening water communication.

2.1.2.1 Proximal and distal defenses

Death anxiety is kept at bay via various defense mechanisms – human responses to mortality awareness – that allow humans to avoid being overcome by subtle or overt reminders of their inevitable death. These defenses distance us from mortality thoughts, bolster self-esteem, and/or strengthen cultural ties (Pyszczynski et al., 2015; Burke et al., 2010). To deeply understand these defenses, TMT scholars have identified a dual-process model.

When mortality is cognitively accessibly, *proximal defenses* are immediately engaged; following an explicit mortality reminder, people consistently respond by denying their risk or vulnerability, distracting themselves from the threat, or rationalizing the threat away (Greenberg et al., 2000; Kosloff et al., 2019; Pyszczynski et al., 1999). These proximal defenses directly distance oneself from an explicit mortality threat, allowing the threat to subside to the subconscious where it is no longer cognitively accessible (Kosloff et al., 2019; Pyszczynski et al., 1999).

Following the subsidence of an immediate, explicit mortality threat, *distal defenses* engage; the threat is no longer consciously accessible, but still influences human responses as mortality awareness persists below conscious attention (Greenberg et al., 2000; Kosloff et al., 2019; Pyszczynski et al., 1999). Distal defenses are connected to self-esteem and worldview reinforcement (Greenberg et al., 2000; Kosloff et al., 2019; Pyszczynski et al., 1999), serving to strengthen one's symbolic meaning and importance, reinforcing the belief that they may persist symbolically after death (Pyszczynski et al., 2015). These defenses include, for example,

bolstering one's support for their cultural identity: if one identifies as strongly liberal and Canadian, they will more strongly support liberal Canadian ideals when mortality is subconsciously activated, as demonstrated via comparable German identities and attitudes (Jonas et al., 2003) and Americans (Greenberg et al., 1997). Simultaneously, this person will distance themselves from conservative, anti-Canadian beliefs and those who support those beliefs – or those whom they perceive to support those beliefs.

2.1.3 Connecting Terror Management Theory to water crisis communication responses

To understand water as a mortality reminder – as something that may evoke existential anxiety and mortality awareness, potentially biasing decision-making by othering those who think differently – we must consider both *how* water crises are communicated and *to whom*.

Water solutions depend on individual responses and actions; these individual activities can often create positive environmental change more quickly than policy (Wynes & Nicholas, 2017). Individual actions may seem small when considered independently but have cumulative global impact (Nielsen et al., 2021). Citizens influence who has political power to make water decisions and can advocate for the groups involved in water decision-making (Stollberg & Jonas, 2021). While water decision-makers may act in groups, individual members will still be influenced by psychosocial responses – or defenses – to threatening water messages, in turn potentially affecting what choices they encourage or avoid and whose opinions they consider more strongly and ultimately support – or oppose (Castano et al., 2002; Nielsen et al., 2021; Uenal et al., 2021; Uhl et al., 2018). We briefly define threatening water communication as an existential threat before reviewing its influence on individual and group decision-making.

2.1.3.1 Water crisis communication as an existential threat

Climate change has been empirically tested and shown to be a mortality reminder in TMT studies (Barth et al., 2018; Fritsche & Häfner, 2012; Pyszczynski et al., 2012; Uhl et al., 2018). Specific findings include: MS increases following natural disasters (Atalay & Meloy, 2020); climate change threat increased ingroup norms (Barth et al., 2018); MS led to increased resource consumption (Kasser & Sheldon, 2000); wilderness activates death-thoughts (Koole & Van Den Berg, 2005); MS influenced environmental concern (Vess & Arndt, 2008) – see Smith et al., 2022 for a review. Water has not yet been established as a mortality reminder, which represents a significant opportunity.

First, water is essential for all life; the thought of its absence or insecure availability may be existentially troubling. Second, humans have a deep, cultural history and often symbolic relationship with water (Sivapalan et al., 2012; Strang, 2014; Sultana, 2018). Humans have used water symbolism in religion, maternal and reproductive imagery, for transport and survival, and for technology and power (Gleick, 1998; Lofrano & Brown, 2010; Marrin, 2005; Neimanis, 2012; Strang, 2014). While clearly there are physical risks, water catastrophes may also destroy things that are of cultural, symbolic value, such as homes, neighbourhoods, or belongings – all symbols that can reinforce one's identity (Ledgerwood et al., 2007) – or even loss of species, ecosystems, and landscapes, features important culturally and for ecological resilience (Boltz et al., 2019; Burmil et al., 1999; Scott et al., 2021). Prior TMT researchers have found that threatening such symbols results in heightened DTA (Cook et al., 2015; Hayes et al., 2008; Ogilvie et al., 2008; Schimel et al., 2007), meaning mortality is salient and potentially activating distal defenses, such as intergroup biases.

Water crises communication will only increase with climate change; these potentially threatening mortality reminders may be inescapable, particularly for those who are responsible for crisis responses. Wolfe & Brooks (2017) argued mortality salience's role in water decision-making, bolstering the human need to control nature and distance self from our natural, mortal state (Cox, Goldenberg, Pyszczynski, et al., 2007; Fritsche & Hoppe, 2019; Goldenberg et al., 2001).

Since water management decisions are made by humans – susceptible to the same predictable, sometimes paradoxical, responses to mortality threats – determining whether water evokes mortality anxieties is important to better illuminate water communications, as with other climate and environmental threats (Akil et al., 2018; Fritsche & Häfner, 2012; Uhl et al., 2018; Vess & Arndt, 2008).

2.1.3.2 Group and individual decision-making in response to threatening water communication

It is important to examine the potential intergroup biases that may arise from threatening messages when aiming for the most effective pro-environmental outcomes. Group decision-making diversity is recommended for positive, equitable outcomes, particularly for environmental decisions (Craft, 2013; Dankelman, 2002; de Boer et al., 2010; Elsass & Graves, 1997; Glover et al., 2002; Hewitt et al., 2017; Swim et al., 2018; Vollan & Henry, 2019). If threatening water communication evokes mortality awareness among decision-makers, distal defenses involving ingroup preference and outgroup derogation may occur, reducing benefits from group diversity. Water leadership has been, and continues to be, male-dominated (Adams et al., 2018; International Water Association, 2016; Jalal, 2014; World Bank Group & Global Water and Sanitation Partnership, 2019). Water decision-making – the processes and responses

to water problems – is a homogenous space, noted as male-dominated and discriminatory towards females in South Africa (Elias, 2017), the United States (Haeffner et al., 2021), and across developing countries (Thompson et al., 2017). The World Bank Group examined global gender and water intersections and found women are less likely to participate in decision-making and policy when they are being discriminated against or when they do not feel valued (Das, 2017). Although gender is just one diversity dimension, if this leadership homogeneity persists during water crises, it may result in minority voices being ignored due to mortality-derived intergroup biases that prioritize voices of the majority (Bradley et al., 2012; Castano, 2004; Castano et al., 2002; Harmon-Jones et al., 1996; Hoyt et al., 2011; Navarrete & Fessler, 2005).

The role individuals play in influencing policy, elected officials, and determining who takes on water decision-making roles must be acknowledged (Nielsen et al., 2021; Whitmarsh et al., 2021). It is also important to recognize how MS leads to stronger group identity (Barth et al., 2018; Castano et al., 2002; Harmon-Jones et al., 1996; Uhl et al., 2018), perhaps allowing individual responses to be more generalizable to, and aggregate within, groups. Determining how threatening water messages influence human responses on an individual level is essential for understanding group-level human responses to water problems. Though differences may exist in group contexts, identifying individual-level response to such messaging is the first step towards guiding water communication and promoting pro-environmental outcomes.

Thus, our central question was whether water crisis communications could be existentially threatening and potentially evoke mortality defenses. Given water crises variety, three operationalizations were explored in comparison to a control to determine the influence of each intervention on death-thought accessibility (DTA). Our hypotheses were:

1) a typical mortality intervention (e.g., MAPS) would increase DTA compared to a control, and;
2) a threatening water intervention would increase DTA compared to a control, operationalized in three ways:
    a. a drowning reminder would increase DTA compared to a control,
    b. a dehydration reminder would increase DTA compared to a control, and
    c. a contaminated water reminder would increase DTA compared to a control.

We did not make predictions regarding effect sizes.

2.2 Methods

We conducted a between-subjects randomized controlled trial. Three water interventions were chosen as sub-conditions within the water group to explore different water catastrophes (e.g., drought, flooding, water quality reduction), described below. The study design received ethics approval from the University of Waterloo Research Ethics Committee (ORE#42340).

2.2.1 Participants and procedure

Study participants included 600 adults from the USA and Canada, recruited in 2020 via Amazon's Mechanical Turk (MTurk). MTurk is an online survey platform increasingly used for experimental research (Crump et al., 2013).

To ensure quality responses, our participants were required to have an MTurk rating ≥85%, meaning they consistently completed studies thoroughly, passed attention checks, and met quality control measures. Participants received $2.50 USD for study completion – the average amount given to similar studies (~30 minutes duration and comparable format).

Sample size was determined via G*Power calculations for a two-tailed test of differences between two independent means, with an expected effect size of 0.35, $\alpha = 0.05$, and power of 0.8. G*Power indicated 130 participants per main group (e.g., control; mortality salience; water) was required. To account for attrition and potential unusable responses, we increased sample size goals to 150 per group. The water group involved three sub-conditions: drowning, dehydration, and contaminated water. Given the particular interest in differences between water interventions, and desire to maintain power, rather than dividing the 150 participants amongst sub-conditions, 100 participants were recruited for each, increasing power from 41% to 69% for water sub-conditions.

2.2.2 Design

The general procedure is displayed below in Figure 2.1. The study included deception: we used a misleading cover story – participants were contributing to personality and attitudes research – and survey to initially disguise the potential mortality prime, as is typical in TMT research on distal defenses (Cox et al., 2018). As such, participants first completed a 22-item personality inventory (Eysenck & Eysenck, 1964).

Figure 2.1. Procedural diagram for study flow.

Participants were then automatically and randomly assigned to one of three main groups:

1. Control (dental pain; n = 150),

2. Mortality Intervention (Mortality Attitudes Personality Survey, Rosenblatt et al., 1989; n = 150); and
3. Water crisis intervention (n = 300).

The three water intervention sub-conditions were styled similarly to the mortality intervention (see Table 2.1). Within the water group, participants randomly received one of three scenario variations to determine if any one water-related intervention was more influential on DTA.

Table 2.1. Intervention and control prompt phrasing

Intervention		Prompts for participant intervention responses. - **bolded text** indicates what wording was changed in interventions, as specified in each row
Mortality Salience		Jot down, as specifically as you can, what you think will happen to you as you **physically die and once you are physically dead.** Please briefly describe the emotions that the thought of **your own death** arouses in you.
Control		…visit the dentist for a painful procedure and once you are physically there. …of visiting the dentist for a painful procedure…
Water	Drowning	…are drowning and once you are physically drowned. …your own drowning…
	Dehydration	…are suffering extreme thirst and once you are physically dehydrated. …your own extreme thirst…
	Contaminated Water	…are drinking heavily contaminated water and once you have consumed heavily contaminated water. …your own pollution by contaminated water…

Following intervention and control, participants completed three delay tasks, to allow the interventions' influence to exit focal attention. Death-thought accessibility (DTA), the dependent variable, was then measured via a word-fragment completion measure and an image-description measure as per standard TMT methods (Cox et al., 2018; Hayes et al., 2008, 2010). These DTA measures allowed recording of death-thoughts active outside participants' focal attention and gave indication of distal defenses without directly asking about death-thoughts, which would then activate proximal defenses (Cox et al., 2018; Hayes et al., 2008, 2010), interfering with the constructs of interest.

Participants' responses were reviewed for accuracy and valid completion. Recruitment platforms (MTurk, CloudResearch) removed 22 (4%) responses that failed attention checks or completed ≤50% of the study. Hand-screening by authors removed 69 (12%) additional responses that did not complete intervention tasks correctly (e.g., < five words written; copied website text into response area). In the dependent variable (DV) tasks, nine (2%) additional responses were removed due to errors in the word-fragment completion task (e.g., blank responses; non-sensical letters input) and 24 (4%) further erroneous responses were removed in the image-description task (e.g., < 10 words provided; same word written multiple times). These removals fell within expected attrition rate, did not substantially influence study power, and were not significantly different in size between dependent variables. Final dependent variable group sizes were N = 510 (word-fragment completion task) and N = 486 (image-description task).

2.2.2.1 Gender and age

Gender was evenly distributed among intervention groups (male, 52%; female, 46%; other, 1%). Participants' age ranged from 21 – 77 years old (M = 40) overall and was not significantly

different between groups. Two-way ANOVAs indicated that neither gender nor age influenced DTA responses (Supplementary Materials 1 and 2, respectively).

It is important to explore these dimensions as gender and/or age can affect results. For example, if an intervention is existentially threatening for men but not women, without investigating gender effects, an overall effect may be missed.

2.2.3 Measures

2.2.3.1 Interventions

Table 2.1 displays phrasing of all interventions, which are described below.

Control: The chosen control intervention has been used in approximately two-thirds of prior TMT studies (Burke et al., 2010). This negative, threatening control, as opposed to a positive or neutral topic, ensured intervention effects were not due to negative emotions or fear but were related to mortality anxiety specifically.

Mortality Salience: We used the Mortality Attitudes Personality Survey (MAPS; Rosenblatt et al., 1989) as our standard mortality reminder. The MAPS has been used in ~80% of TMT studies, allowing for greater consistency and comparison with prior work (B. L. Burke et al., 2010; Cox et al., 2018). The MAPS consists of two open-ended questions (Table 1).

Water Crisis Interventions: The water-related interventions were assigned two open-ended questions regarding one of three water crises (e.g., drowning, extreme thirst, or drinking contaminated water), designed to resemble the generic mortality intervention and control (Table 1). These scenarios were used as they are explicitly life-threatening, thus more likely to evoke MS.

Directly following the specific intervention or control, all participants engaged in delay tasks.

2.2.3.2 Delays

Delay tasks were included so interventions and the expected related anxieties would not be in the participants' focal attention, thus allowing distal defenses to engage and allowing us to measure DTA. A five minute or greater delay is common in distal TMT studies (Cox et al., 2018; Hayes et al., 2010); we included three tasks to produce this timed delay, described in Supplementary Material 3.

2.2.3.3 Dependent variable – Death-Thought Accessibility

Next, participants completed dependent variable measures to record DTA. We chose to measure DTA rather than a distal defense measure as we did not have a baseline measure of participants' worldviews or pre-existing self-esteem measures. Death-thoughts would be quantifiable indirectly through the measures described below. Researchers who have completed TMT review studies found that distal MS defenses are due to high DTA (Hayes et al., 2010). To determine whether mortality was made salient by the interventions, DTA was measured in two indirect ways, both used in prior TMT studies (e.g., Burke et al., 2010; Cox et al., 2018; Gailliot et al., 2006; Greenberg et al., 1994). The indirect approaches avoid reintroducing mortality into participants' focal attention and activating proximal, rather than distal, defenses. If death-thoughts were more accessible in water-related interventions than in the control, we could be confident that the intervention made mortality salient (Hayes et al., 2010).

We anticipated DTA outcomes to be higher than in past TMT studies due to the ongoing COVID-19 pandemic (Courtney et al., 2020; Pyszczynski et al., 2020; Su & Shen, 2020). However, no baseline DTA for general populations were available for comparison. As such, we

can only flag that somewhat smaller effects could be expected in this study when compared to effects found in prior TMT research. Pandemic implications for participants' mortality awareness are further explored in the Discussion.

Word-fragment task: The first DTA measure was the word-fragment completion task (Greenberg et al., 1994). During this task, participants are shown word-fragments (e.g., C _ _ F _ _) and asked to fill in the letters to complete the word (Burke et al., 2010; Cox et al., 2018; Greenberg et al., 1994). Participants could potentially complete the word-fragments with either a mortality-related word (e.g., C **O F** F **I N**) or an innocuous word (e.g., C **O F** F **E E**). If participants provide more mortality-related words, then death-thoughts are more accessible for these participants than for those who provide more innocuous words (Cox et al., 2018; Hayes et al., 2010). Steinman & Updegraff (2015) reviewed DTA studies and found that the varying number and ratio of death-related to innocuous words did not have significant influence on effect size. We used a word set containing six mortality-related and fourteen innocuous word-fragments to gather enough data to analyze significance without making the task too onerous for participants.

Image-description task: The second DTA measure was an image-description task (Gailliot et al., 2006). Participants saw an image that could be interpreted as either a skull or two people dining (Supplementary Material 4) and asked to respond with the first ten words that came to their minds. Words were coded as death-related or non-death-related based on an anonymized 100-word sample set coded by researchers uninvolved in the study and unaware to word sources and via consultation with pre-existing word lists (Fernández-Alcántara et al., 2017). Participants who used more death-related words were considered to have higher DTA than participants who used more non-death-related words.

2.2.3.4 Demographics

Demographic information was collected in the final study stage to avoid influencing responses by thinking about income, ethnicity, gender, or age. While gender and age data were examined in this study, additional demographic information was not but could be useful for future research as suggested below.

A deception check question was included as the final study question.

2.3 Results

2.3.1 Descriptive statistics

2.3.1.1 Death-Thought Accessibility measures

An averaged DTA measure was calculated by transforming word-fragment responses into a score out of 10, to match image-description scores, and then averaging the responses for each participant. As the image-description measure is less frequently used and the two measures have not been used together previously, we wanted to test whether combining the measures would provide additional insights into our data. This combination allowed three measures of one construct (e.g., DTA), which can be more reliable than one measure alone (Jhangiani et al., 2020). The implications of this combination are presented in the Discussion section. Descriptive statistics are available in Supplementary Material 5.

Shapiro-wilk normality tests indicated all DTA measures had non-normal overall distribution (word-fragment: $W = 0.92$, $p < 0.05$; image-description: $W = 0.95$, $p < 0.05$; averaged DTA: $W = 0.99$, $p < 0.05$). However, visual inspection of response distributions (via histograms) and residuals (via fitted, kernel density, and quantile-quantile plots) indicated a slight positive skew

for the image-description measure and a more normal distribution for word-fragment and averaged DTA measures (Supplementary Material 6).

2.3.2 Analysis, inferential statistics, and effect sizes

Levene's tests indicated homogeneity of variance for word-fragment ($F(4, 505) = 0.42$, $p = .793$), image-description ($F(4, 481) = 1.53$, $p = .193$), and the averaged DTA measure ($F(4, 481) = 0.45$, $p = .776$).

Given the close-to-normal distributions and homogeneity of variance for all measures, one-way ANOVAs were run in SPSS 28 (2021) and indicated significant differences present in all measures, warranting further analyses (word-fragment: $F(4, 505) = 3.87$, $MSE = 1.15$, $p = .004$, $\eta^2 = .03$; image-description: $F(4, 481) = 2.79$, $MSE = 4.44$, $p = .026$, $\eta^2 = .023$; average DTA: $F(4, 481) = 4.09$, $MSE = 3.40$, $p = .003$, $\eta^2 = .033$), displayed below in Table 2.2. To identify interactions responsible for the significant differences, planned contrast analyses were run (Table 3). Effect sizes are reported in Cohen's d_s (Cohen, 2013; Lakens, 2013).

Table 2.2. ANOVA and planned contrast results with Cohen's d_s effect sizes

Word-Fragment			
ANOVA Outcomes	$F(4, 505)$		p
	3.867		0.004*
Contrast Outcomes			
vs Control	$F(1, 505)$		
	F	p	d_s
Death	7.92	0.005*	0.36^S
Drowning	7.30	0.007*	0.37^S
Dehydration	0.32	0.572	0.08
Contaminated Water	0.01	0.912	-0.02
All Water	1.77	0.184	0.29^S
Image-Description			
ANOVA Outcomes	$F(4, 481)$		p
	2.787		0.026*
Contrast Outcomes			
vs Control	$F(1, 481)$		
	F	p	d_s
Death	6.34	0.012*	0.33^S
Drowning	4.06	0.045*	0.29^S
Dehydration	0.56	0.456	0.11
Contaminated Water	7.90	0.005*	0.40^S
All Water	5.56	0.019*	2.33^L
Averaged DTA			
ANOVA Outcomes	$F(4, 481)$		p
	4.091		0.003*
Contrast Outcomes			
vs Control	$F(1, 481)$		
	F	p	d_s
Death	11.88	0.001*	0.45^S
Drowning	8.99	0.003*	0.42^S
Dehydration	0.69	0.407	0.12
Contaminated Water	1.51	0.219	0.18
All Water	4.57	0.033*	2.41^L

*$p<0.05$ is significant difference; $^S d_s$=0.2-0.49 is considered a small effect; $^M d_s$=0.5-0.79 is considered a medium effect; $^L d_s \geq 0.8$ is considered a large effect.
Negative d_s implies effect in opposing direction than expected (e.g., the intervention reduced DTA compared to control).

Positive effects indicate that the intervention(s) in the contrast led to significantly higher DTA scores compared to the control, supporting our hypotheses. Mortality salience and drowning had small positive effects on DTA across all measures (d_s = 0.33-0.45 and d_s = 0.29-042, respectively). Contaminated water had a small positive effect on DTA in the image-description measure (d_s = 0.40), and no effects in the word-fragment measure (d_s = -0.02) or the averaged DTA measure (d_s = 0.18). Dehydration had no effect on DTA in any measure (word-fragment: d_s = 0.08; image-description: d_s = 0.11; averaged DTA: d_s = 0.12). A final contrast was run to compare all water conditions combined against the control. A medium positive effect was found for this contrast on DTA in the word-fragment measure (d_s = 0.29) and large positive effects were found for the image-description (d_s = 2.33) and averaged DTA measures (d_s = 2.41).

Finally, correlational analyses indicated significant positive relationships between word-fragment and averaged DTA measures ($r(484) = .82$, $p < .001$) and image-description and averaged DTA measures ($r(484) = .63$, $p < .001$). Word-fragment and image-description measures were not significantly correlated ($r(484) = .08$, $p = .07$). The results' implications are presented below.

2.4 Discussion

Our study outcomes are compared with extant literatures to explicate findings before practical implications for public water communication and decision-making are presented.

2.4.1 Water intervention assessments

To summarize our findings (Table 2.3), all DTA measures indicated that the drowning intervention was significantly different from the control and showed effect on DTA when compared to control. Thus, drowning indeed functioned as a mortality reminder by increasing

DTA when compared to an established aversive but non-life-threatening control. The contaminated water intervention showed effect on DTA in the image-description but not the word-fragment measure, with potential reasons presented below. Across all measures, the dehydration intervention was not significantly different from the control and showed little to no effect on DTA.

Table 2.3. Summary of overall findings and most plausible explanations

	Result	Potential explanation
Contrast outcomes		
Mortality	Significant, small effects across all DTA measures	Supporting TMT theories
Drowning	Significantly different from control across all DTA measures Most similar to mortality of all water interventions	Perhaps more explicit a mortality reminder than other water interventions
Dehydration	Not significantly different from control Dissimilar from mortality	Familiarity Less threatening experience
Contaminated Water	Significantly different from control in image-description measure Similar to mortality in second DTA measure	Delay tasks may have been too brief for full DTA effect in word-fragment measure Intervention wording may have been too vague for strong effect in both DTA measures
All Water	Significantly different in image-description and averaged DTA measures Small effect in 1st DTA measure, large effect in 2nd and averaged	Brevity of delay tasks may have diminished initial effects
Overall effect sizes		
	Effects ranged from small to large Similar studies* found medium effect size	COVID-19 may have increased baseline mortality awareness for all participants, reducing size of detectable differences between groups

*Steinman & Updegraff (2015) - meta-analysis

Participants resided in the USA or Canada, countries that are experiencing growing, but typically less-lethal, water threats; these countries have not yet witnessed the water disasters of

other regions. However, drowning's potency as a MR could be related to the relative abundance of water in the study region – perhaps participants were more familiar with this threat from exposure to recreational water activities. It would be worthwhile for future studies to contemplate location, prevalence of water, and other environmental threats when considering climate communication.

2.4.1.1 Intervention differences

Dehydration: Across DTA measures, dehydration showed no significant difference from control and no effects. This could relate to intervention wording; participants were not asked to think about *dying* from thirst explicitly, but about *experiencing* extreme thirst. Perhaps we can think about extreme thirst as a survivable experience where drowning is not; it may be participants could recall being extremely thirsty and it being somewhat familiar and non-lethal, but drowning may have been a less common experience. It is also possible that geophysical context influenced results: in a population where water is scarce and fatal dehydration is more likely, a greater effect may be seen.

Contaminated water: Contaminated water may have generated such relatively large effects in the image-description measure due to its connection to disgust. Prior TMT research has found that disgusting stimuli, such as feces, urine, or blood, activate mortality defenses due to their connection to animality; we know animals die, so reminders that we, too, are animals remind us that we are not immortal (Cox, Goldenberg, Pyszczynski, et al., 2007; Goldenberg et al., 2001). Existing work on water reuse communication has noted difficulty in gaining support related to audience disgust reactions stemming from human excrement (Etale et al., 2020; Goodwin et al., 2018; Massoud et al., 2018; Nkhoma et al., 2021; Rozin et al., 2015). Thus, there is potential for

contaminated water to be a strong mortality reminder, as observed in the second DTA measure. Some responses to this intervention reported ambiguity on what was contaminating the water; if participants did not interpret the contamination as harmful, this intervention may not have been anxiety-inducing. Future research on water contamination as a mortality reminder would benefit from testing differences across contaminant type and within contamination communication.

2.4.1.2 Death-Thought Accessibility measure use and controversy

Death-Thought Accessibility (DTA) measures have been designed to detect death-thoughts that are not cognitively accessible to individuals, i.e., subconscious death-thoughts. While most TMT studies have utilized one DTA measure (Burke et al., 2010; Hayes et al., 2010), it may be that our use of a second DTA measure re-exposed participants to a mortality reminder, activating proximal defenses and, thus, lowering DTA scores on the image-description measure. This was mildly seen in the drowning intervention results (d_s = 0.37 vs. 0.29). This death-thought reactivation possibility matches prior DTA measure criticisms.

Some scholars have suggested that the word-fragment and image-description tasks are unreliable as the writing out of death-words could reactivate death-thoughts (Naidu et al., 2020). As word-sets tend to have just six possible death-words (Burke et al., 2010; Greenberg et al., 1994), and few participants complete all possible death-words (Hayes et al., 2010), it is unclear whether this minor task could reactive death-thoughts. Yet, recent research has shown that word-fragment sets do indeed influence death-anxiety defenses (Hayes & Schimel, 2018). When a mortality intervention is followed by a DTA measure, a subsequent distal defense measure will not show as strong or any effect (Hayes & Schimel, 2018). However, this recent research (Hayes & Schimel, 2018) focused on DTA measure's influence on a mortality anxiety defense (i.e., self-

enhancement) and not an additional DTA measure – as was the case in our study. Further, the authors emphasized importance of delay after initial mortality reminder and speed in which participants completed delay tasks, factors which were also important in our study.

2.4.1.3 The role of delay

The contaminated water intervention results are puzzling – recall, no effect was found for the word-fragment or averaged DTA measures, but a large effect was present in the image-description measure (see Table 2.2). It is possible that participants in this intervention completed delay tasks faster than those in other groups, meaning distal defenses were not activated until the second measure. This possibility could also explain effect size differences noted in the combined water contrast results (Tables 2.2 and 2.3). Unfortunately, we were not able to record time taken by participants at a task-by-task level, so this comparison could not be made but would be useful for future research. Influence from delay could also explain relatively low correlation between the two individual DTA measures; if some participants were not experiencing full death-thought suppression until the second DTA measure, the first would not have measured sub-conscious death-thoughts. Prior TMT work has acknowledged delay importance following mortality interventions when investigating distal defenses (Cox et al., 2018; Greenberg et al., 1994, 2000; Hayes & Schimel, 2018; Pyszczynski et al., 2015).

2.4.1.4 The role of coding

While sample word-sets from our research were coded by researchers unaware of experiment purpose and pre-existing codified word sets were consulted (Fernández-Alcántara et al., 2017), it is possible some death-related words could have been missed or, conversely, some non-death-words were coded as death-words. This could partially explain varied results seen in the

contaminated water intervention. Alternate coding could lead to differing results, yet this explanation seems unlikely as the mortality intervention maintained significant difference and somewhat similar effect size.

2.4.1.5 Mortality and overall effect sizes

While delay's role was not our focus, average effect sizes found in an extant TMT meta-analysis of DTA provide a useful comparison (Steinman & Updegraff, 2015). These authors separated traditional MS interventions from non-death-explicit interventions, which may be similar to the water-related interventions in our study. For typical MS interventions, effect size was $d = 0.70$, higher than for non-death-explicit interventions ($d = 0.54$; Steinman & Updegraff, 2015). These effect sizes are close to, but higher than, those in our study (d_s = 0.29-0.42 for drowning and d_s = 0.29-2.41 for combined water).

A potential explanation for this effect size difference could relate to the COVID-19 pandemic. Our study ran in late 2020, before vaccines were available and pandemic news coverage was omnipresent, unavoidable, and fear-inducing. It is possible that the control group was influenced by pandemic-related mortality anxiety, a finding supported by recent research (Courtney et al., 2020; McVeigh & MacLachlan, 2021; Pyszczynski et al., 2020; Su & Shen, 2020). This constant anxiety percolation may have increased baseline mortality awareness within our control, lending to lesser effect sizes than may have been found otherwise. Baseline mortality anxiety established for the pandemic period would be useful for future comparative analyses.

2.4.2 Recommendations for water crisis communication

With our findings and possible explanations provided, it is now essential to consider real-world applications. Our results should help guide water communication for public services,

governments, or non-profits attempting to explicate water problems, increase support for water solutions, or to increase pro-environmental water behaviours. The influence threatening water messages may have on different audiences is presented generally. We then relate our findings to real-world water crises.

Our findings support that these threats increase MS, as shown through increased DTA; further studies should expand our work to test the extent and/or presence of actual reinforcement of environmental identity following water communication. As discussed, those with pro-environmental identities should reinforce those identities when faced with a subtle existential threat – such as those tested here.

2.4.2.1 Implications for water communication to the public

Mortality reminders within water communication can influence people differently depending on their pre-existing worldviews; threatening messages may only be suitable for or effective with those who are already environmentally-inclined (Akil et al., 2018; Barth et al., 2018; Castano, 2004; Fritsche & Häfner, 2012; Fritsche & Hoppe, 2019; Greenberg et al., 1997; Peter et al., 2022). Distal mortality threats result in defenses that involve self-esteem bolstering, leading to more strongly supported worldviews (Burke et al., 2010; Greenberg et al., 2000; Yanagisawa et al., 2017). Audiences who do not hold environmental worldviews may need messages with moderating factors (e.g., water conservation framed as a social norm) to increase environmental behaviours' social value – or avoid exposure to threatening water messages altogether. Whenever possible, these messages should be framed in ways that do not evoke these anxieties if the goal is to maximize pro-environmental outcomes. Our interventions and findings are

summarized in a decision-making tool in Figure 2.2. designed for water communicators to inform when to use or avoid threatening messaging within environmental campaigns.

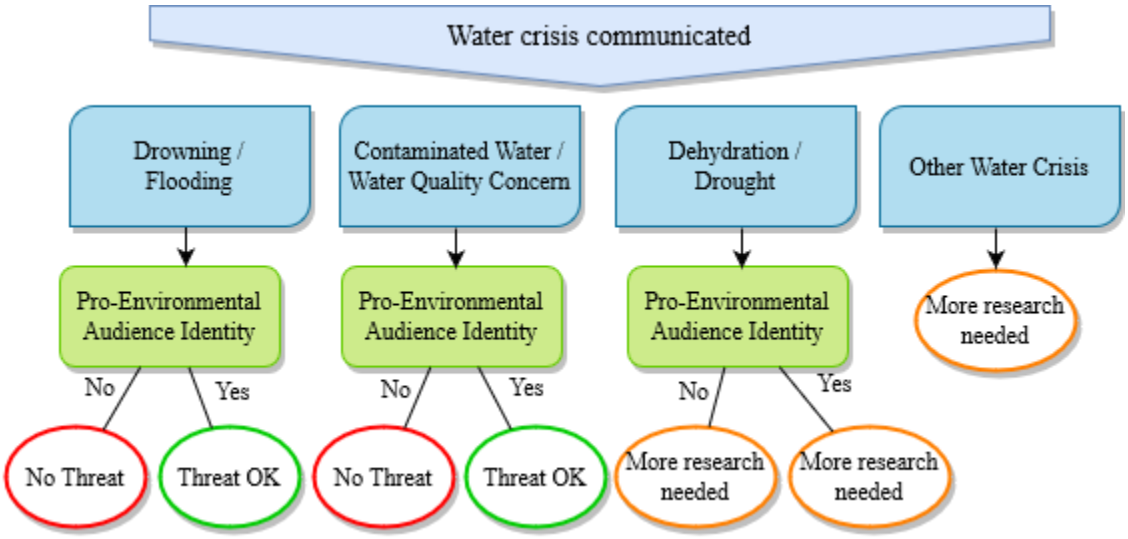

Figure 2.2. Decision-making tree for threat use in water crisis communication based on pro-environmental identity in audience.

As the drowning intervention had similar effect as the established mortality reminder, it is possible that water communicators should consider how threatening messaging may influence audiences more generally. Drowning is the leading cause of death from flooding worldwide, disproportionally harming Indigenous peoples and ethnic minorities (Willcox-Pidgeon et al., 2020), and global natural disaster deaths are primarily caused by flooding (Doocy et al., 2013; Sindall et al., 2022). Drowning is expected to increase globally with climate change due to increased flooding, more frequent swimming – by swimmers and non-swimmers alike – due to higher temperatures, along with riskier, water-related behaviours (Brunkard et al., 2008; Doocy et al., 2013; Meddings et al., 2021; Rappaport, 2014; Sindall et al., 2022). While the USA and Canada do not presently have high drowning fatality rates (<1% of annual fatalities; CDC, 2021; Clemens et al., 2016), the message is clearly potent and increased drowning risk communication

can and should be expected as the climate changes. This may engage mortality defenses if not carefully framed for relevant audiences. If communication is too threatening, it may be ignored altogether as a proximal defense. If drowning messages are persistent and subtle, they could have negative environmental consequences for those who do not already hold pro-environmental worldviews.

Our contaminated water intervention showed some similarity to the mortality threat and could evoke mortality anxieties, particularly related to disgust themes, such as feces contamination (Bronfman et al., 2015; Massoud et al., 2018; Rozin et al., 2015). While further research will help clarify these effects, in the meantime, water communicators may want to follow similar caution as provided for drowning risk communication.

2.4.2.2 Implications of mortality salience for water decision-making processes

Even considering the mixed success of psychology's replication studies (Klein et al., 2019; Chatard et al, 2020; Chen et al., 2022), strongest MS effects are seen on attitudes towards others: threatening communication can increase prejudices and stereotypes, bolstering ingroup preference and outgroup derogation (Barth et al., 2018; Bradley et al., 2012; Burke et al., 2010; Fritsche et al., 2012; Stollberg & Jonas, 2021; Uhl et al., 2018). This could lead to minority group members being ignored or a reluctance to include those who are not already part of the decision-making ingroup, thus perpetuating homogenous group composition. Should threatening communication be used in water decision-making, equitable, pro-environmental outcomes could be an even greater challenge. Our results support this concern.

Researchers have shown that diverse decision-makers make more environmentally friendly and equitable decisions (Craft, 2013; Ergas et al., 2021; Glover et al., 2002; Swim et al., 2018;

Vollan & Henry, 2019) that generate more innovative water solutions (Ajami et al., 2014; Alsos et al., 2013; Blake & Hanson, 2005; Elledge et al., 2020; Nählinder et al., 2015). The homogeneity in water decision-making processes is a concern. Research shows that exposure to existentially threatening messages limits diversity because intergroup biases emerge from distal defense mechanisms, harming potential water solutions if this persists through crisis conditions. This dilemma warrants future research to extend our findings on water crises as existential threats.

2.5 Recommendations for future research

Future research recommendations have been briefly mentioned above and are summarized here.

2.5.1 Reactivation of death-thoughts

Investigating potential death-thought reactivation with a second DTA measure would bring additional information for TMT methodology and for understanding human responses to rapid, sequential mortality reminders. Prior research found a seven to twenty minute delay results in stronger MS effects (Burke et al., 2010; Steinman & Updegraff, 2015). In future, particularly when baseline MS might be higher than usual and potentially masking effects, longer delays should be sought while recognizing the more complicated research logistics likely associated with those extended times.

2.5.2 Terror management research during times of high mortality salience

At present, a standard MS or DTA score among non-clinical populations does not exist. While a control group helps compare interventions to the study's average, during a global existential threat (such as a pandemic or climate change), the control's measure may be higher than prior

studies, potentially blurring effects. A control group meta-analysis of MS or DTA could provide a baseline or correction factor applicable to studies done in threatening times Researchers should at very least acknowledge how these factors may influence results, especially as climate change is expected to bring greater uncertainty and anxiety.

2.5.3 Alternate contexts and interventions

In future research, it would be useful to explore water interventions in explicitly differing environmental and cultural contexts. For example, how different water messages (e.g., threatening vs. non-threatening) influence people in regions with high or low water security. This examination would be worthwhile for future water communication strategies; a threatening water message may influence people familiar with extreme thirst in water scarce regions differently than someone in a water abundant region. Similarly, research into human response to threatening messaging within conservation, human-nature interactions, or natural disaster communication would guide future strategies for securing pro-environmental goals.

While we used three water interventions, many more threatening environmental messages – and human response to those messages – as well as variations of water sub-conditions used in our research are open for investigation (Smith et al., 2022).. It would also be beneficial to extend our research by empirically testing threatening water and/or other environmental communications' influence on decision-making processes. While our research and prior TMT studies have not explicitly focused on expert inclusion or exclusion among participants, we anticipate that experts that make environmental decisions are unlikely to be immune to mortality anxieties and related defenses. It would nevertheless be worthwhile to investigate MS influence on expert decision-making in future research to realize these relationships more fully.

2.6 Conclusion

We have examined three water crisis communications and compared their influence on DTA to a control and a mortality intervention. Our drowning intervention provided results closest to mortality and contaminated water gave mixed results. Exploring the influence of these water interventions, among others, for expert populations and decision-making groups could provide further insights on water communication strategies that are most effective for reaching pro-environmental goals. Water crises are expected to increase with climate change. Understanding now how to best communicate these problems for specific audiences will help ensure the needed environmental actions are obtained.

Chapter 3. Beyond the watery grave: Death and water reminders as (un)expected ways to increase pro-environmental identity and behaviour

3.0 Chapter summary

Climate change increasingly stresses global water availability and reliability, resulting in either too much (e.g., floods) or too little (e.g., droughts). To ensure safe water access and management, pro-environmental behavior (PEB) change is needed among both water consumers and decision-makers. Yet discussing water vulnerabilities can be existentially threatening – these crises involve considering physical harm or death from a life-sustaining resource. Implicit or explicit awareness of such existential threats may result in contradictory behaviors that actually limit positive water solutions.

We examined how three life-threatening water messages – specifically drowning, contaminated water consumption, dehydration – influenced environmental identity compared against a standard existential mortality threat and a control among 600 adults in the USA and Canada. Our results indicate that existentially threatening messages significantly increase environmental identity polarization ($p \leq .05$). We discuss implications for sustainable water management within an increasingly threatening global environment.

3.1 Introduction

Increasing climate stressors will undermine water security and confidence in continued safe water access necessary for life (Powell et al., 2017; United Nations Water, 2010). Climate change will disrupt water availability, leading to droughts in some regions and flooding in others (Hirabayashi et al., 2008; Pascale et al., 2020). Individual and policy-level change is urgently required to both mitigate and respond to these changes (Kenis & Mathijs, 2012; Klein et al.,

2022). However, researchers have shown that how these climate dangers are communicated may be counter-productive to generating the behavioral responses needed to effectively address these crises; this existentially threatening messaging activates psychological defenses that can impede pro-environmental solutions (Akil et al., 2018; Fritsche et al., 2010; Fritsche & Häfner, 2012; L. K. M. Smith et al., 2022; Vess & Arndt, 2008; Wolfe & Tubi, 2019).

New insights from Terror Management Theory (TMT) can help design more effective pro-environmental messaging. Terror management researchers have found that communicating life-threatening scenarios can have incongruous results, depending on audience values and norms (Barth et al., 2018; Fritsche & Häfner, 2012; Greenberg et al., 2000; Harrison & Mallett, 2013; L. K. M. Smith et al., 2022; Stollberg & Jonas, 2021; Wolfe & Tubi, 2019). The importance of effective water crises communications – one of many climate hazards worth exploring – is explicated, followed by our operationalization of these communications, and key TMT concept descriptions.

3.1.1 Water crises and communications

Everyone requires accessible and reliable water for myriad essential uses: drinking, sanitation, agriculture, waste management, production, energy (United Nations Water, 2010; US Environmental Protection Agency, 2021). Water crises are multi-layered, with diverse actors, temporal uncertainties, and competing demands; different regions will face differing water crises with climate change (Beevers et al., 2022; He et al., 2021). Due to anticipated increase in climate and water crises and their communications (Boykoff et al., 2022; Stoddart et al., 2016), understanding human responses to these life-threatening reminders is vital for realizing pro-environmental behavior (PEB). Reminding individuals of water's loss or precarity could function

as a mortality reminder (MR) according to TMT (Smith et al., 2022; Chapter Two), and could subsequently influence behavioral outcomes.

To investigate this hypothesis, we explicitly tested life-threatening water reminders' influence on PEB, measured via an environmental identity (EID) scale, in comparison to a traditional MR. Environmental psychologists have found that those who score higher on EID measures – individuals who more strongly identify as environmental – are also more likely to adopt additional PEBs (Clayton, 2003; Vesely et al., 2021). We sought to determine whether life-threatening water hazards could be existential threats, reaffirming prior findings and TMT-climate studies (summarized in Smith et al., 2022), and thus influencing EID – and PEB – in polarizing ways as a distal defense mechanism (Section 3.3). In the next sections, we provide an overview of PEB change and connect to TMT foundations via identity, self-esteem, and their influence on PEB. We then describe our research on life-threatening water reminders' influence on environmentalism.

3.2 Pro-environmental behavior change

Pro-environmental behavior (PEB) can be defined in many ways: it may encompass individual-level, environmentally conscious actions, such as recycling, consuming fewer animal products, or opting for public transit. Pro-environmental behavior may also include supporting environmental policies or actors, as citizen voter or government official, or PEB may occur in corporations when leaders adopt corporate social responsibility strategies or 'greener' manufacturing. While these examples involve *intentional*, 'purpose-oriented' behaviors (Kurisu, 2016), PEBs may also be 'fact-oriented' and have pro-environmental outcomes without necessarily being purposefully environmental (e.g., choosing a plant-based diet or cycling for

health rather than environmental benefits). It is generally accepted that PEBs are behaviors that *increase positive* environmental effects or *reduce* environmental *harms* (Li et al., 2019; Stern, 2000).

While many variables and structures can influence an individual's choices (e.g., socio-economic class, power, ability, etc.), we focus on the interactions between threatening climate communications and consequent psychosocial responses relating to one's sense of meaning and identity. While governance has substantial power over water policy and decisions, we focused on the individuals involved – in governance or as water consumers – rather than governance systems. We adopted an individual-level approach as, ultimately, decisions on water management are made by individuals with their own identities, values, and influences (Morelli et al., 2022; Staerklé, 2015). Over time, PEB change theories have increasingly focused on social-identity and collectivist attitudes (see summary table, Supplementary Material 7). As identity is our research focus, its use is explained before differentiating between self- and social-identities.

3.2.1 Identity in pro-environmental campaigns

One's identity – environmental or otherwise – can encompass numerous potential behaviors (Fritsche et al., 2018; van der Werff et al., 2014; Whitmarsh & O'Neill, 2010). As such, identity-focused campaigns are particularly powerful for influencing PEB: identity is malleable and researchers have shown EID can be fostered via education, contact with nature (real or virtual), ingroup modelling of climate-friendly behavior, and social comparison on environmental behaviors (Schmitt et al., 2019; Vesely et al., 2021). If a behavior change campaign successfully promotes EID, it can have substantial impact as several PEBs may increase in tandem. Identity-focused interventions are also unlikely to harm emotional well-being (Vesely et al., 2021); they

may promote group identity, improving self-esteem via strengthening close relationships (Plusnin et al., 2018).

By designing PEB campaigns and water crisis communications to match audience members' identities, it is possible that collective efficacy can also increase. Collective efficacy is the sense one's group can accomplish shared goals – in this case, climate action (Fritsche & Masson, 2021). Interestingly, collective and private efficacy seem linked: greater collective efficacy leads to greater personal efficacy – perhaps even further increasing PEB outcomes (Fritsche & Masson, 2021; Hamann & Reese, 2020). Moreover, Vesely et al. (2021) note in their meta-analyses, even among non-explicitly pro-environmental groups, strengthening ingroup bonds increased PEBs – perhaps because climate action is generally seen as a necessary, important collective objective. Thus, identity-focused PEB campaigns and communication may have significant positive gains over other PEB efforts due to malleability of identity, collective efficacy benefits, and potential for positive spillover effects (Fritsche et al., 2018; Lauren et al., 2019; Vesely et al., 2021). As social-identity and collective action have drawn attention recently within PEB change, differences between self- and social-identity are briefly explained before TMT's role is illustrated.

3.2.2 Self- and social-identity

Both self- and social-identity have been identified as essential for understanding PEB changes. The difference is self-identity involves how one defines themself while social-identity considers how others define an individual and what groups they do or do not belong to (Ellemers et al., 2002). As climate problems are rarely an individual's sole responsibility, and solutions require collective responses (Clayton, 2003), both concepts have been linked to EID and PEB (Dono et

al., 2010; van der Werff et al., 2014; Vesely et al., 2021; Whitmarsh & O'Neill, 2010). Collective, cultural connection is particularly relevant as TMT emphasizes the significance of self-esteem derived from society, culture, and relationships as a mortality anxiety defense (Castano et al., 2002; Greenberg et al., 1990; Kosloff et al., 2019; Plusnin et al., 2018). These defenses can exacerbate intergroup biases, potentially barring successful collective action efforts that require cooperation amongst those who do not hold similar worldviews. With increased life-threatening climate communications, this may be particularly true as MRs result in stronger adherence to worldviews and identity (Greenberg et al., 1990; Pyszczynski et al., 2015; Schimel et al., 2019), perhaps making it even more difficult to convince low-EID individuals that action is needed. Moreover, identity's role within social-identity and collective action is important to understand from a TMT perspective: human responses to existential threats involve clinging more strongly to one's ingroup and distancing from outgroups (Castano et al., 2002; Harmon-Jones et al., 1996). In these ways, the collective action required to address climate changes will necessitate an understanding of one's social identity and working with those *in – and adjacent to* – one's ingroups to achieve a mutual goal (Barth et al., 2018; Fritsche & Masson, 2021).

Overall, attitudes, norms, values, and identity are integrally involved in PEB adoption (Li et al., 2019; Newell et al., 2021). The persistence of these features in PEB illustrates where TMT connects and why TMT may explain some environmental behaviors – or their absence.

3.3 Terror Management Theory

Over 30-years, social psychology researchers have identified predictable, human responses to reminders of our own demise (Burke et al., 2010; Pyszczynski et al., 2015). Humans are uniquely aware life is finite, but we experience existential discomfort when reminded of this reality.

Terror Management Theory (TMT) scholars have shown existential anxiety, stemming from MRs, influences identity, beliefs, self-esteem, and, ultimately, behaviors (Greenberg et al., 1990; Schimel et al., 2019). Mortality reminders increase *death-thought accessibility* (DTA) – the explicit (cognitively accessible) or implicit (cognitively inaccessible) awareness of death-related thoughts (Hayes et al., 2008, 2010; Schimel et al., 2019). Mortality reminders can lead to increased resource consumption (Kasser & Sheldon, 2000), stricter sentencing for socially transgressive offenders (e.g., sex workers; Florian & Mikulincer, 1997; Rachlinski & Wistrich, 2017), and preferences for those of similar race, gender, or background and increased distance from those that are different (Harmon-Jones et al., 1996; Uenal et al., 2021). These responses strengthen sense of identity and connection to culture, allowing symbolic immortality beyond physical demise.

3.3.1 Dual process defence model

Mortality reminders can be explicit (e.g., asking someone to think of their own death) and evoke immediate, proximal responses, or reminders can be subtle (e.g., walking past a cemetery; the word ‘death’ flashed quickly as a subliminal message) and evoke subconscious, distal responses. Figure 3.1 (from Smith et al., 2022) displays proximal responses (denial, distraction, and rationalization) and distal (self-esteem bolstering and worldview reinforcement; Kosloff et al., 2019; Pyszczynski et al., 1999; Wolfe & Tubi, 2019).

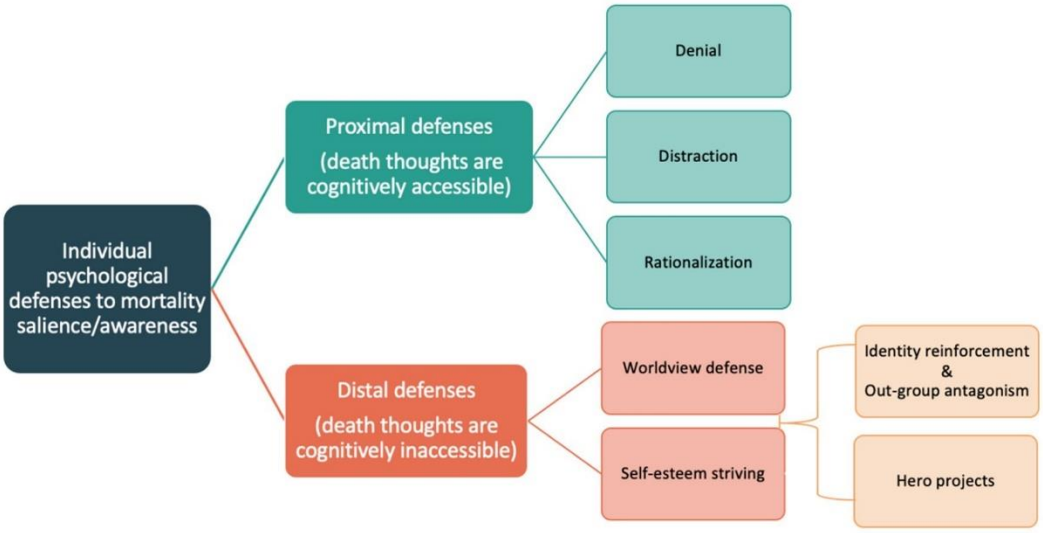

Figure 3.1. Dual-process model of mortality reminder defence mechanisms (Smith et al., 2022)

Terror Management Theory posits that bolstering self-esteem defends against existential anxiety evoked by MRs – by strengthening cultural, societal identity, existential anxiety is offset via symbolic immortality. Our focus lies in distal defences involving identity and worldview, and their connections to PEBs, explicated below.

3.3.2 Implications on pro-environmental behaviors

Distal mortality-related defences are particularly significant as they can influence PEBs and support for or against climate policy and solutions. Distal defences may result in strengthened beliefs and identities (Barth et al., 2018; Castano et al., 2002; Harmon-Jones et al., 1996; Stollberg & Jonas, 2021). Concerning EID, those who already self-identify as highly environmental may even more strongly support these values in response to existential threats to reinforce identity and protect self-esteem. For individuals who do not identify as environmental, mortality threats may elicit behaviors aligned with dominant cultural identities. In a Western

context, these include individualism, consumerism, and capitalism, all of which are problematic for climate solutions that require collective action, reduced resource consumption, and significant social changes (Metz, 2015).

Climate threats will only increase with predicted environmental changes, requiring urgent attention on human response to life-threatening water crisis communication, especially regarding EID, explained below.

3.3.3 Environmental identity

Environmental identity (EID) is connected to the social group one identifies with; there are political ideologies around environmental interests that may be linked to sense of self (Clayton, 2003; 2012). For example, someone who identifies as right-wing or more politically conservative is less likely to support climate policies compared to left-wing or more liberal-identifying people (Unsworth & Fielding, 2014). Just as a person may reinforce connections to other social groups following a MR (Barth et al., 2018; Castano et al., 2002; Harmon-Jones et al., 1996), they may more strongly – or weakly – reinforce their EID (Stollberg & Jonas, 2021; Uenal et al., 2021; Uhl et al., 2018). While some TMT researchers have found greater death anxiety can increase negative nature evaluations due to creatureliness reminders – connections to our animal natures and, thus, mortality – these researchers did not differentiate participants according to pre-existing EIDs or values (Fritsche & Hoppe, 2019; Koole & Van Den Berg, 2005). It is possible that EID could have an unidentified moderating role in these instances (Fritsche & Häfner, 2012). Given these considerations, EID seems an integral component when considering PEB; connections are described below.

3.3.4 Pro-environmental behavior

Environmental identity can be a PEB predictor: environmental psychologists found those who identify more strongly as environmental also engage in more PEBs (Clayton, 2003; Dono et al., 2010; Vesely et al., 2021; Whitmarsh & O'Neill, 2010). Vesely et al. (2021) conducted large-scale meta-analyses to determine the relationship between identity and PEBs: EID held medium-sized relations to pro-environmental intentions (r = 0.62) *and* behaviors (r = 0.56). Further, Clayton (2003) noted moderate-to-strong relationships between EID and collectivism (r = 0.37) and PEB (r = 0.64). As such, when PEB cannot be measured directly, EID is a useful, reliable indicator measure (Clayton, 2003; van der Werff et al., 2014).

Environmental identity additionally warrants investigation as there is opportunity for any one PEB to contribute to increase in another PEB with greater EID – in part due to positive spillover effects – thereby enhancing overall PEBs and impact (Vesely et al., 2021). Further, identity persists beyond traditional incentives typically provided in behavior change programs – conserving frequently scarce budgetary resources (Vesely et al., 2021). However, if efforts to increase EID are threatening, the opposite effect may occur (Stollberg & Jonas, 2021). Recall the paradoxical responses to mortality threats: threatening messages may discourage PEB by othering those with the biggest changes to make – those who are non-environmental. Although EID has been studied as a moderator for MS effects (Fritsche & Häfner, 2012), explicit testing of how MRs – or life-threatening water-reminders – affect EID has yet to occur. Our exploration of these dynamics is elucidated below.

3.4 Methods

We hypothesized that since MS leads to strengthened ingroup identity as a distal defense to boost self-esteem, mitigating mortality anxieties, we would find broader EID score distributions compared to a control. We expected a more extreme EID score spread in intervention groups compared to control as those with low-EID would score lower following existential threats – in this case, mortality and water threats – and those with high-EID would score even higher following the same threats as a worldview-supporting distal defense.

To test this idea, water crises were operationalized in three ways: (1) drowning, (2) extreme thirst, and (3) contaminated water consumption. These were compared to two separate participant groups who were asked to think about a traditional MR or a control. Environmental identity (EID) was measured in all groups after a delay.

Since we proposed that water crises could be existentially threatening, we expected life-threatening water reminders would reinforce identity in the same ways as the traditional MR; we expected to see more extreme EID scores in water intervention groups compared to a control.

All groups and methodologies are explained below; materials and study design were approved by a University of Waterloo Office of Research Ethics.

3.4.1 Participants

Six hundred adult participants from the USA and Canada were recruited in 2020 via Amazon's Mechanical Turk (MTurk) – a crowd-sourcing online platform frequently used in social psychology studies. Details on MTurk and screening processes can be found in Supplementary Material 8.

After incomplete or erroneous response removals, total N was 457 (descriptive statistics and attrition details in Supplementary Material 9). The 23% attrition rate was within expected and acceptable range for an MTurk study (15%-30%; Aguinis et al., 2021).

3.4.2 Procedure

Participants were informed they would be completing a study on personality and sustainability. We disguised full study purpose to avoid priming participants with mortality or confounding concepts. As part of the deception, participants were first asked to complete a 22-item personality inventory (Eysenck & Eysenck, 1964), a typical cover in TMT research (Cox et al., 2018). The subsequent study procedure was consistent with conventional TMT study design (Figure 3.2).

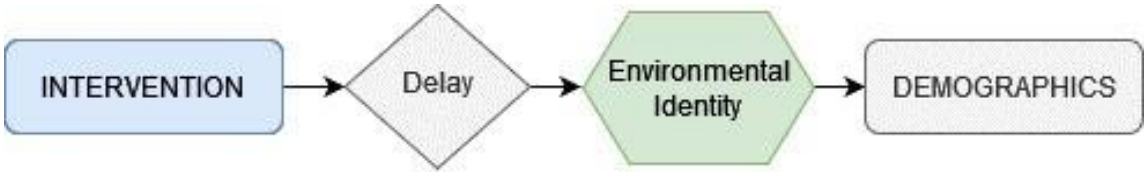

Figure 3.2. Visual procedural flow diagram of study design

Participants were randomly assigned to one of five intervention groups (e.g., control, mortality salience, drowning, dehydration, or contaminated water), where they were asked to respond to two open-ended questions about their own death (Mortality Attitudes Personality Survey; see Supplementary Material 10). Water interventions replaced ‘death’ with either drowning, extreme thirst, or contaminated water consumption (Supplementary Material 10). The control group was asked about a painful dental visit as an anxiety-inducing but non-life-threatening prompt – a well-established control used in ~two-thirds of previous TMT research (Burke et al., 2010; Cox et al., 2018).

Next, two delay tasks were presented – the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) and the Rosenberg Self-Esteem Measure (Rosenberg, 1965), allowing MRs to reach subconscious levels, activating distal defences (Greenberg et al., 2000).

After delays, the Environmental Identity Scale – short version (EID; Clayton, 2003; Clayton et al., 2021) was presented. This 11-item measures includes items such as: "I think of myself as a part of nature, not separate from it" and "Behaving responsibly toward the earth -- living a sustainable lifestyle -- is part of my moral code." The EID was chosen because we were not able to measure environmental behaviors remotely and the EID has been frequently used in PEB research (Balundė et al., 2019) and widely validated (Clayton et al., 2021; Olivos & Aragonés, 2011). The short version was used to avoid participant fatigue and shows reliable, consistent results compared with the full version (Chew, 2019; Clayton, 2012).

Finally, demographic information was collected, followed by a deception check and debriefing materials.

3.4.3 Statistical analyses

Environmental Identity means and distribution were analyzed via SPSS 28 software to compare the interventions' response spread to that of the control (Supplementary Material 11). Cronbach's alpha indicated high internal consistency across responses (11 items; $\alpha = .90$). To statistically determine if responses were more drastically spread in intervention groups, indicating stronger responses compared to control, the Moses Extreme Reactions Test was used. This test determines difference in response extremity – in either direction – between two independent groups, designed intentionally to determine treatment variable influences when extreme reactions in opposing directions might be expected (e.g., an intervention compared to a

control; (Arnold & Briley, 1973; Colman, 2015; Moses, 1952). In this test, both groups' scores are combined and become ranks (Moses, 1952). The test statistic is one group's range plus one; the group is chosen at random. Span probability is calculated and then recalculated after removing a certain number of extreme scores from each end, before one-tailed probability is determined (Moses, 1952). Where Levene's tests determines homogeneity of variance between groups, Moses Extreme Reactions tests explicitly for response extremity. Typical means comparison statistical tests were not relevant to the main hypothesis, as group means could be similar while maintaining different response spread and distribution, blurring effects. Table 3.1 displays similar means found for each group.

3.5 Results

3.5.1 Response distributions

Overall mean Environmental Identity (EID) response was 4.89, on a scale from 0-7, with a range from 4.80-4.95 across all groups (Table 3.1). Response distributions were statistically compared via the Moses Extreme Reactions test, displayed in Table 3.1.

Table 3.1. Moses Extreme Reactions Test: Comparing intervention response spread to control

Group	***n***	***M***	***SD***	Test Statistic [a]	*p*
Control	115	4.91	1.16		
Mortality Salience	123	4.95	1.21	206	.042*
Drowning	72	4.83	1.29	160	.007**
Contaminated Water	77	4.92	1.24	164	.007**
Dehydration	70	4.80	1.26	160	.019*

[a] For each Moses test N = $n_{\mathbf{control}}$ (115) + $n_{\mathbf{intervention}}$ (reported above)

$p < 0.05$ indicates responses significantly more extreme responses (in either direction) than in control; *$p < 0.05$; **$p < 0.01$

Results indicate all interventions had responses significantly more extreme than the control ($p \geq .05$). Before discussing the implications of our findings, we should acknowledge the context in which this research was completed. The COVID-19 pandemic brought frequent MRs worldwide, initially impacting US and Canadian populations around March 2020 (Courtney et al., 2020; Pyszczynski et al., 2020). Our recruitment occurred in Fall 2020, prior to widespread COVID-19 vaccine availability. Recurrent pandemic-related MRs in this time could have subdued observed effects' strength as our control may have had above average mortality awareness. To our knowledge, an average mortality anxiety score for the pandemic period has not been established for comparison but would be useful within future research.

3.6 Discussion

Through this research, we have shown both MRs and life-threatening water reminders increased extremes for EID scores; existential threats led participants to support their environmental identity – or lack thereof – more strongly. Our discoveries offer crucial new perspectives on how individuals may undergo EID changes in response to life-threatening communication. This is a vital preliminary step to understanding this often dire messaging's influence on water consumers' and decision-makers' PEB. Below we explain our findings compared to other empirical research, followed by anticipated implications for PEB and water-specific behavior change strategies. We discuss both individual behavior and water management or policy-level decision-making implications related to our findings.

3.6.1 Research results in empirical context

Overall, we found MS and all water crises interventions significantly increased the polarization of EID compared to the control. This was particularly true for the drowning and contaminated water interventions, both at $p = .007$ significances. Our findings support prior work by Vess & Arndt (2008) and Fritsche & Häfner (2012) who tested environmental concern and/or identity in the context of MS and TMT. Vess & Arndt (2008) found that for people who derived self-esteem from environmental behaviors, MS increased their concern for environment; for people who did not derive self-esteem from environmental behavior, the reverse relationship presented. While Vess & Arndt (2008) utilized the Environmental Contingencies of Self-Worth scale as a measure of self-esteem derived from environmental behavior, rather than EID, the trend was replicated within our findings. Fritsche & Häfner (2012) noted that MS decreased motivations for participants to protect the environment for intrinsic reasons and investigated EID as a potential moderating variable. They found that when people did not define themselves as part of nature or an environmentalist group – thus having low EID – they had less motivation and concern for the environment as something to value for intrinsic reasons (Fritsche & Häfner, 2012).

While we did not have a pre-existing measure of EID for our participants, groups can be assumed to have a normative mix of pro-environmental individuals. Although American and Canadian studies indicate growing awareness and concern regarding climate change, this awareness is not the population majority nor is awareness equivalent to EID or, critically, translate to environmental action (Leiserowitz et al., 2021; Mildenberger et al., 2016). Americans are increasingly identifying as "Alarmed" about climate change – up to 24% of the population according to Yale's *Global Warming's Six Americas* (Leiserowitz et al., 2021). While

encouraging for potential climate solutions, even within this segmentation, 20% are "Inactive" – potentially less likely to engage in PEBs. Compared to the US, a greater proportion of Canadians believe climate change is happening, but belief that humans are responsible is mixed. Researchers have shown that only ~20% of people in the Prairies and oil-economy areas believe humans are responsible for climate changes while ~70% of Canadians take responsibility on the East and West coasts (Mildenberger et al., 2016).

Given these baseline findings, some of our participants likely identified as pro-environmental, but for others who did not, EID would not be a self-esteem source. For those participants with low-EID, their identity and self-esteem were likely more strongly linked to traditional consumerist values, which remain prevalent in Western society (Metz, 2015).

It would be worthwhile for future studies to investigate individual changes in EID related to MS, water crises, and other environmental messages by including an initial EID measure, perhaps from an earlier pre-screen study. This would allow for a fuller understanding of effects and implications of existential threats. Smith et al. (2022) provide additional environmental operationalizations worth considering in future environmental-TMT research.

3.6.2 Implications for behavior change and water management

Our findings inform future water crises communications for those who aim to increase pro-environmental identities and behaviors. On an individual level, it would be valuable to understand someone's values, worldviews, and identity related to water and environmentalism before implementing a PEB strategy. For a more widespread PEB campaign, it may be beneficial to know the majority EID in the audience, as has been aptly exemplified via consumer segmentation efforts by industry and academia. For examples, Yale's *Global Warming's Six*

Americas, assesses awareness and concern among the public and Słupik et al.'s (Słupik et al., 2021) European energy user analysis based on behavioral and socioeconomic factors, although many other examples exist. A campaign designed around the majority's worldview would admittedly result in some individuals not receiving messages that would most effectively increase their PEB, but it may be the best option given budget and resource constraints that are common in environmental efforts.

While individual behavior change can offset some forecasted water insecurities (IPCC, 2018), various structural barriers (e.g., class, gender, race) prevent individual actions from having more powerful or sustained change impacts (Kenis & Mathijs, 2012; Newell et al., 2021). Significant water management power lies with government and policy makers; considering how existential threats may influence these expert decision-makers is crucial.

Whether working in a group or alone, we consider decision-makers *as* individuals and recognize that they are all influenced by their own values, worldviews, and identities (Staerklé, 2015; van der Werff et al., 2014), as explicated above through TMT perspectives (Pyszczynski et al., 2015). Despite what historical economics espouse, humans are not merely rational machines (Johnson, 2021; Staerklé, 2015); it is necessary to consider these individualized factors that influence decisions – particularly in water-related contexts (Wolfe, 2017). While some economists have argued that groups can exercise more rational decision-making than individuals (Kugler et al., 2012), it is important to recognize these groups consist of individuals with their own backgrounds, beliefs, worldviews, and values.

Further, recent environmental scholars find identity-diverse groups (e.g., diverse genders, races, and/or classes) make more ethical, environmentally protective, and equitable decisions

(Craft, 2013; Glover et al., 2002; Vollan & Henry, 2019). Time and again, researchers have argued that environmentally responsible decisions are best made when processes involve diverse members affected by the issue, are open, transparent, and built on trust, and are participatory, collaborative, and flexible (Decaro et al., 2017; Powell et al., 2017). However, when discussing life-threatening crises, MRs that arise may evoke worldview reinforcement as defenses against death anxieties (Castano et al., 2002; Harmon-Jones et al., 1996; Uhl et al., 2018), as observed with EID in our study.

Our findings provide important and novel insights into how individuals may experience EID changes following life-threatening communication and is a necessary first step to understanding how these messages could also influence powerful decision-makers. Future research on life-threatening communication among water-experts specifically would be essential. Our findings show further inquiry with specific sub-populations would be worthwhile to determine how water crisis decisions are impacted by life-threatening communications.

3.7 Conclusions

Future EID research with a collectivist lens could provide a more extensive understanding of the influence of both identity and threatening messaging on PEB. Emerging social science research has highlighted need for collectivist perspectives, and social-identity theory notes usefulness in embedding EID within these views (Fritsche & Masson, 2021; Kenis & Mathijs, 2012; Klein et al., 2022). It would also be valuable to replicate our research in different social contexts and with participants who have the power to directly influence environmental and climate outcomes.

Climate and water crises require swift and impactful action to obtain effective solutions. Efforts to cultivate environmental identities may increase support for such solutions when

campaigns are constructed with mortality messaging – and defenses – in mind. Should existential threats in climate messaging be used arbitrarily, we risk opportunities to motivate broader population segments to adopt climate solutions, and we may also inadvertently encourage behaviors that hasten irreversible climate disaster. Failure to heed these reminders in decision-making contexts could lead to loss of effective, equitable, and powerful water solutions, perpetuating the persistence of water crises.

Chapter 4. Death at the tap: Uncovering gender bias in appraisal of male vs. female water managers

4.0 Chapter summary

This final manuscript combines and expands findings from prior chapters. Water crises are increasing with climate change and require effective solutions and management. Environmental decision-making researchers have shown that sustainable, efficient, and equitable solutions come from diverse teams. However, women are lacking in water management and leadership scholars show that gender bias is rampant in these roles, hindering equitable decision-making. Further, water crises carry inextricable mortality reminders as access to a life-sustaining resource is threatened. These mortality reminders activate predictable human responses that exacerbate stereotypes and biases already present in managerial contexts.

I empirically tested the influence of a typical mortality reminder, a life-threatening water reminder (e.g., drowning), and a control to determine their influence on appraisal ratings of same or differently gendered water decision-makers. As water managers are predominantly male, men were our focal group and women were exploratory. Ambivalent sexism was included as a moderator and significant interacting effects for benevolent sexism (BS) were revealed.

Men and women overall and those higher in BS scored female decision-makers significantly more positively. After a threat, lower-BS men rated decision-makers significantly less positively. Lower-BS women rated female decision-makers significantly less positively. Our results indicate that water crises communication, mortality reminders, and sexism around gender roles have important implications for equitable water management and inclusion efforts.

4.1. Introduction

Climate and water problems are abundant, undeniable, and increasing worldwide. Urbanization and land-cover changes additionally impact the water cycle, increasing runoff, reducing water quality, and influencing evapotranspiration patterns – in turn effecting flood and drought frequency and climate change (Sterling et al., 2013; Vörösmarty et al., 2000). Changes in water cycles are centrally linked to climatic changes; increased water vapor in the atmosphere from greater evapotranspiration leads to higher overall temperatures (Neelin et al., 2022). Yet, these changes are complex, difficult to predict, and require deliberate, collaborative, and interdisciplinary decision-making (Larson et al., 2015; Neelin et al., 2022; Vörösmarty et al., 2000). Environmental researchers have shown that the most effective solutions for such climatic problems require decision-maker diversity (Cook et al., 2019; Hannagan & Larimer, 2010; Horbach & Jacob, 2018; Lau et al., 2021; Li et al., 2017; Lu & Herremans, 2019; Nadeem et al., 2020; Orazalin & Baydauletov, 2020). However, current water-related decision-making groups tend to be homogenous and male-dominated (Adams et al., 2018; Figueiredo & Perkins, 2013; International Water Association, 2016; Jalal, 2014; Thompson et al., 2017; World Bank Group & Global Water and Sanitation Partnership, 2019; Zwarteveen, 2011). Further, persistent and threatening climate and water messaging evokes psychological defenses that trigger predictable responses that can be harmful for diversity efforts, essentially restraining diverse voices (Akil et al., 2018; Fritsche et al., 2012; Uenal et al., 2021; Uhl et al., 2018). These diversity-damaging defenses include exacerbating intergroup biases, as demonstrated through decades of social psychology research from Terror Management Theory (TMT; Castano et al., 2002; Giannakakis & Fritsche, 2011; Harmon-Jones et al., 1996; Navarrete & Fessler, 2005). Yet threatening water

reminders specifically remain underexplored despite water's essential role in human survival and the myriad of water-related catastrophes connected to climate change (IPCC, 2022; Caretta et al., 2022; Gosling & Arnell, 2016; Whitehead et al., 2009). Moreover, climate scholars have identified the dire need for attention on water issues within climate change policy (Douville et al., 2022). We explore this space with a sociopsychological lens to understand human responses to this messaging and how these influence intergroup gender biases related to appraisal of female vs. male water decision-makers.

Gender and leadership scholars have investigated diversity and equity in decision-making groups – from firms to governance, homogeneity persists (Burke, 2000; Gorman, 2005; Heilman & Eagly, 2008; Majumdar & Weber, 2023). Gender biases prevent marginalized members from being heard or considered equally to dominant – often male – counterparts (Brescoll, 2011; Diehl et al., 2020; Stoddard et al., 2020), which limits opportunities for more equitable (Hannagan & Larimer, 2010), innovative (Chen et al., 2016; Díaz-García et al., 2013; Nielsen et al., 2017), collaborative, successful environmental solutions (Li et al., 2017; Lu & Herremans, 2019; Nadeem et al., 2020; Orazalin & Baydauletov, 2020; Rao & Tilt, 2016).

Equity issues in top management permeate many issues and sectors. Our work adds to the broad research on human responses to existential threats (e.g., within Terror Management Theory), specifically on how mortality reminders may influence gender bias and decision-making. Our work also contributes to the understanding of climate/water crises' influence on environmental decision-making, how this may influence gender and intergroup biases, and, ultimately, how this can influence pro-environmental outcomes and positive, equitable, solutions.

4.1.1 Goals and objectives

Designing and implementing the most effective water solutions is paramount for human longevity given climate change. To achieve this goal, diversity is required in the decision-making process. While this diversity should and could include various identity intersections (e.g., race, class, age, etc.), we focused our research on gender to allow for more in-depth analyses. While sex refers to one's physical body and genitalia, gender refers to the societal construct and expression of one's identity (Heidari et al., 2016; Wood & Eagly, 2015). We were interested in appraisal of others based on their presumed gender – as evidenced via pronouns in a vignette. Given the psychosocial factors involved in judgements about others we referred to gender rather than sex. People in Western contexts are often viewed as the gender they present – or perform (Butler, 1988) – even if that may be a shallow, binary understanding of gender (Gaillard et al., 2017; Morgenroth et al., 2021; Ward & Lucas, 2023). As such, we focused on women vs. men decision-makers because the contexts we considered (e.g., workplaces, management, decision-making teams) follow these gender assumptions. Additionally, while we included self-disclosure for transgendered, non-binary, and gender-non-conforming identities, few participants (<1%) identified in this category.

Social psychology scholars have found a plethora of evidence for gender bias in workplaces and particularly for women in management or leadership positions (Hoyt & Burnette, 2013; Klutsey, 2020; Scott & Brown, 2006). This in part stems from gender role incongruity (Eagly & Karau, 2002); women are presumed to take on stereotypically 'feminine' roles – those that are caring, nurturing, or requiring communal skills – and face biases and/or criticism when they are in gender incongruent roles – those thought to require 'masculine' traits, such as assertiveness

and competition (Heilman & Eagly, 2008; Powell et al., 2002; Schein, 2001; Sczesny et al., 2004). Within social psychology, Terror Management Theory (TMT) scholars have demonstrated the influence of mortality reminders – termed mortality salience (MS) in clinical settings – on gender stereotypes and ingroup biases, explained more fully in Section 4.3.1. In water-specific TMT research, drowning reminders evoke MS similarly to traditionally used TMT mortality reminders (Smith & Wolfe, forthcoming; Chapter Two). To explore how ingroup gender bias may present in environmental decision-making contexts, we tested typical MS and drowning MS influences on participants' evaluations of same or different gender water decision-makers. Due to established male-dominance in top decision-making and management roles (Adams et al., 2018; Figueiredo & Perkins, 2013; International Water Association, 2016; Jalal, 2014; Majumdar & Weber, 2023; Thompson et al., 2017; World Bank Group & Global Water and Sanitation Partnership, 2019; Zwarteveen, 2011), we were particularly interested in male responses to threatening messages and how that influenced their appraisal of female decision-makers, a currently underrepresented group in this professional space.

In the sections below, we first outline current research on water crises, required solutions, and water management practices as a rationale for our water focus. We then discuss gender, gender bias, and its role in decision-making, particularly within water management. We briefly describe TMT's principles, human response to existential threat, and the related influences on gender bias and group decision-making. Our methods and subsequent results follow, with discussion on the implications of our findings and relevance for practitioners and further research.

4.2 Climatic water crises management

Water availability and quality are central concerns for human life in a changing climate, both threatened by predicted extreme weather conditions (Gosling & Arnell, 2016; IPCC, 2022; Schewe et al., 2014; Whitehead et al., 2009). Efficient and effective management of water resources is essential; water management and governance scholars argue that diverse and collaborative groups are required for water solutions (Bhattarai et al., 2021; Figueiredo & Perkins, 2013; Imburgia et al., 2021; Lacey, 2008; Pahl-Wostl et al., 2008; Powell et al., 2017; Singh, 2008). Specifically, researchers have shown that gender diverse decision-making groups (e.g., groups with similar numbers of women and men) make more pro-environmental and equitable decisions (Cook et al., 2019; Craft, 2013; Ergas et al., 2021; Glover et al., 2002; Swim et al., 2018; Vollan & Henry, 2019) that generate more innovative and creative water solutions (Ajami et al., 2014; Alsos et al., 2013; Blake & Hanson, 2005; Elledge et al., 2020; Nählinder et al., 2015). While innovative, technical solutions have been previously espoused and prioritized (Ajami et al., 2014; Elledge et al., 2020), water scholars have more recently argued that water crises are governance and management crises, due to climatic and physical boundary uncertainties and greater opportunities from reallocating resources (Babuna et al., 2023; Biswas & Tortajada, 2010; Pahl-Wostl & Knieper, 2014). There has been greater demand for collaborative, transdisciplinary, intersectional water management and solutions that meet basic human and planetary needs over economic interests alone (Boelens & Vos, 2012; Gleick, 2018; Pahl-Wostl et al., 2020; Truelove, 2019). It is clear that diverse input is required to identify, develop, and implement effective water solutions – when underrepresented groups are absent from these discussions, their needs often go unmet, exacerbating the harms these groups face

(Cuomo, 2011; Dankelman, 2002; Hannagan & Larimer, 2010; Lu & Herremans, 2019; Moosa & Tuana, 2014; Rao & Tilt, 2016). However, present water management teams are male-dominated. Before gender-specific considerations, we must confine the water decision-making and management focused on in the present research. Our geographical focus and decision-making dynamics of interest are specified below.

4.2.1 Regional focus

Regional delineations are difficult and wrought with political context, yet important to consider to avoid potentially racist false dichotomies (Khan et al., 2022). We refer to the global to generally refer to WEIRD societies – Western, educated, industrialized, rich, and democratic (Henrich et al., 2010) – that are our focus. While the Global South is not homogenously made up of non-WEIRD cultures, this term is used for simplicity to differentiate past research focus. Likewise, all those in the global North are not WEIRD individuals, but we are interested in those who are in power over water management decisions – those who are most often WEIRD or acting with similar worldviews, such as prioritizing economic growth and efficiency over collaborative, inclusive decision-making (Dobbin & Lubell, 2021; Kim et al., 2015; Meehan et al., 2020).

While women in the global South are the primary water collectors, this position does not equate to decision-making power regarding water usage or management (Miroux, 2011). When it comes to water management in the global North, men hold the highest-ranking positions (Cleaver et al., 2010; Upadhyah, 2003; Borba, 1997), perhaps related to the prioritization of technology within water management (Ajami et al., 2014). We consider WEIRD societies for our research as there is a dearth of examination for this region; much of the gender-water literature

focuses on the global South (Hanrahan & Mercer, 2019; Meehan et al., 2020). While extant research is valuable, it is important to be self-reflective and recognize the power and resources in the Global North to make significant positive changes to water management. Additionally, water privatization companies, based in the Global North, are increasingly expanding into the South (Laurie, 2005, 2011) and the decision-making power remains in WEIRD hands. Lastly, we focus on the Global North as there is clear room for improvement in our water-related decision-making capacity. For example, over 100 Indigenous reserves remain under boil water advisories in Canada (Hanrahan & Mercer, 2019; Meehan et al., 2020) and various water contamination concerns persist in the United States, such as those in Flint, Michigan (Meehan et al., 2020). Relatedly, we must acknowledge select water management areas where women have been noted as the majority in the North before continuing – water stewardship and non-profit work (Caretta, 2020) and Indigenous water relations (Chiblow (Ogamauh annag qwe), 2019; Kim et al., 2013; Lawless et al., 2015). These gendered relationships with water are unique in several important ways. First, stewardship and non-profit labour are often unpaid, underpaid, and/or volunteer-based; this labour can be viewed as a form of care work, a field that is often women-dominated (Caretta, 2020; Elson, 2017). Within these fields, the gender gap in paid and unpaid care work has only been aggravated by the COVID-19 pandemic, as women have more often taken on increased care responsibilities with children kept at home from school or other care options (Camilletti & Nesbitt-ahmed, 2022; Madsen et al., 2022). This has led to, as one consequence, reduced publications from female scholars in comparison to male aligned with the pandemic's onset (Madsen et al., 2022).

Second, while Indigenous women are frequently responsible for water protection and considered to have special understandings about water (Kim et al., 2013; Lawless et al., 2015), it is rare that Indigenous perspectives are meaningfully incorporated into water-related decision-making (Emanuel & Wilkins, 2020; von der Porten et al., 2016). Relatedly, the stewardship and non-profit efforts where women are a majority, while important for influencing policy or governments, do not hold the same decision-making power as formal water management to make decisions regarding water crisis response (Brisbois & de Loë, 2016; Wilson et al., 2019).

Considering the tensions described above, it is clear that there is water insecurity in the global North that requires intersectional, transformative, communal solutions (Majumdar & Weber, 2023) – solutions that diverse groups do best (Ahlers & Zwarteveen, 2009; Haeffner et al., 2021; Imburgia et al., 2021; Lacey, 2008; Zwarteveen & Boelens, 2014).

4.2.2 Human-centric research focus

We centre our focus on human decision-making components of water crisis management. Although various models and tools have been developed to aide complex water decision-making such as, Decision Making Under Deep Uncertainty frameworks (Marchau et al., 2019; Webber & Samaras, 2022) or participatory modelling, (Voinov et al., 2018), we focus on the human decision-making that occurs with or without these models' outputs. These tools have varying degrees of stakeholder and/or community involvement, which can incorporate some diverse insight into the problem at hand. Yet, even with these models and the choices they provide, the final decisions are made by a limited number of humans with their own values and emotions, and susceptibility to bias (Moallemi et al., 2020; Stanton & Roelich, 2021). These models and tools

still require interpretation and human implementation (Stanton & Roelich, 2021); final decisions are most often made by a powerful few.

4.2.3 Gendered decision-making in water management and leadership

The powerful few in water decision-making are most often male; women are lacking in water management and leadership roles (Adams et al., 2018; Alda-Vidal et al., 2017; Cleaver & Hamada, 2010; Figueiredo & Perkins, 2013; International Water Association, 2016; Jalal, 2014; Thompson et al., 2017; World Bank Group & Global Water and Sanitation Partnership, 2019; Zwarteveen, 2011). For example, in water utilities – responsible for safe drinking and wastewater transportation and treatment – only 23.3% of managers are women (World Bank Group, 2019). In the global North, water management has been regarded as a highly technical field (Ajami et al., 2014; Lofrano & Brown, 2010), with increasing reliance on technology for monitoring, control, and treatment, and not seen as stereotypical women's work (Haeffner et al., 2021; Rap & Oré, 2017).

In these formal water decision-making spaces, male homogeneity permeates. Persistent gender-leadership stereotypes (detailed below) can be a barrier for women entering management roles (Heilman & Eagly, 2008; Hideg & Shen, 2019; Kossek et al., 2017). Conventional leadership roles are often viewed as requiring stereotypically masculine traits of assertiveness, dominance, and competitiveness, which contradicts entrenched societal expectations around female behaviours (Heilman, 2001; Hoyt & Murphy, 2016; Klutsey, 2020; Scott & Brown, 2006). Women who act agenticly – more independent and assertive, traits often associated with 'good leaders' for males – are viewed more negatively and are rated as *poor* leaders, in part because women are expected societally to display more communal traits (Eagly, 2007; Mendelberg &

Karpowitz, 2016; Scott & Brown, 2006). This negative appraisal of female leaders is especially prominent in male-dominated fields, such as engineering (Faulkner, 2009). However, business scholars argue that transformational leadership, which relies on collaborative, communal traits, and interpersonal skills – qualities typically associated with and a style more often displayed in women (Eagly et al., 2003) – is what leads to improved environmental outcomes (Nduneseokwu & Harder, 2023). Despite this acknowledged need for transformational leaders, notwithstanding the identified improved environmental outcomes with gender diverse decision-making groups, gender inequity persists (Cleaver & Hamada, 2010; Haeffner et al., 2021; World Bank Group & Global Water and Sanitation Partnership, 2019).

Increased diversity in groups is not easy or straight-forward and, at times, can lead to negative outcomes rather than positive. Some arguments that more women on corporate boards increases board performance stem from consulting groups that do not have the full empirical picture (Eagly, 2016). For instance, firms that are performing strongly may have additional resources to hire and support women in higher roles – but this is not presented in these reports (Eagly, 2016). In addition, a token woman or singular marginalized group member hire is unikely to feel valued or influence group decisions as they will most likely be viewed as an outgroup (Bodenhausen et al., 2012). This recognition of increased diversity complexity is not to say it is not worthwhile to address representation or inclusion concerns, rather it is important to recognize the nuances of the issues to be an ‘honest knowledge broker’ (Eagly, 2016).

While gender stereotypes regarding water work and leadership may explain some of women’s absence from these decision-making spaces, an inextricable aspect of human psychology has yet to be considered. Terror Management Theory (TMT) explains our subconscious responses to

existential threats – for example, unreliable access to a life-sustaining resource. Our psychosocial defenses to these threats, explained below, may help explain lacking diversity in water management.

4.3 Terror Management Theory: Human response to existential threat

All humans are aware that their lives will one day cease, but the existential dread evoked by this awareness induces psychological defenses that push this anxiety aside (Burke et al., 2010; Greenberg et al., 1990; Pyszczynski et al., 2015; Rosenblatt et al., 1989). These defenses can activate unconscious biases against those seen as 'others' – whether of different gender, race, or other social identity (Castano et al., 2002; Giannakakis & Fritsche, 2011; Harmon-Jones et al., 1996). Over 30 years of social psychological research has aided in the development and validation of TMT (Burke et al., 2010; Pyszczynski et al., 2015; Schimel et al., 2019). A brief overview of TMT is provided below, with detail on its influence on gender biases specifically before we describe its potential role in water crisis decision-making and our research.

Human mortality is unavoidable and requires persistent mental effort to avoid being overwhelmed by this reality. Terror management scholars have identified predictable human responses to mortality reminders – which create mortality salience (MS), termed mortality awareness in non-clinical settings (Wolfe & Tubi, 2019) – that serve to tamper the existential anxiety that arises from these reminders (Kosloff et al., 2019; Pyszczynski et al., 1999). Specifically, explicit, direct mortality reminders (e.g., thinking about one's death, attending a funeral, experiencing death of others) evoke *proximal* defenses; we deny our vulnerability or mortality, distract ourselves from the reminder, or rationalize that we are not at risk in response to direct mortality reminders (Pyszczynski et al., 1999). When mortality reminders are more

subtle or indirect (e.g., the word 'death' flashed subliminally; a delay occurs following the reminder allowing it exit focal attention), *distal* defenses occur; we seek to boost our self-esteem by more vigorously supporting our worldviews and those who are aligned with our values, distancing ourselves from those who are different, and supporting 'hero-projects' that will outlast our physical existence after subtle mortality reminders (Pyszczynski et al., 1999). In essence, proximal defenses serve to minimize the mortality threat while distal defenses provide ways in which we may survive symbolically beyond our mortal lives.

Distal defenses are our focus due to the ingroup preference and outgroup derogation – or intergroup biases – that can occur. Prior TMT scholars have found that mortality reminders increase ingroup preference regarding political opinions (Chatard et al., 2010; Weise et al., 2012), religion (Greenberg et al., 1990), race (Greenberg et al., 2001), nation (Castano, 2004; Nelson et al., 1997), societal norms (e.g., greater punishments for socially transgressive behaviour following mortality reminders; Rosenblatt et al., 1989), and gender (Goldenberg, 2012). Recent TMT work has identified that climate change reminders can serve as mortality reminders, instigating similar anxiety defenses as traditional death-related stimuli (Akil et al., 2018; Fritsche & Häfner, 2012; Naidu et al., 2022; Smith et al., 2022; Wolfe & Tubi, 2019). It may be that when water, a life-sustaining resource, is threatened, subtle mortality reminders percolate and activate these intergroup biases to bolster self-esteem and ensure ingroup survival. Prior TMT-gender research is presented briefly below to illustrate the potential gender biases that can occur from such reminders.

4.3.1 Terror Management Theory and gender

Gender identity is a component of self-identity and self-esteem (Baron et al., 2014; Wood & Eagly, 2015); following distal mortality reminders, one may seek to strengthen positive connections with gender identity to protect their self-esteem, potentially resulting in ingroup gender bias (Arndt et al., 2002; Hoyt et al., 2009). In male-dominated groups, mortality awareness could activate ingroup preferences, leading men to prefer other men and to dislike women, as observed by Hoyt et al. (2009) and Arndt et al. (2002), resulting in gender discrimination. Due to preexisting gender and societal stereotypes (e.g., role congruity theory, Eagly & Karau, 2002), this could increase the challenge of achieveing gender equity in such spaces, an already difficult task.

In addition, physical female sex traits can remind people of procreation – while procreation may seem the opposite of death, it is a bodily reminder that we are similar to animals which, too, have finite lifespans (Cox, Goldenberg, Pyszczynski, et al., 2007; Goldenberg et al., 2019). Tampons (Roberts et al., 2002), pregnant women (Goldenberg et al., 2007), and breast-feeding (Cox, Goldenberg, Arndt, et al., 2007) have all been shown to stimulate MS and increased negative ratings of women. Interestingly, appraiser gender often did not change how the target woman was rated – both women and men rated women more negatively or with greater objectification when mortality was salient (Goldenberg et al., 2009, 2019; Goldenberg & Roberts, 2000). However, because TMT researchers demonstrate MS can evoke negative evaluation of women in general (Goldenberg, 2012; Goldenberg et al., 2019; Landau et al., 2006) it is unclear if these negative reactions are related to intergroup biases or if they are a more general mortality anxiety defense. Perhaps womanhood or femininity in itself is a subtle

mortality reminder that we seek to distance ourselves from, whether we identify as woman or not.

This gender bias from MS repeats itself in leadership appraisals where gender stereotype threats may occur. Women are often viewed negatively when they occupy roles traditionally seen as 'masculine' or when they are in male-dominated groups (Arndt et al., 2002; Eagly & Karau, 2002; Heilman & Eagly, 2008; Hoyt & Burnette, 2013; Hoyt & Murphy, 2016). Business-focused TMT researchers explored MS influence on stereotype bias and on ingroup-gender bias effects (Hoyt et al., 2009). These scholars found that, when mortality was salient, women preferred a female candidate and men preferred a male candidate – a clear indication of ingroup biases. In a second study, the more stereotypically agentic (e.g., assertive, independent, competitive) candidate was preferred regardless of gender when mortality was salient – though male participants preferred only agentic-male candidates, not agentic-female candidates (Hoyt et al., 2009). Further, MS has been shown to increase use of agentic leadership traits when participants were asked to define an effective leader (Hoyt et al., 2011). Mortality salience has also been shown to increase preference for charismatic leaders and decrease preference for relationship-oriented leaders (Cohen et al., 2004). These altered preferences may additionally increase bias against those who do not display these attributes (e.g., women) in existentially threatening scenarios. This is particularly troubling when we consider that transformational leaders, as described above, are those recommended for improved environmental outcomes (Nduneseokwu & Harder, 2023); if agentic traits are preferred following mortality reminders, people may be predisposed to leaders who may look the part, but may not necessarily be best suited to providing effective, equitable climate solutions, according to prior environmental

decision-making research (Cook et al., 2019; Craft, 2013; Glover et al., 2002; Hannagan & Larimer, 2010; Imburgia et al., 2021; Lacey, 2008).

Given the combined need for diverse groups to obtain the most effective sustainable water outcomes, the stereotypical gender biased expectations for leadership roles, and the potential for water crises to activate mortality anxieties and exacerbate those biases, it is essential to understand how female and male decision-makers are viewed by peers (e.g., other water decision-makers) after mortality reminders.

4.4 Methods

We tested and compared the influence of a typical mortality reminder and a life-threatening water reminder on appraisal of a fictional female vs. male water decision-maker, in comparison to a control, among a male sample. We made no hypotheses regarding female participants. Our female sample was treated as exploratory and an initial glimpse into what might be expected in future research.

4.4.1 Hypotheses

We hypothesized that if typical MS and/or drowning MS increased ingroup gender bias, male participants in those intervention groups would rate a male decision-maker more favourably on appraisal measures (i.e., likeability, competence) than a female decision-maker, compared to a control (described below). As the decision-makers were not explicitly described as leaders, we did not expect stereotype threat effects from gender role incongruity to outweigh ingroup gender bias effects. We included a sexism measure (the Ambivalent Sexism Inventory – ASI; Glick & Fiske, 1996) to capture further insights on potential gender biases. We expected that participants

in typical MS and/or drowning MS interventions would score higher on this sexism measure than those in the control due to activated ingroup gender biases.

4.4.2 Participants and recruitment

We recruited 656 adult participants (161 women, 495 men) via Prolific, an online crowd-sourcing platform, from the United States and Canada to complete a ~20-minute survey for ~$3.25 CAD remuneration. The sample size was determined to balance desired power (.95 to detect medium effect size of d = .25 at .05 alpha error probability) and resource availability (e.g., financial constraints within the research budget). As men were the focal group, they were recruited at a 3:1 ratio to women. Enrollment was limited to participants with (a) a minimum bachelor-level education to approximate experience to those who may be in water management roles and (b) Prolific approval ratings over 90% to ensure quality responses.

Prolific automatically screened out responses when attention checks failed, surveys timed out, or there was evidence of non-human activity, removing 8 women and 33 men. Our exclusion criteria (e.g., incomplete intervention prompts, responses >3 *SD*s from mean) did not identify any additional removals, providing final samples of 153 women and 453 men.

4.4.3 Procedure and design

We employed a randomized between-subjects 3 (Intervention: typical MS vs. drowning MS vs. control) x 2 (Vignette decision-maker gender: female vs. male) preregistered study design (https://osf.io/x2vab), displayed graphically below. The research was approved by a University of Waterloo Research Ethics Board.

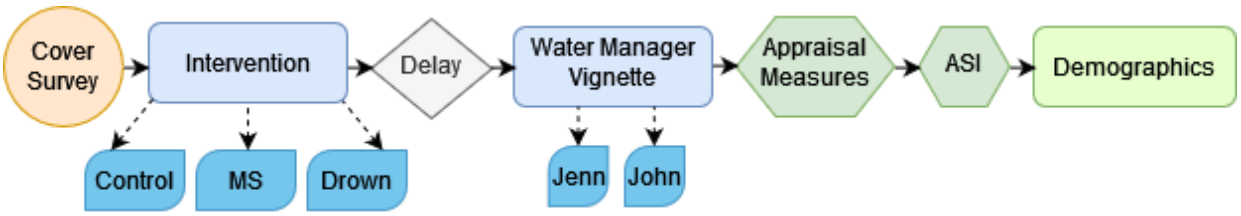

Figure 4.1. Visual representation of study procedure.

Our study design and procedure followed methodologies frequently employed in TMT research (Burke et al., 2010; Cox et al., 2018; Pyszczynski et al., 2015), detailed below.

Deception and cover survey

Implicit biases as subconscious distal defenses were of interest so participants were first presented a cover personality survey (Eysenck & Eysenck, 1964) to disguise our study purpose and to avoid inadvertently priming all participants with mortality reminders (Bradley et al., 2012; Cox et al., 2018). This survey is commonly used as an initial cover survey in TMT research (Burke et al., 2010; Cox et al., 2018).

Independent variable

After completing the deception personality survey, participants were then randomly assigned to one of three intervention groups (Table 4.1: Control, typical MS, Drowning MS) and asked two, open-ended questions regarding physical and emotional experiences of an event, modeled after the Mortality Attitudes Personality Survey (MAPS; Rosenblatt et al., 1989).

Table 4.1. Intervention phrasing, adapted from Rosenblatt et al., 1989.

Intervention	Prompts for participant intervention responses. - **bolded text** indicates what wording was changed in interventions, as specified in each row
Mortality Salience	Jot down, as specifically as you can, what you think will happen to you as you **physically die and once you are physically dead.** Please briefly describe the emotions that the thought of **your own death** arouses in you.
Control	…visit the dentist for a painful procedure and once you are physically there. …of visiting the dentist for a painful procedure…
Water Drowning	…are drowning and once you are physically drowned. …your own drowning…

The control event was an anxiety-inducing but non-life-threatening painful dental visit, used as the control in ~two-thirds of TMT studies (B. L. Burke et al., 2010; Cox et al., 2018), the typical MS group described their own death, while the water-specific MS group described drowning due to successful water-MS observed in a prior study (L. K. M. Smith & Wolfe, 2023).

Delay Tasks

As per standard TMT research procedures (Cox et al., 2018; Greenberg et al., 2000; L. K. M. Smith et al., 2022), to allow death anxiety to reach subconscious levels and activate distal defenses, participants completed three delay tasks: the PANAS (Watson et al., 1988), Rosenberg Self-Esteem Measure (Rosenberg, 1965), and State-Trait Anxiety Inventory (Spielberger et al., 1983) to extend the delay period – prior TMT researchers have found that longer delays strengthen defense effects (Steinman & Updegraff, 2015).

Following the three delay tasks, participants within each group were divided and presented with one of two vignettes (Supplementary Material 12) describing a water-related decision made by either Jennifer or John, to serve as female vs. male decision-maker identities. Moss-Rascusin et al. (2012) have demonstrated that this simple naming difference elicited significant appraisal biases of a female vs. male candidate; candidates named Jennifer were rated significantly lower and offered a lower salary in a hypothetical hiring scenario compared to John. Similar to the described research, our vignettes were identical in all ways other than name and pronouns used throughout the text.

Dependent Variables

After reading the vignette, participants were directed to rate the decision-maker on likeability (16 items measured using an 8-point Likert scale) and competence (12 items measured using a 5-point Likert scale), metrics that were adapted from social psychology and leadership studies (Anderson, 1968; Cohen et al., 2004; Ehrhart & Klein, 2001; Giannakakis & Fritsche, 2011). These surveys included questions such as "I agree that the decision-maker is friendly", "I would enjoy working with the featured decision-maker", and "I trust the decision-maker". Full scales available in Supplementary Material 13.

Ambivalent sexism was measured via the Ambivalent Sexism Inventory (ASI; Supplementary Material 14), which includes 22 items using a 6-point Likert scale (Glick & Fiske, 1996), ranging from 0-5. This inventory is used to assess hostile and benevolent sexism (HS and BS), the former originating from patriarchal society ideals, leading women to be viewed as inferior, and the latter from female reproductive roles, leading to preference for traditional female values and roles (Glick et al., 1997; Glick & Fiske, 1996). For example, researchers using the ASI in a Turkish

sample have found that those individuals with high HS view female managers less positively than male managers (Sakalli-Ugurlu & Beydogan, 2002). The ASI has been used in various prior research investigating gender biases (Christopher & Mull, 2006; Glick & Fiske, 2001) and, on occasion, within TMT studies (Chonody & Teater, 2016; Stiller & Di Masso, 2023). While other sexism measures exist (Modern Sexism, involving denial of gender-based inequality, and Old-Fashioned Sexism, involving preference for traditional gender roles; Swim et al., 1995), the ASI encapsulates overt – HS – and more discrete – BS – sexist attitudes in a straightforward survey. While it can be argued that the ASI may be limited by its heteronormativity, sexual preference or gender identity was not a focus in this study (and < 1% participants identified other than male or female), so ASI's use is relevant here. That said, future research into nonheteronormative applications of ASI would be worthwhile. Alternatives to the ASI, such as implicit association tests (IAT), where participants quickly connect (or associate) images or words displayed on a screen, revealing implicit biases, are also common in gender-psychology studies (Gothreau et al., 2022), but are more resource demanding than the ASI. For these reasons, we chose the ASI for the present study.

Participants' demographics and consent

Demographic information (e.g., age, gender, location, education), was collected next followed by a final deception-check question. Participants were then informed of the study deception before recollecting consent to have their information used.

Statistical analyses

As described in preregistration, following data cleaning (e.g., removal of outliers and/or erroneous responses), general linear models (GLMs) with orthogonal planned contrasts were

used to test differences across conditions (e.g., interventions) for all dependent variables. Contrasts and reasons for their use are summarized below in Table 4.2.

Table 4.2. Planned contrasts and explanation for inclusion.

Contrast	Explanation
C1: MS Threats (Typical and Drowning) vs. Control	• Compares control versus overall intervention effects. • Negative effects indicate lower scores on outcomes (e.g., likeability, competence) in the intervention (typical MS, drowning MS) than control conditions.
C2: Typical MS vs. Drowning MS	• Compares mortality versus drowning effects. • Negative effects indicate lower scores on outcomes (e.g., likeability, competence) in the Drowning MS than typical MS condition.
C3: DM Gender (Jennifer vs. John)	• Compares decision-maker gender effects. • Negative effects indicate lower scores on outcomes (e.g., likeability, competence) for female than male DMs.
C4: Threats x DM Gender	• Compares effects of interventions across decision-maker gender. • Positive effects indicate that the effect tested by Contrast 1 (threats > control) emerges more for female than male DMs, because the effect is larger in the predicted direction for female DMs (or larger but in the opposite direction for male DMs).
C5: Typical MS vs. Drown MS x DM Gender	• Compares effects of typical MS vs drowning MS across decision-maker gender. • Positive effects indicate that the effect tested by Contrast 2 (Drowning MS > Typical MS) emerges more for female than male DMs, because the effect is larger in the predicted direction for female DMs (or larger but in the opposite direction for male DMs).

4.5 Results

Data were analyzed via linear regression in SPSS 28 following pre-registered orthogonal contrasts to test hypothesized effects of interventions, decision-maker gender, and their interactions (Table 4.2 for contrast details). Deviations from pre-registration are specifically indicated (e.g., Ambivalent Sexism as a moderator rather than a dependent variable). When intervention effects were tested for influence on appraisal of specific decision-maker gender, focal gender was dummy coded as the reference group and follow-up models explored effects for the non-focal gender (Table 4.6, simple effects). Exact *p* values were reported and effect size in η^2. Tables 4.5 and 4.6 display unstandardized regression estimates (*b*) and *SE*. Unless specifically indicated, age and education did not significantly moderate appraisal scores.

4.5.1 Descriptive statistics

Participant distributions into intervention and control groups, age range, and predominant education level are displayed in Table 4.3 below.

Table 4.3. Participant distributions, age, and education.

		Decision-maker gender				
Sample	Condition	Female (Jennifer)	Male (John)	Total	Age range	Education
Female					22-71	≥ Master's (95%)
	Control	26	29	55		
	Typical MS	29	21	50		
	Drowning MS	20	27	47		
	Total	75	77	152		
Male					18-75	≥ Master's (90%)
	Control	71	58	129		

Typical MS	66	69	135
Drowning MS	92	97	189
Total	229	224	453

Note. MS = mortality salience.

Descriptive statistics for dependent variables displayed in Table 4.4 below.

Table 4.4. Descriptive statistics for female and male participants

Sample	Measure	Means range	Mean	*SD*	Cronbach's alpha
Female	Likeability	4.24-6.18	5.16	1.29	.94
	Competence	2.03-3.00	2.47	0.96	.97
Male	Likeability	4.42-6.10	5.23	1.19	.93
	Competence	2.25-3.17	2.66	0.99	.97

Male participant outcomes are presented before exploratory analysis of female participants' outcomes are provided.

4.5.2 Male participants

Likeability and competence scores are displayed by intervention and decision-maker gender in Figures 4.2 and 4.3. For the control, female and male decision-makers were rated similarly in likeability and competence. Female likeability rating appeared constant regardless of intervention, while male's likeability was lower in drowning MS, and even lower in typical MS.

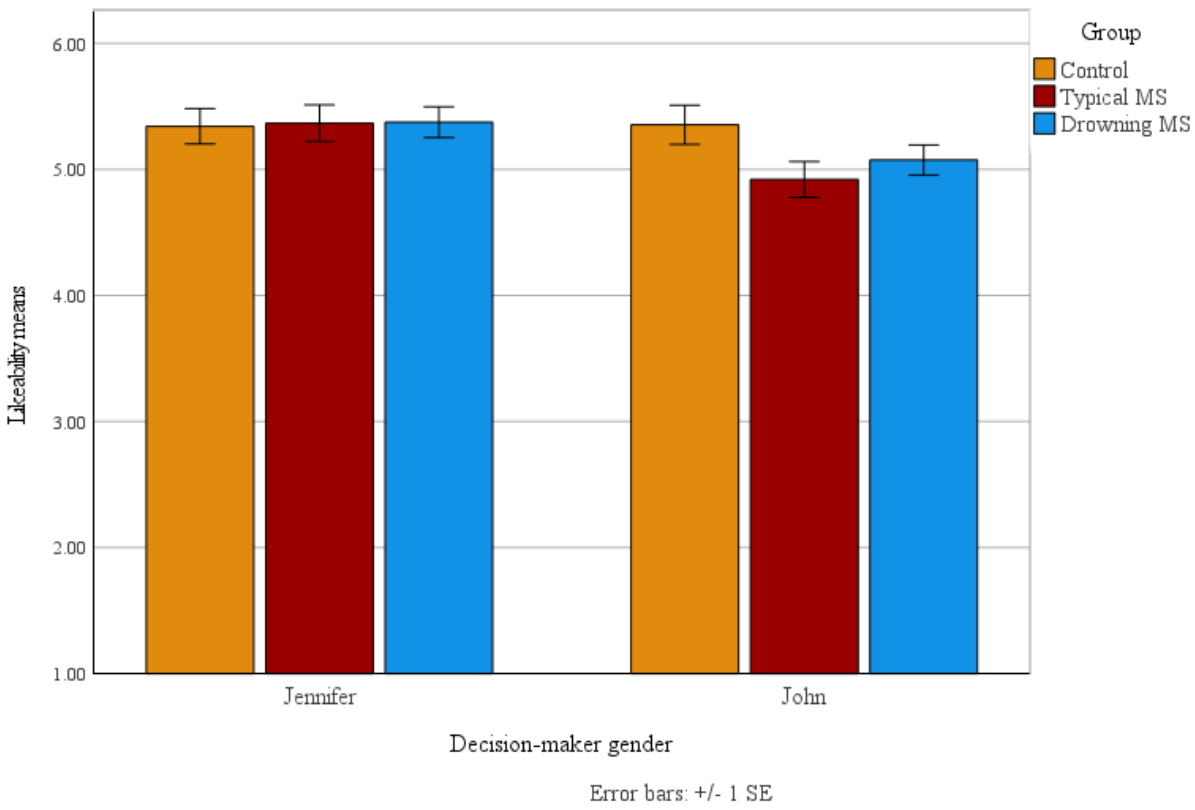

Figure 4.2. Mean distribution of likeability ratings for female (Jennifer) and male (John) decision-makers across conditions among male participants.

This pattern repeats for male decision-makers for competence ratings while female decision-makers appeared slightly more competent to the control group (Figure 4.3).

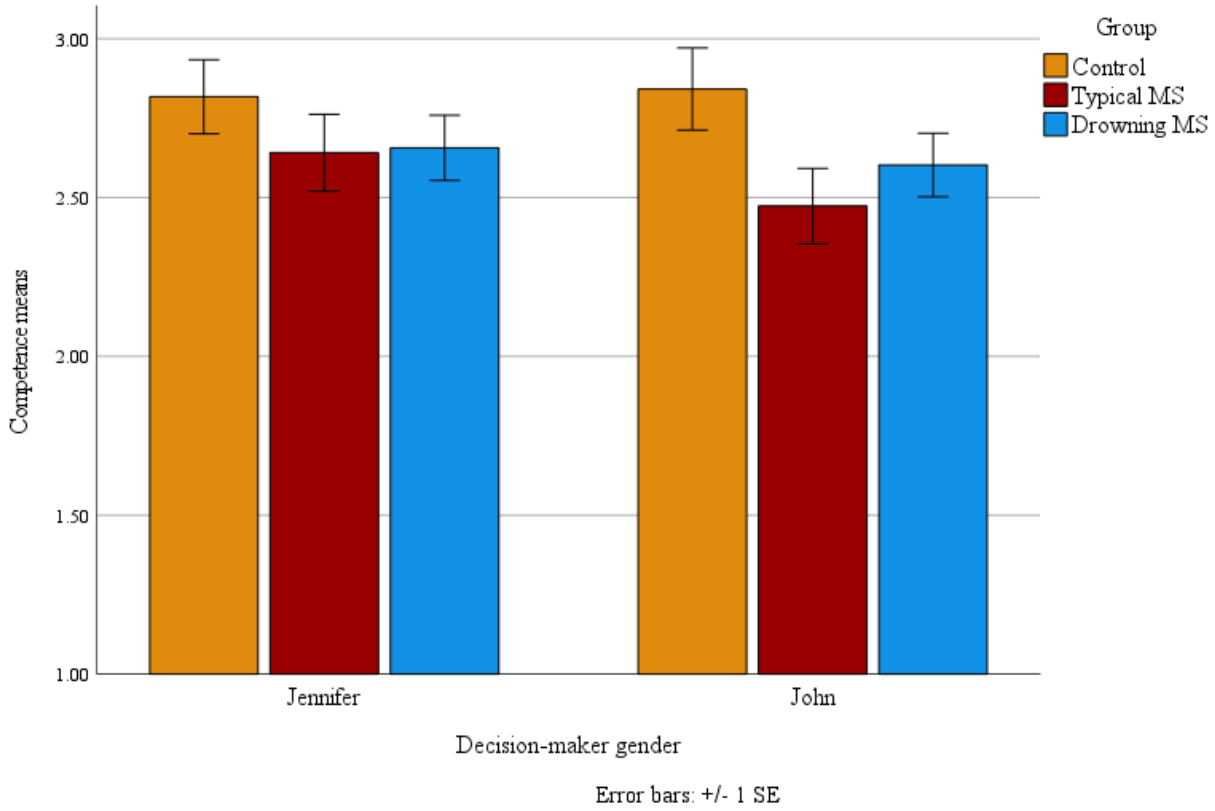

Figure 4.3. Means distribution of competence ratings for female (Jennifer) and male (John) decision-makers across conditions among male participants.

These mean differences were explored further to identify significance and potential effects.

4.5.2.1 Inferential statistics for male participants

Results from planned contrast GLMs revealed significant effects for likeability in the DM Gender contrast (*b* = .12, *SE* = .06, *t*(1, 447) = 2.17, *p* = .030, η^2 = .010) and for competence in the Threat vs. Control contrast (*b* = -.08, *SE* = .03, *t*(1, 447) = -2.29, *p* = .023, η^2 = .012). These effects mean that first, female decision-makers were rated higher on likeability (by .24 points, *C.I.* 95% 0.02, 0.46) than males and second, following a mortality or drowning threat, decision-makers were rated lower on competence (by 0.24 points, *C.I.* 95% -6.87, 0.06) than the control.

Analysis of ASI as a dependent variable revealed no effects so we deviated from our preregistration to analyze ASI as a predictor. This decision was supported by literature as ASI has been shown to be a stable individual difference variable that does not typically alter following situational changes (Glick & Fiske, 1996). Thus, hostile and benevolent sexism were mean-centred and moderation GLMs were created.

The HS moderation model showed no evidence of interaction effects. The BS moderation model for likeability showed significant interactions of Threat vs. Control x mean-centred BS (b = -.09, SE = .04, $t(1, 447) = -2.20$, p = .028, η^2 = .011) and DM Gender x mean-centred BS (b = .17, SE = .06, $t(1, 447) = 2.87$, p = .004, η^2 = .018). For competence, the Threat vs. Control contrast x mean-centred BS neared significance (b = -.06, SE = .04, $t(1, 447) = -1.69$, p = .093, η^2 = .006).

Likeability results are presented first, followed by competence. Likeability decision-maker ratings are displayed in Figure 4.4 below where, as BS increased, so did likeability of the female decision-maker and little change in male decision-maker likeability occurred.

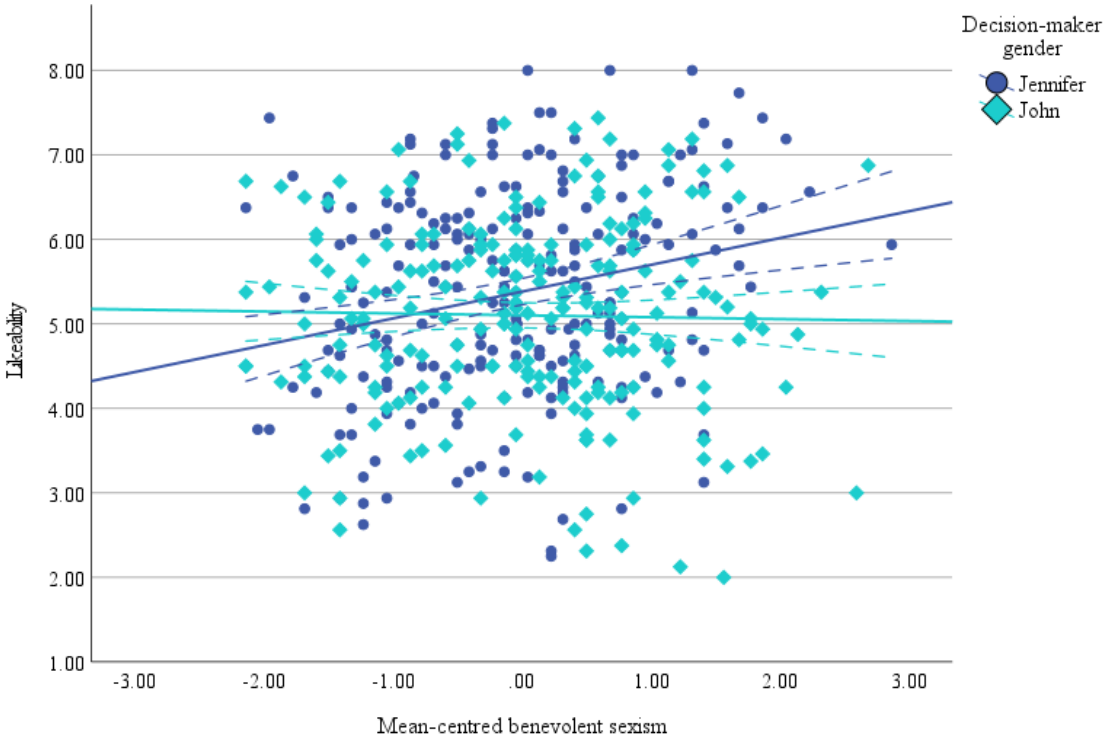

Figure 4.4. Mean-centred benevolent sexism for likeability ratings of female (Jennifer) versus male (John) water decision-makers among male participants. Female decision-makers were rated higher on likeability by those with higher benevolent sexism scores, whereas no difference was seen for male decision-makers' likeability. Dashed lines indicate 95% confidence bands.

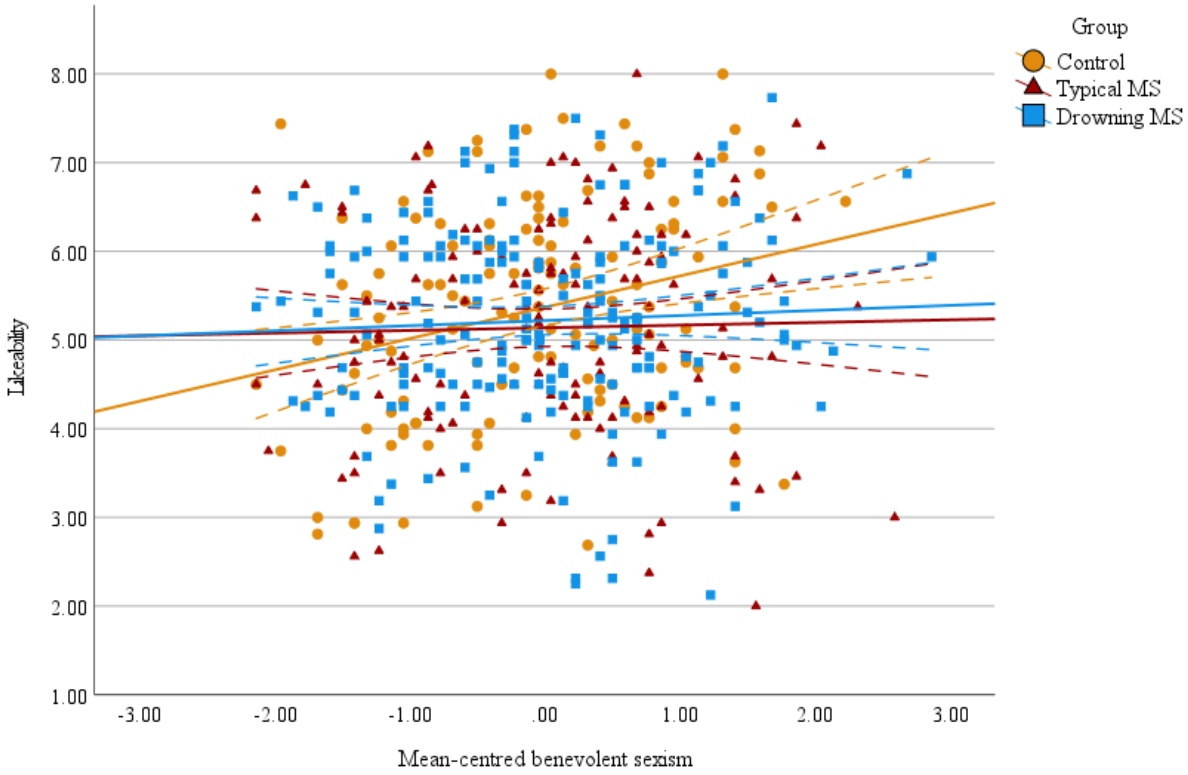

Figure 4.5. Mean-centred benevolent sexism for likeability ratings across interventions among male participants. An inverse relationship between likeability and benevolent sexism is noted for mortality salience interventions, compared to control. Dashed lines indicate confidence bands (95%).

We probed these interactions further by creating Higher-BS (1 *SD* above mean) and Lower-BS (1 *SD* below mean) models (Aiken & West, 1995). Significant effects were found within likeability ratings for DM Gender (b = .30, SE = .08, $t(1, 447) = 3.74$, $p < .001$, $\eta^2 = .031$) and Threat vs. Control (b = -.16, SE = .06, $t(1, 447) = -2.62$, $p = .009$, $\eta^2 = .015$) for those higher in BS, but not lower (b = -.03, SE = .08, $t(1, 447) = -0.32$, $p = .750$ and b = .03, SE = .06, $t(1, 447) = 0.49$, $p = .624$, respectively). Table 4.5 displays outcomes from our base GLM and from BS moderation GLMs.

Table 4.5. Male participants' outcomes for base model and benevolent sexism moderation.

	Likeability		Competence	
	b	*SE*	*b*	*SE*
Base model (with contrast coding)				
Threat (1) vs. Control (-2)	-.06	.041	-.08*	.034
MS (-1) vs. Drowning (1)	.04	.066	.04	.055
DM Gender: Female (1), Male (-1)	.12*	.056	.03	.047
Threat x DM Gender	.06	.041	.02	.034
MS vs Drown x DM Gender	-.04	.066	-.03	.055
Benevolent Sexism (BS) Moderation Model				
Threat vs. Control	-.06	.041	-.09*	.034
MS vs. Drowning	.03	.066	.03	.055
DM Gender	.14*	.056	.05	.047
Threat x DM Gender	.05	.041	.01	.034
MS vs Drown x DM Gender	-.04	.066	-.03	.055
Threat vs. Control x BS	-.09*	.043	-.06†	.036
MS vs. Drowning x BS	.01	.067	.05	.056
DM Gender x BS	.17**	.057	.07	.048
Threat x DM Gender x BS	.00	.043	.01	.036
MS vs Drown x DM Gender x BS	-.03	.067	-.04	.056
Effects at High BS				
Threat vs. Control	-.16**	.059	-.14**	.049
MS vs. Drowning	.04	.092	.08	.076
DM Gender	.30**	.079	.12†	.066
Threat x DM Gender	.05	.059	.02	.049
MS vs Drown x DM Gender	-.07	.092	-.07	.076
Effects at Low BS				
Threat vs. Control	.03	.057	-.03	.048
MS vs. Drowning	.02	.093	-.02	.078
DM Gender	-.03	.079	-.03	.066
Threat x DM Gender	.05	.057	.00	.048
MS vs Drown x DM Gender	-.01	.093	.01	.078

Note. MS = mortality salience; DM = decision-makers; †p≤.10; *p≤.05; **p≤.01

The positive *b* in the DM Gender at Higher-BS model means that decision-makers' likeability was significantly influenced by their gender among those higher in BS (.60 points higher, *C.I.* 95% 0.28, 0.90), but not those lower in BS, as significant gender effects were not found in the Lower-BS model (see Table 5 and Figure 4). The negative *b* in the Threat vs. Control at Higher-BS model means that decision-maker likeability decreased (by .48 points, *C.I.* 95% -3.27, -0.12) in threat (vs. control) conditions among higher-BS men (Table 5; Figure 5), but no significant effects were found among those lower in BS (Table 5; Figure 5).

Competence ratings were similarly explored for higher and lower BS. Figure 4.6 displays a scatterplot of competence scores across interventions, as we found significant effects at higher-BS levels for the Threat vs. Control contrast (b = -.14, SE = .05, $t(1, 447)$ = -2.90, p = .004, η^2 = .019) but not at lower-BS (b = -.03, SE = .05, $t(1, 447)$ = -0.55, p = .584). Among men with higher BS, mortality salience threats (typical and drowning) lowered competence ratings of decision-makers, compared to the control.

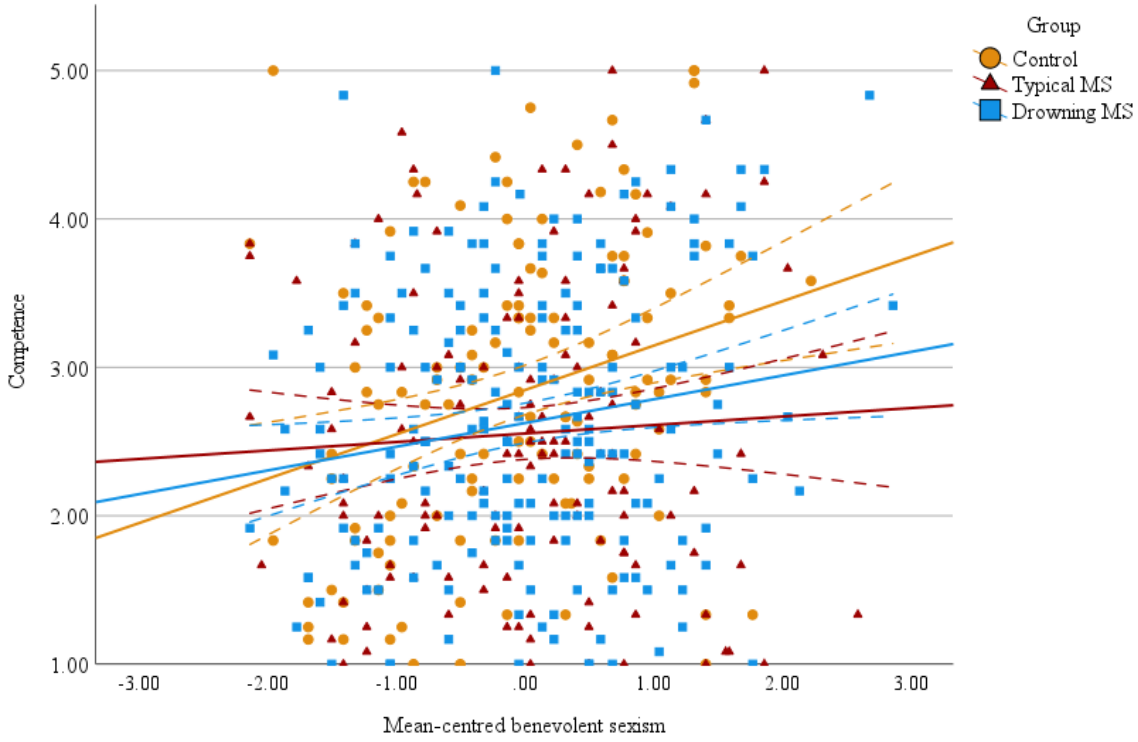

Figure 4.6. Mean-centred benevolent sexism for competence ratings across interventions among male participants. The mortality intervention displays a slight inverse relationship with benevolent sexism, where, as benevolent sexism increased, competence for the decision-maker decreased. Drowning appears similar to the control. Dashed lines indicate 95% confidence bands.

Marginally significant moderation effects were found for decision-maker gender at higher-BS (Figure 4.7). With higher BS, female decision-makers' competence ratings increased to a greater extent than did male decision-makers' ratings.

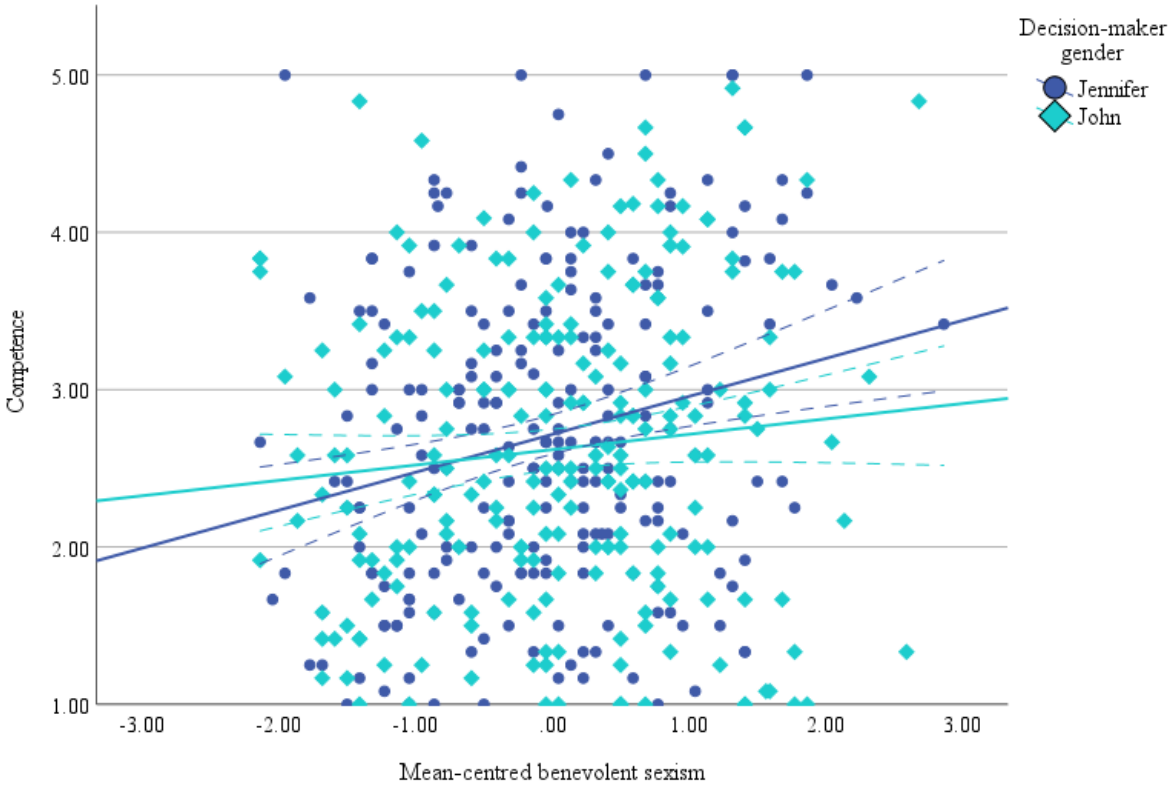

Figure 4.7. Mean-centred benevolent sexism for competence ratings of female (Jennifer) versus male (John) water decision-makers among male participants. Female decision-makers were rated higher on competence by those with higher benevolent sexism scores (nearing significance), whereas no significant interaction effects were found for lower-BS men. Dashed lines indicate 95% confidence bands.

4.5.3 Exploratory female results

For female participants, initial planned contrast results showed significant effects of DM Gender for likeability (b = .21, SE = .11, t(1, 147) = 2.02, p = .046, η^2 = .027) and near significant effects for competence (b = .15, SE = .06, t(1, 147) = 1.90, p = .059, η^2 = .024). Mean scores for likeability and competence across intervention and by gender are displayed in Figures 4.8 and 4.9, below.

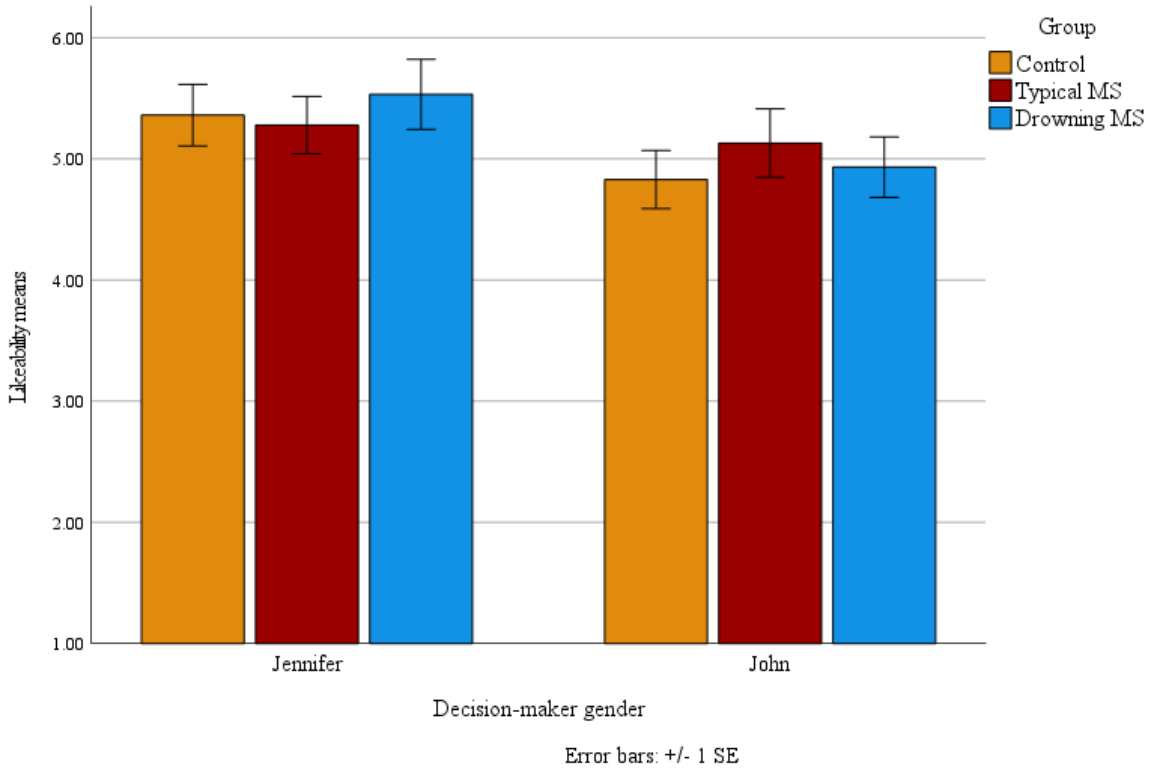

Figure 4.8. Means distribution of likeability ratings for female (Jennifer) and male (John) decision-makers across conditions among female participants.

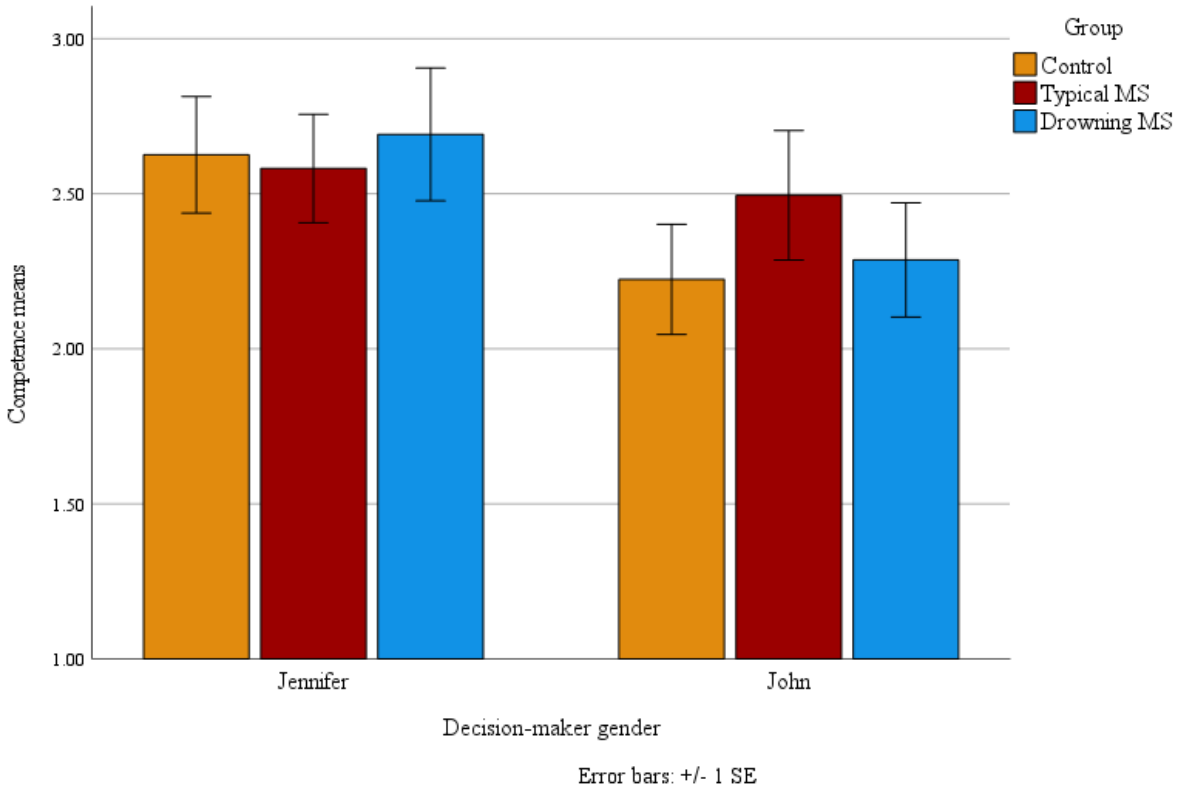

Figure 4.9. Means distribution of competence ratings for female (Jennifer) and male (John) decision-makers across conditions among female participants.

We explored mean-centred hostile and benevolent sexism, as was done with male participants; for likeability ratings, the Threat x DM Gender interaction effect was moderated by BS (b = .21, SE = .08, t(1, 147), = 2.63, p = .009, η^2 = .047). Competence ratings showed similar patterns, with the Threat x DM Gender interaction again moderated by BS (b = 12, SE = .06, t(1, 147) = 2.02, p = .045, η^2 = .028). As such, higher and lower BS were probed; outcomes are displayed in Table 4.6.

Table 4.6. Female participants' outcomes for base model and benevolent sexism moderation.

	Likeability		Competence	
	b	*SE*	*b*	*SE*
Base Model (with contrast coding)				
Threat (1) vs. Control (-2)	.04	.073	.03	.054
MS (-1) vs. Drowning (1)	.01	.133	-.03	.098
DM Gender: Male (-1), Female (1)	.21*	.106	.15†	.078
Threat x DM Gender	-.03	.073	-.03	.054
MS vs Drown x DM Gender	.11	.133	.08	.098
Benevolent Sexism Moderation Model				
Threat vs. Control	.03	.072	.02	.052
MS vs. Drowning	.00	.130	-.04	.094
DM Gender	.20†	.104	.13†	.075
Threat x DM Gender	-.03	.072	-.03	.052
MS vs Drown x DM Gender	.10	.130	.06	.094
Threat vs. Control x BS-mean	.06	.080	.07	.058
MS vs. Drowning x BS-mean	-.02	.133	.09	.096
DM Gender x BS-mean	.06	.111	.04	.080
Threat x DM Gender x BS-mean	.21**	.080	.12*	.058
MS vs Drown x DM Gender x BS-mean	-.04	.133	.01	.096
Effects at High Benevolent Sexism				
Threat vs. Control	.09	.104	.08	.075
MS vs. Drowning	-.01	.178	.05	.128
DM Gender	.26†	.146	.17	.105
Threat x DM Gender	.17	.104	.08	.075
MS vs Drown x DM Gender	.07	.178	.07	.128
Effects at Low Benevolent Sexism				
Threat vs. Control	-.02	.103	-.04	.074
MS vs. Drowning	.02	.182	-.12	.131
DM Gender	.14	.147	.10	.106
Threat x DM Gender	-.22*	.103	-.14†	.074
MS vs Drown x DM Gender	.14	.182	.06	.131
Simple Effects for Low BS and Male DM				
Threat vs. Control	.20	.143	.10	.103

	Likeability		Competence	
	b	*SE*	*b*	*SE*
MS vs. Drowning	-.12	.248	-.18	.179
Simple Effects for Low BS and Female DM				
Threat vs. Control	-.25†	.149	-.18†	.108
MS vs. Drowning	.16	.266	-.07	.192

Note. MS = mortality salience; DM = decision-makers; †p≤.10; *p≤.05; **p≤.01

For both higher and lower HS, no interaction effects were found. Among higher-BS women, marginally significant simple effects were found for DM Gender (*b* = .26, *SE* = .15, *t*(1, 147) = 1.77, *p* = .078, η^2 = .022) on likeability ratings. For lower-BS women, we found simple interactions of Threat by DM Gender (*b* = -.22, *SE* = .10, *t*(1, 147) = -2.18, *p* = .031, η^2 = .032). Thus, the liking effect of Threat vs. Control varied with DM Gender. For competence ratings, no significant interaction effects were found for higher BS and marginally significant interaction effects of Threat by DM Gender were found at lower BS (*b* = -.14, SE = .07, *t*(1, 147) = -1.85, *p* = .066, η^2 = .024). These three-way interactions are displayed for likeability (Figure 4.10) and competence (Figure 4.11).

Simple effects were further probed via dummy variables to determine significance regarding ratings of male versus female decision-makers among lower-BS women (Table 4.6). For both appraisal ratings, marginally significant simple effects were found for Threat vs. Control (likeability *b* = -.25; competence *b* = -.18).

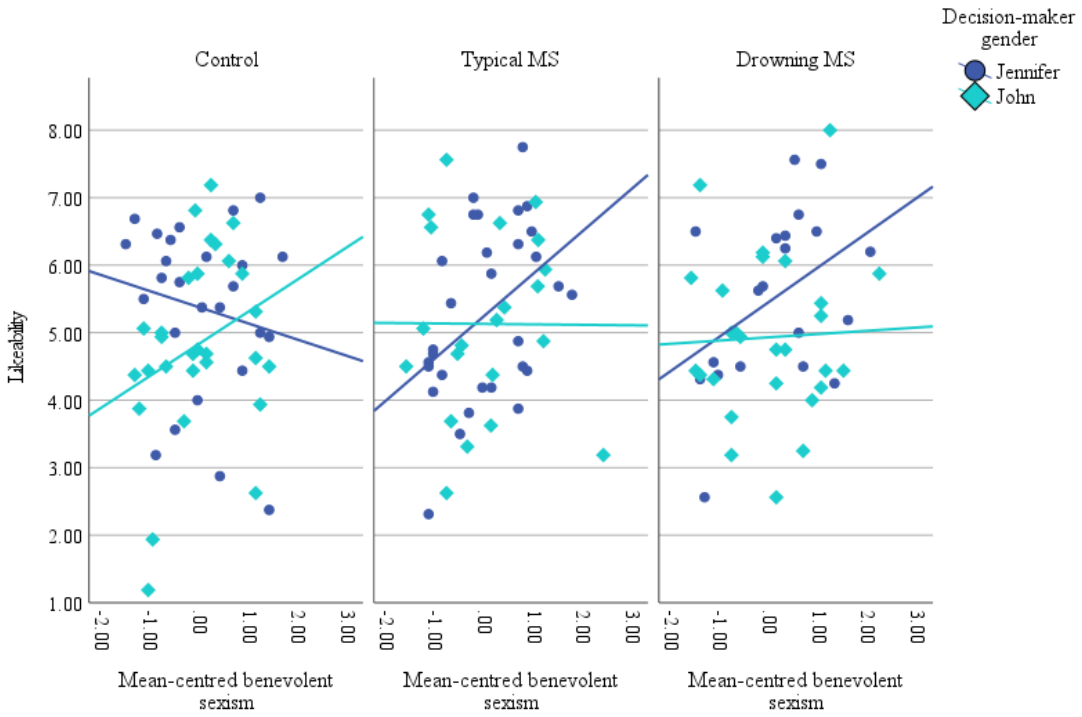

Figure 4.10. Significant three-way interaction of intervention, decision-maker gender, and benevolent sexism on likability ratings among female participants.

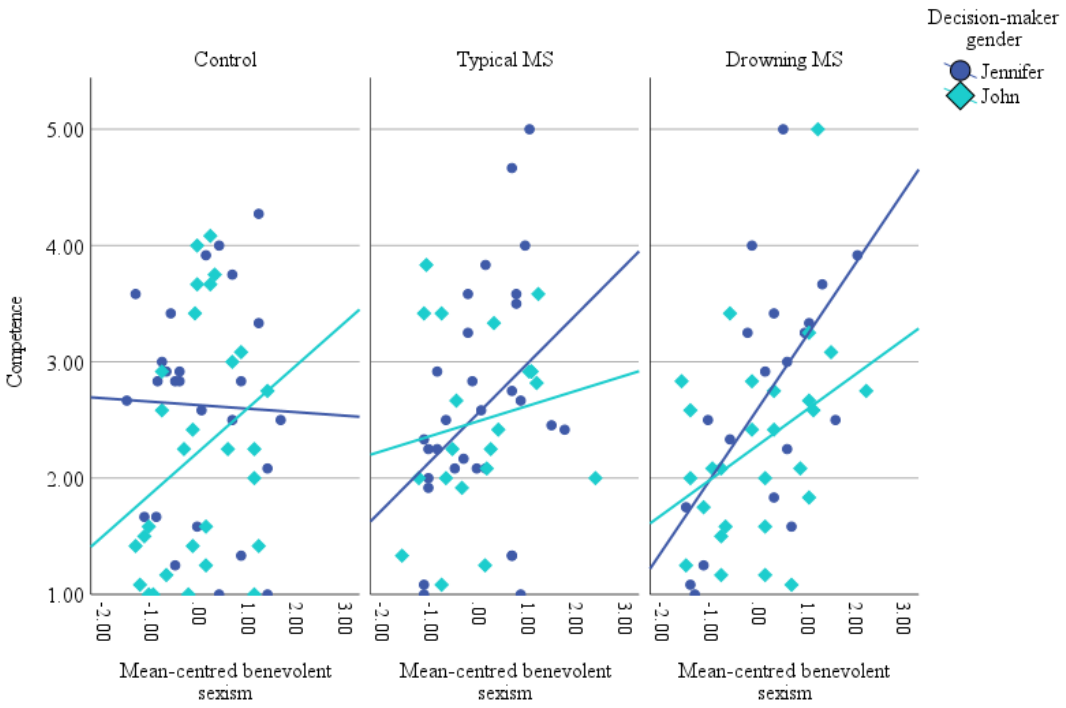

Figure 4.11. Significant three-way interaction of intervention, decision-maker gender, and benevolent sexism on competence ratings among female participants.

4.6 Discussion

Overall findings are explained below, first discussing general likeability and competence results before considering BS influence on decision-maker likeability and susceptibility to threat conditions. We then considered BS's role regarding likeability and competence ratings under threat. Male participant outcomes are described first, with female results thereafter. We discussed drowning MS outcomes for both participant groups. Lastly, we connected our findings to extant literatures, relating to Terror Management Theory and gender-leadership discourse, before considering practical applications for decision-making in water management.

4.6.1 Male participants: Overall decision-maker appraisal and the role of benevolent sexism

While we expected detectable interactions between intervention and decision-maker gender, resulting in more negative appraisal of female decision-makers in threat conditions, the overall effects of decision-maker gender for likeability and MS effects within competence ratings were central. Potential explanations are presented below.

4.6.1.1 Likeability ratings from male participants

A possible explanation for higher female decision-maker likeability comes from gender-social psychology literature. These scholars have identified that women are often rated more favourably than men in general, referred to as the "women-are-wonderful" (WAW) effect (Eagly et al., 1991; Eagly & Mladinic, 1994). This effect can be seen as a form of benevolent sexism, as BS involves expecting women to be kind, gentile, and agreeable (Eagly & Mladinic, 1993). A high

rating of women from those higher in BS may not persist when women are in gender incongruent roles, such as management or leadership, where such communal traits are not stereotypically valued. In fact, WAW may explain our findings considerably, as expanded below. Further, the likeability scale directly measured how likeable the decision-maker was to the participant; it may be that the WAW effect was strong enough to outweigh any underlying intervention differences, such as those observed for overall competence ratings by male participants. Perhaps with a larger sample size or different wording, intervention differences might be more evident. For instance, if the decision-maker had been explicitly described as a leader or in a top managerial position, outcomes may have been more negative for female decision-makers due to gender role incongruity (Eagly & Karau, 2002).

4.6.1.2. Competence ratings among male participants

Following typical MS and drowning MS, decision-makers were rated less competent regardless of gender by male participants. We suggest two potential explanations for this finding.

First, it is possible that decision-makers were seen as outgroups by our participants. While we selected people with similar education levels to water managers and decision-makers, we did not specifically limit participants to those in water sectors nor did we ask participants to imagine themselves as water managers. If participants were primed to consider the decision-makers as part of their ingroup or with some shared interest, perhaps decision-makers would have been rated more favourably, as observed in other TMT (Greenberg et al., 1992; Motyl et al., 2011) and intergroup bias research (Hewstone et al., 2002; Van Assche et al., 2023). Additionally, our

vignettes mentioned mortality risks from the water decision being made: "…potential contaminants could cause nausea, diarrhea, or even fatalities among vulnerable populations." (Supplementary Material 12). This text could have reprimed participants with mortality anxiety, causing participants to distance themselves from the water decision-maker if they were seen as an outgroup or as someone with different values and/or worldviews than the participant. However, outgroup distancing is a distal defense and while the text may have been a subtle reminder, instigating distal defenses, we might alternatively expect proximal defenses from the reminder's temporal recency (Pyszczynski et al., 1999). A death-thought accessibility measure may illuminate what defenses were involved at this stage (Hayes et al., 2008), but was not included as we did not want to interfere with the MS defenses of interest (e.g., ingroup bias via decision-maker appraisal). Further, other TMT scholars have argued that death-thought measures may reprime mortality anxieties, making it difficult to infer what precisely influences participant behaviour when that behaviour is measured after death-thoughts (Hayes & Schimel, 2018).

A second explanation for threat effects on competency considers the questions of this measure. Our competence questions asked specifically about working with, respect for, and trust in the decision-maker and their choices. Perhaps the WAW effect was not as strong when competency was being evaluated as participants were being asked more about collegial and workplace relations rather than general likeability of the decision-maker. This devaluation of women at work – particularly in leadership roles – has been documented in prior gender research (Klutsey, 2020; Koenig et al., 2011; Kossek et al., 2017) and in TMT-gender literature where women were

rated less competent following a mortality reminder (Goldenberg et al., 2007; Roberts et al., 2002), particularly when they are seen as gender incongruent (Florian et al., 2001).

4.6.1.3 Benevolent-sexism-specific findings among male participants

When participants were examined for higher vs. lower BS moderation, several findings emerged.

First, we found that the higher the BS score for men, the higher the female decision-makers were scored for likeability, consistent with what was found for men overall. This matches our considerations above regarding why overall likeability ratings were higher for women; perhaps those higher in BS are especially likely to rate women as more favourable because they see women as more agreeable and likeable in general (Eagly & Mladinic, 1994). Further, BS has been correlated with positive attitudes towards women (Glick & Fiske, 1996). It must be stressed that this does not mean BS is not harmful; recall it represents beliefs that women should remain in stereotypically traditional care-taking and domestic roles and hinges on men maintaining dominion over women (Glick & Fiske, 1996). In addition, management scholars have found that BS can prevent women from being assigned challenging but important skill-development tasks, reducing opportunity for promotion and leadership as male counterparts gain experience from these tasks instead (King et al., 2012).

Second, BS significantly moderated likeability ratings in threat conditions, and to marginal significance for competence ratings. While likeability and competence increased with higher BS in the control, this was not observed in threat conditions. Perhaps these participants sought to distance themselves from the decision-maker whose existence confirms an existential threat.

Rating the decision-maker more negatively may have been a way to deny mortality risk and keep death anxiety at bay.

Third, DM Gender was significantly moderated by higher-BS for likeability and marginally for competence ratings. Thus, among men higher in BS, appraisal ratings were indeed influenced by BS and different for male versus female decision-makers. As seen in Figure 4.4 for likeability and (marginally) in Figure 4.5 for competence – while the male decision-maker ratings did not vary with BS, female decision-maker ratings increased with higher BS.

Overall, the significant simple effects described above regarding Threat vs. Control and decision-maker gender were found at higher-BS, but not at lower-BS for male participants. Thus, depending on how men viewed women – whether they believed women belong in traditional, nurturing roles – influenced their appraisal of the female water decision-maker. While this bias seemed to benefit women on likeability ratings, it did so only marginally on competency. Again, considering that likeability does not translate to equitable treatment at work, these effects warrant further attention. It does not benefit women nor serve to improve equity and inclusion if women are merely rated more likeable but not rewarded for their efforts or provided the mentorship and opportunities for advancement (Schulz & Enslin, 2014; Sunil, 2022).

4.6.2 Female participants: Overall decision-maker appraisal and the role of benevolent sexism

As the female population was an exploratory analysis with a smaller sample size, we did not make hypotheses regarding expected appraisal outcomes. We did find overall significant effects

of decision-maker gender on likeability and marginally significant on competence ratings. These results are discussed below in addition to benevolent sexism's moderating role.

4.6.2.1 Likeability and competence ratings from female participants

We found that women rated female decision-makers significantly more likeable than male, and marginally significantly more competent. As overall threat effects were not found, this finding could be related to the WAW effect described above, or perhaps to inherent ingroup biases that lead women to prefer other women (Rudman & Goodwin, 2004). This effect seemed to be slightly diminished for competency ratings, but for both appraisals, women scored male decision-makers lower than women after typical or drowning MS, potentially reaffirming ingroup gender preferences as a distal mortality defense.

4.6.2.2 Benevolent-sexism-specific findings among female participants

Considering benevolent sexism, interesting interacting effects were found. Marginally significant interaction effects were found for Threat x DM Gender x BS for likeability and competence.

Lower-BS women rated female, but not male, decision-makers less likeable and less competent in threat conditions (mortality or drowning) but not the control. Perhaps gender role incongruence led women to view other women more negatively following the threats (Eagly & Karau, 2002), or terror management effects influences could explain the negative ratings via creaturely reminders (Goldenberg et al., 2019). As explained above, we did not ask participants to identify common ground with the decision-maker, so ingroup gender bias was not enough here to cause lower-BS women to prefer female decision-makers. However, low-BS women in

general are less gender congruent themselves, so this explanation may not suffice. Social psychology research shows a negative relationship between women's BS and approval of agentic behaviour among women (Kahn et al., 2021). An alternate explanation may be that lower-BS women are holding gender in-group members to a higher standard (Fernández et al., 2014). The female decision-maker chose financial-savings over improved environmental outcomes, thus may be contradicting expectations for lower-BS peers who may hold women in leadership roles, a position in which women are a minority, to higher standards thus expecting more moral behaviour (Fernández et al., 2014).

4.6.3 Water-specific mortality threat influence on decision-maker appraisal

One of our central goals was to determine if water-specific MS influenced decision-maker appraisal similar to typical MS. We observed overall threat effects on DM appraisal ratings (as discussed above and summarized below). We did not find drowning MS to be any more or less potent a threat than typical MS. As such, it would be important for water crisis communicators to consider the implications of threatening language in decision-making scenarios. Our results illustrate how MS can limit appraisal ratings of decision-makers compared to a control. In scenarios where gender biases may be active due to gender role incongruency, such as when increasing involvement of underrepresented leaders or managers, problem framing and language choice warrants consideration lest mortality salience further exacerbate gender biases present.

4.6.4 Theoretical implications

Our findings relate and are applicable to Terror Management Theory, gender role theory, or a combination thereof. Overall, some of our findings supported prior TMT and gender studies research and others did not. We found MS to be moderated by benevolent sexism for (a) higher-BS male participants regarding decision-maker appraisals and (b) lower-BS female participants' appraisal of female decision-makers. Potential explanations for these similarities and discrepancies are provided below, considering timing and sample size in comparison to TMT and gender studies, before discussing connections to leadership literatures.

Timing

First, the study recruitment timing may have influenced our results. Participants were recruited in 2021-2022, amid the widespread media coverage of an ongoing COVID-19 pandemic and fluctuating restrictions in the USA and Canada. The pandemic has been established as a societal-wide mortality reminder (Courtney et al., 2020; Emanuel et al., 2021), perhaps minimizing the difference between intervention and control MS effects. Perhaps a non-pandemic study would have detected stronger MS effects, perhaps even outweighing WAW effects observed here. A stronger MS effect could also lead to stronger intergroup biases, as noted in prior TMT research (Barth et al., 2018; Castano, 2004; Castano et al., 2002; Fritsche et al., 2012; Giannakakis & Fritsche, 2011; Harmon-Jones et al., 1996; Uhl et al., 2018), potentially influencing appraisal more starkly than detected in this study.

Sample size

Another possible factor for differences could relate to sample size. Burke et al.'s 2010 review of 20-years of TMT research noted that, on average, TMT sample sizes have been around 87 participants, with a range of 17 – 343. Our 453 male participant sample is far above that range – even our 153 female sample is above Burke et al.'s 2010 average. Gender-specific TMT studies have typically focused on the extent to which female bodily reminders influence mortality anxiety, objectification, and health behaviour changes (see Goldenberg et al., 2019 for a review). While Cohen et al. (2004) examined MS influence on leader appraisal based on leadership styles (N=190) and Hoyt et al. (2009, 2011) explored MS and gender roles within leadership specifically (N=89-91), it is clear more research is required, preferably with larger sample sizes for increased confidence in findings.

More research in general into gender-specific appraisal differences following mortality threats would provide necessary insights into gender biases in climate and water decision-making contexts. For example, Florian et al. (2001) found that MS caused gender congruent girls and boys to prefer interacting with other gender congruent peers than those who were gender incongruent, while those who were gender incongruent preferred gender incongruent others. Due to the various stereotypes and norms regarding women in decision-making roles – such as incongruent gender roles and human responses to existential threats that can exacerbate these stereotypes – it is clear from our findings that judgements about decision-makers under threat leads to complicated psychosocial reactions. By examining implicit sexism factors – particularly BS – we can observe patterns important to consider within real-world decision-making scenarios, especially when equity and diversity are goals for improved environmental outcomes.

Ultimately, a better understanding of TMT and gender role implications within realistic-but-threatening decision-making scenarios may help clarify how to best increase diversity in these spaces.

4.6.5 Implications for water crisis practitioners

It is clear from our findings and literature review that the path to increasing diversity and equity in water management for more sustainable outcomes can be arduous. To consider the real-world applications of our research, several areas must be discussed. First, leadership applications are discussed as significant power lies in these positions. Next, workplace dynamics are addressed before suggestions are provided on how to tackle gender biases.

Our findings respond to calls for increased behavioural research within leadership theory (Banks et al., 2021). We have argued that greater gender diversity is needed in high-ranking positions to obtain more effective, durable, and widely applicable solutions to impending water crises. With diverse leaders, more versatile water solutions can be applied that serve the needs of many. Leadership scholars have argued that gender equality is insufficient: women need to be the clear majority to be heard and acknowledged and group norms need to signal that each member has valuable contributions regardless of implicit biases held (Mendelberg & Karpowitz, 2016; Stoddard et al., 2020; Terjesen et al., 2009). As those in leadership positions are those with the power to make decisions on organization direction and focus, such as more sustainable water choices, diverse, inclusive leadership has the potential to develop water solutions that will be effective, successful, and equitable. However, simply placing women in leadership roles is

insufficient. Women must be well-prepared for the required tasks (Harris, 2009) and sufficiently supported in the workplace.

The workplace itself must also be equipped to support women, particular in spaces that have been frequently male-dominated, such as water management. Despite increased education and recruitment rates for women in traditionally male-dominated fields, retainment maintains an issue that prevents women from reaching management and leadership positions (Bird, 2011; Fritz & van Knippenberg, 2018; Kossek et al., 2017). Workplaces often lack sufficient childcare considerations – important as women remain predominant caregivers in households (Cousins, 2021; Moreno-Colom, 2017) – and organizations lacking women in leadership roles have limited training and mentorship opportunities for women, and lack non-male role models (Fritz & van Knippenberg, 2018; Kossek et al., 2017). Considering the effects we found for both high and low benevolent sexism among men and women (respectively), additional strategies that address BS in the workplace would be beneficial. Prior psychology research would support this, for example, Hideg and Ferris (2016) examined BS and workplace gender equity and found that individuals higher in BS were more supportive of workplace equity policies – but only those that funneled women into stereotypically feminine positions. Incorporating BS-aware equity strategies may help increase gender diversity among management and leadership.

Lastly, our findings have shown that gender biases and implicit sexism influence same and different gendered decision-maker appraisal. Further exploration of these patterns among actual decision-makers and leaders would provide valuable insights for enhanced water solutions.

Fortunately, strategies exist to limit these biases and increase cooperation among diverse decision-making groups. For example, psychologists have found that increased intergroup contact – more interaction with different types of groups – decreased prejudice and outgroup derogation (Pettigrew, 1998; Van Assche et al., 2023). Recent research on allyship has shown that proactive – for example, including underrepresented groups on projects they might not be otherwise – even more than reactive – responding to biased behaviour as it happens – effectively reduces discrimination felt by underrepresented employees (Hall, Schmader, Cyr, & Bergsieker, 2022; Hall, Schmader, Inness, & Croft, 2022). Identifying similarities among group members has also been found to reduce bias, by psychologists (Gaertner et al., 2012) and terror management scholars specifically (Giannakakis & Fritsche, 2011). Water managers should incorporate such strategies when seeking to increase diversity among decision-makers. These changes may be difficult and complex, but the benefits to sustainable, equitable water outcomes are worthwhile as the solutions are increasingly needed with climate change.

4.7 Conclusion

Water crises will only increase with climate change, requiring effective, pro-environmental, impactful solutions that provide water security for all. As environmental scholars have shown diverse decision-making groups are well-equipped for these solutions, it is imperative that water management makes equity and diversity in decision-making a priority. Our research responds to calls to fill water gaps in climate change recommendations (Douville et al., 2022) and behavioural gaps in leadership studies (Banks et al., 2021). We have illustrated how life-

threatening topics can influence decision-maker appraisals, which in turn can determine whose voices are heard and valued, and subsequently, what solutions are implemented. Group dynamics are complex; our results show gender dynamics, particularly benevolent sexism, within typically male-dominated settings only add to this complexity. Given the potential – if not likelihood – for gender and intergroup biases to influence decisions in water crisis management, it is essential that diversity efforts in these workplaces be intentional and strategic. For instance, diversity strategies that emphasize differences can fail to engage or motivate those in power – and those without (Dobbin & Kalev, 2018). Rather, efforts that stress similarity, collective goals, proactive allyship, and interaction with different others, as described above, have been effective for improving inclusion. Empirically supported strategies to minimize intergroup biases should be in place in addition to attention on retention of underrepresented groups. While our initial research focused on gender, other identity intersections are necessary to consider within water decision-making and are worth incorporating in future research (Rice et al., 2019). The need for equitable representation in water decision-making does not equate to the responsibility for these decisions falling solely to underrepresented groups. Rather, these voices, values, and knowledge provide unique perspectives that can identify solutions and highlight concerns that may be otherwise missed. To ensure such diversity is obtainable and equitable, intergroup biases that occur at individual and structural levels within water management – and other homogeneous spaces – must be addressed. A broader, nuanced understanding of water crises and potential solutions is possible with greater diversity at the decision-making table.

Chapter 5. Conclusions

5.0 Chapter summary

This conclusory chapter is a summary and synthesis major findings and significant knowledge contributions from my dissertation. I first review the research purpose, then major findings from the three manuscripts, before detailing overall contributions to academia and practice. I discuss limitations encountered and recommendations for future research and close with reflections on my doctoral research journey.

5.1 Research purpose

The purpose of my research was twofold. The first goal was to understand how life-threatening water communication influenced human psychosocial responses, specifically regarding mortality anxiety and environmental identity. Second, I sought to understand how that communication influenced intergroup gender biases among water decision-makers. Theoretical background was provided in Chapter One, in addition to a literature overview necessary for understanding the context of the research program and illustrated unique opportunities from synthesizing several research fields for improved water crisis response. Three life-threatening water scenarios were empirically tested in Chapter Two in comparison to a typical mortality reminder and a control to identify resulting mortality anxieties among a real-world sample (Research Question One). Life-threatening water scenarios were further examined in Chapter Three by determining their influence on polarizing environmental identity, and connecting that response to potential pro-

environmental behaviour (Research Question Two). In Chapter Four, these findings were applied to water decision-making and gender bias, empirically testing the influence of a typical mortality reminder and a life-threatening water reminder on appraisal of similar or different gendered water managers (Research Question Three).

My dissertation was guided by research objectives to identify whether Terror Management Theory (TMT) insights could improve both water crisis decision-making and gender equity and inclusion within water management. This research is one of the first, if not the first, to test water communications specifically as mortality reminders and to measure their influence on environmental identity and gender bias within water decision-making. Major findings are synthesized below with the research implications for the academy and practice thereafter.

5.2 Major findings

> *"Given today's accelerated pace of technological development and the slow pace of social developments, it seems likely that the biggest issue or constraint in the future will remain what it is today: namely the human component of water management, not the technical one." (Cosgrove & Loucks, 2015).*

Three related but independent manuscripts presented dissertation research and findings; these outcomes are presented in chronological order.

Chapters Two and Three were designed to test human psychosocial responses to life-threatening water messages. Findings are described separately and then combined below.

Results in Chapter Two showed that some, but not all, operationalizations of life-threatening water messaging increased mortality anxieties – via death-thought accessibility (DTA) measures – similar to a typical mortality reminder. Specifically, a drowning reminder increased DTA in word-fragment and image description tasks, contaminated water increased DTA in the image description task, and dehydration did not increase DTA on either measure. When all water conditions were combined and compared against a control, significant difference was found, with larger effects on the latter DTA measure (image description task). These findings demonstrated that life-threatening water reminders concerning drowning and contaminated water influence mortality anxieties in real-world populations. As discussed in Chapter Two, this may relate to drowning's mortal potency and disgust responses connected to contaminated water. Dehydration may be a survivable experience that is too abstract from drought scenarios to be an effective mortality prime for our American and Canadian sample population.

The outcomes in Chapter Three demonstrated that life-threatening water reminders and typical mortality reminders led to more polarized environmental identities among a real-world population. Aligned with previous TMT literatures, these existentially threatening reminders led participants to support environmentalism beliefs more vigorously. This has implications for pro-environmental behaviour as social psychologists have connected environmental identity (EID) with increased pro-environmental intention and behaviour.

In combination, the findings from Chapters Two and Three deepen our understandings of how and when to use threatening water messaging in pro-environmental campaigns that seek to

improve water outcomes. The results from these chapters show that life-threatening water messages engage psychosocial responses similar to typical mortality reminders used in conventional TMT research and engage identity bolstering defenses. This is essential and perhaps unexpected information for future water crises framing within decision-making scenarios.

Chapter Four further examined threatening water communication within water decision-making contexts, building on previous chapters and using the strongest water-related mortality reminder: drowning. Major chapter findings showed that men rated female decision-makers more likeable and, following a mortality or water threat, male participants rated decision-makers of either gender less competent than in the control. When Benevolent Sexism (BS) was included as a predictor variable, significant effects were found for higher, but not lower, BS men. As BS increased, so did appraisal ratings in the control but not in the MS groups. Benevolent sexism also significantly moderated DM Gender effects on likeability, so that as BS increased, likability of female decision-makers increased while male decision-maker ratings did not. This trend repeated for competence ratings to a lesser extent. Potential explanations for these findings considered the "women-as-wonderful" effect and intergroup differences between participants and the fictional decision-makers.

Among the exploratory female sample, women generally rated female decision-makers significantly higher on likeability and nearing significance on competence. Benevolent sexism was again included as a predictor variable in a moderation model. A significant three-way

interaction was found for Threat, Gender, and Benevolent Sexism on ratings of likeability and competence. This interaction was probed to explore higher versus lower-BS and significant effect was found for lower-BS regarding likeability and marginally for competence. Further probing revealed simple effects for lower-BS on Threat vs. Control regarding ratings of female, but not male, decision-makers. While appraisal ratings generally increased with higher BS in MS intervention groups, mortality salient female participant groups with *lower* BS displayed *lower* appraisal ratings for female decision-makers than the control. Potential explanations considered that perhaps female decision-makers were viewed as outgroups by female participants lower in BS or that mortality reminders enhanced negative biases towards women, as found in prior TMT research (Cox, Goldenberg, Arndt, et al., 2007; Goldenberg et al., 2007; Roberts & Gettman, 2004), discussed further below in academic contributions.

Overall, mortality threats influenced appraisal ratings of water decision-makers and benevolent sexism influenced women and men in different ways, dependent on degree of BS. We found that male participants' ratings of decision-makers significantly differed by condition (for Threat vs. Control and DM Gender) among those *higher* in BS, whereas female participants' ratings of decision-makers significantly varied (for Threat X DM Gender) among those *lower* in BS. The findings from Chapter Four illustrated the complexity of water decision-making, decision-maker appraisal, and gender analysis within water crisis management. Water-specific morality threats appear to be similarly potent to typical MS, thus, ensuring communication in water crises considers psychosocial responses to mortality reminders is essential when equitable and sustainable outcomes are sought. Moreover, there are gender-specific differences, particularly

contingent on benevolent sexism presence, that are worthy of further exploration in order to best understand group decision-making dynamics within water crisis management.

5.3 Academic contributions to theory and practice

In line with transdisciplinary goals of the School of Environment, Resources and Sustainability doctoral program (University of Waterloo, n.d.), I sought to ensure the dissertation research provided practical insights in addition to significant and original contributions to academic knowledge. Academic contributions from the dissertation research are outlined below, followed by practical applications.

5.3.1 Academic contributions

Academic contributions are described first regarding Terror Management Theory, environmental psychology, and then gender intergroup relations.

My dissertation adds to TMT literature on climate change as an existential threat and resulting human responses. Specifically, Chapter Two methods and findings contributed to the Death-Thought Accessibility hypothesis. Here I empirically tested three water reminders and determined that drowning and contaminated water increased death-thought accessibility similar to a typical mortality reminder, while dehydration did not. This provides a launching point for further specific operationalizations of climate change reminders and responses. As observed with the Terror Management Theory Health Model (Goldenberg & Arndt, 2008), built to understand health responses to mortality reminders, a TMT-Climate Model could be possible with further

climate operationalizations and response studies, as suggested by Smith et al., 2022. The research within Chapters Three and Four contributed to our understanding of TMT's Mortality Salience hypothesis. Specifically, worldview reinforcement (Environmental Identity) changes following existential threat exposure was examined in Chapter Three. These findings expanded TMT-Climate insights, illustrating that water-related mortality reminders increased polarization in EID similarly to a typical mortality reminder. Results from Chapter Four deepened insights about ingroup appraisal and outgroup derogation following existential threats in a gendered, water management context. Prior TMT scholars have found that women and men both display negative gender biases towards women following mortality threats (Cox, Goldenberg, Arndt, et al., 2007; Goldenberg et al., 2007; Roberts & Gettman, 2004), although these studies also included body and disgust reminders. Alternatively, other TMT scholars have found that those who identity with their sex-role (e.g., feminine women, masculine men) avoid those who are gender incongruent (e.g., masculine women, feminine men) following mortality threats (Florian et al., 2001). For gender incongruent participants, feminine men but not masculine women avoided gender congruent others (Florian et al., 2001). These earlier findings were not replicated in my research: for men, appraisal ratings increased in the control but not MS groups and was moderated by BS but not decision-maker gender. Sex-role congruency was not measured or controlled for in this dissertation but could reveal differences not detected here. While likeability of female decision-maker seemed to increase with higher BS among male participants, this was distinct from mortality salience effects.

Our lower-BS female participants, however, rated female decision-makers lower following existential threats. This supports prior TMT findings regarding women and creaturely reminders, which led to decreased preference for women following mortality threats (Cox, Goldenberg, Arndt, et al., 2007; Goldenberg et al., 2007; Roberts & Gettman, 2004). Our results deepen this understanding by presenting the moderating role of benevolent sexism: while lower-BS women rated other women more negatively following a threat, it appeared that, although not significant, with higher BS, women rated women decision-makers more highly and male decision-makers less likeable (Figures 4.10, 4.11).

Combined, findings from these three manuscripts add depth and breadth to TMT postulations regarding climate change, environmental threats, and gender biases, highlighting opportunities for future research (discussed further in Section 5.4) and further contribute to the nascent TMT-Climate Model.

Outcomes in Chapter Three also add to environmental psychology literature. As outlined in the manuscript, Environmental Identity has been identified as a reliable indicator for pro-environmental intention and behaviour. Psychological research on PEB has been of great importance with climate change and calls to incorporate individual behaviour as a form of climate adaptation and/or mitigation (Atkinson & Jacquet, 2021; IPCC, 2023; Nielsen et al., 2021; Schmitt et al., 2020; Steg, 2023; Stollberg & Jonas, 2021; Whitmarsh et al., 2021). Results from Chapter Three illustrate that communication details, or framing, are vitally important within PEB research as life-threatening reminders can significantly alter environmental identity

reinforcement as a distal mortality anxiety defense. Further academic contributions to gender studies and ambivalent sexism literatures were provided in Chapter Four.

5.3.2 Practical contributions

My dissertation provides practical contributions for water communication (Chapters Two and Three), for water management (Chapter Four), and for equity within water-related decision-making (Chapter Four).

Chapters Two and Three outcomes illustrate that how we communicate threatening water messages is important, whether in a pro-environmental campaign or within discussions around water problems and solutions. On an individual level, considering day-to-day behaviours among everyday people, increasing life-threatening water communication will have paradoxical effects, particularly regarding flooding and water contamination or quality concerns among the global North. This mortality-laden communication is likely to increase pro-environmental behaviour and intention among those who already value the environment and decrease behaviour for those who do not. This sharpens the importance of audience segmentation for environmental communication campaigns (targeting specific subgroups for greatest influence), ensuring that people receive messages that are motivating for them, based on their values and worldviews. A one-size-fits-all approach risks demotivating some individuals and increasing undesired behaviours, such as resource consumption.

In decision-making contexts, life-threatening water communication may have similar effects, influencing intergroup biases, as found in Chapter Four. Benevolent sexism influenced appraisal

ratings of decision-makers, particularly likeability of female decision-makers. The "women-are-wonderful" effect may provide women certain 'protection' from negative appraisals from those high in benevolent sexism, but this was less significant for competency appraisals. Benevolent sexism also moderated threat influence on decision-maker appraisals, more strongly for higher-BS men and lower-BS women. Moreover, when our findings are combined with those from Hoyt et al. (2011), where mortality salience (MS) increased masculine traits connected to leadership ideals, we see that MS is an important variable to consider within leadership appraisal. For practitioners, this means considering the language around problems to be solved, especially when gender imbalance is present and when decision-making members may be viewed with implicit bias. In addition, ensuring that underrepresented groups feel included is essential for minimizing negative consequences of various stereotypes (Hall, Schmader, Cyr, & Bergsieker, 2022).

Importantly, my dissertation illustrates that water crises communication leads to predictable but perhaps unexpected psychosocial responses; the audience – in this case our participants – may not be aware of how the message is influencing their behaviours and implicitly held biases. Implicit gender and racial biases are recognized by many as workplace concerns, though are not without opponents. Empirical psychology research has identified strategies to address these biases, often in form of increased intergroup contact (Pettigrew, 1997; Van Assche et al., 2023) and via inclusive workplaces (Hall, Schmader, Cyr, & Bergsieker, 2022), as described in Chapter 4. Specifically, Hall et al. (2022)'s Table 2 outlined actions for leaders and employees to improve inclusion and minimize stereotypes and biases. Recommendations centre on adjusting workplace culture and norms. Notably, implementing Hall et al. (2022)'s recommendations

would respond to many of the reasons women give for leaving water work and are barred from leadership roles, including limited training opportunities and an overall lack of mentorship and role models (Fritz & van Knippenberg, 2018; Hegde, 2020; Hideg & Shen, 2019; Kossek et al., 2017; Terjesen et al., 2009).

5.4 Study limitations and future research

Chapters Two through Four detailed limitations and recommendations specific for the hypotheses associated with each chapter. Limitations from these chapters and opportunities for future research are summarized in Table 5.1. General limitations, broadly applicable to the dissertation as a whole, and opportunities for future research are described following Table 5.1.

Table 5.1 Limitations and opportunities for future research

Chapter	Limitation	Opportunities
2-4	Online sample, while thoroughly screened, could be erroneous	Real-world replication studies could reveal similar – or different – results to expand understandings of human response to threatening water messages E.g., among practitioners; among climate aware vs. unaware publics; in different climate-vulnerable regions
3	No pre-study environmental identity (EID) score	Replication study with pre-test EID score recorded far enough in advance as to not influence study variables E.g., pre-screening EID survey; target segments of Six Americas survey
2-4	Delay timing not recorded or tracked	Quantitative study including preset delay time to ensure delay length is consistent E.g., video that participants cannot skip or rush through
2-4	Subset of water crisis operationalizations –one to three used, many more exist	Additional studies could use alternate water framings to determine MS E.g., recycled water, desalinated water, explicit flooding scenario
2-4	Pandemic communications may have increased baseline mortality salience	Quantitative research to determine pandemic and non-pandemic MS in general populations. E.g., if sufficient material is available in studies that occurred before and during the pandemic, a meta-analysis could estimate these baselines

Chapter	Limitation	Opportunities
4	Sample educated similarly to but not explicitly required to be in decision-making roles or leadership	Quantitative and qualitative studies with actual decision-makers would further deepen understanding of biases and feelings of different gendered workers in these spaces E.g., focus groups or observation studies of decision-making groups with differing gender ratios
4	Exploratory female participant pool	Initial findings indicate worthwhile to further examine female appraisals in a higher-powered study with greater sample size
4	Focus on binary gender representations and not intersecting identities	Research specific and sensitive to intersectional identities within water decision-making. E.g., quantitative analysis on the influence of MS on appraisals of underrepresented individuals (*including* race, class, nonheteronormative identity intersections) by similar and different identities

In addition to the limitations summarized above, I want to address two specific limitations: intersectionality; inter/transdisciplinarity in a disciplined academy.

5.4.1 Intersectionality

While binary gender representation limitations are briefly presented in Table 5.1, it is worth discussing further how this presents across the dissertation and what opportunities are available. Demographic surveys in all manuscripts included questions on gender identity and sex-assigned-at-birth in effort to be inclusive and encapsulate different gender identities. They did not include questions on sexuality as this did not seem relevant to the research. Race, household income, and education were recorded and analyzed for potential influence on outcomes – which were not found – but these identity categories were not considered in combined ways (e.g., did certain Income X Education individuals respond in significantly different ways than other Income X Education individuals?). While the choice to focus on gender alone in this dissertation was made to allow a deeper analysis into this segment of intergroup decision-making dynamics, intersectional analyses would certainly reveal further complexities.

However, should this research occur, caution and care should be taken in order to avoid harm to individuals that are often underrepresented and marginalized (Rice et al., 2019). This may mean additional compensation for their time, alternate research approaches that are more accessible, and consultation with such groups to ensure potential harms are not overlooked. Moreover, careful consideration of the research purpose and goals should occur to ensure a group is included – and forced to disclose – for justifiable reasons (Rice et al., 2019). As Rice

(2019) argues, scholars incorporating intersectionality should consider intersectionality's origin (e.g., Black feminism, Crenshaw, 1989) as well as their own identities, power, and biases throughout the research process to ensure the questions being asked are fair, just, and of minimal harm.

5.4.2 Interdisciplinarity

As noted in Chapter One, the SERS PhD is framed as an inter- or transdisciplinary program. This is, generally, a good thing: breaking the silos between disciplines and increasing collaboration across fields increases knowledge sharing, creativity, and potential for novel, impactful solutions (Bromham et al., 2016; Freiband et al., 2022). Considering the wide-spread, multi-scalar impacts of climate change, interdisciplinarity is necessary for identifying climate solutions (Ledford, 2015). Yet, academic institutions most often retain disciplinary structures (Freiband et al., 2022) and, according to an Australian review, interdisciplinary proposals are less often funded (Bromham et al., 2016).

As a scholar striving to obtain a diverse skillset, seeking knowledge about and solutions to complex problems, and as a person who is deeply curious, I chose to conduct this doctoral research in an interdisciplinary manner. I chose to incorporate quantitative methods in part to expand my skillset but also to provide outcomes regarding a societal problem (e.g., gender bias in water crisis decision-making) that would stand up to scrutiny from more 'hard' science scholars. I sought methods that would effectively fend off criticism regarding my own personal biases within the research. In adopting a blended approach that is not pure psychology,

sociology, ecology, communications, human geography, nor gender study in methods or theory, the outcomes are widely applicable but difficult to place in a scholarly homebase.

Interdisciplinarity has limitations, for instance, where outcomes may be published. While many journals officially espouse to be interdisciplinary, firm and sometimes unstated boundaries around relevant fields persist. Additionally, translating the backgrounds, methods, and outcomes into clear, concise, and familiar language across disciplines is a challenge for interdisciplinary scholars. Moreover, interdisciplinarity necessitates choices regarding how deep a scholar may dive into any one discipline. There are several areas that, were this a disciplinary dissertation, further analyses would be expected. For example, for a psychology dissertation, additional variables, analyses, and studies might be expected. For human geography, deeper considerations of place, systemic influences on decision-making, and for qualitative expectations, interaction with actual decision-makers. There are many different forms this dissertation could have been conducted, all equally valid regarding what knowledge and understanding they could provide or uncover, some of which are indicated in Table 5.1. The form I chose encapsulated my past training and areas I sought to explore to discover outcomes that were defensible, relevant, and useful within and beyond academia.

5.5 Reflections

I entered the doctoral process keen to build on my master's research by incorporating Terror Management Theory insights to Community-Based Social Marketing, then transitioning to focus on gender bias in cleantech entrepreneurship to build on personal experiences, and landing on

water-mortality messaging and gender bias in decision-maker appraisal as a streamlined, more widely applicable (e.g., pro-environmental communication campaigns; decision-making in various spaces) research topic. The journey from start to end was determined and supported by several essential ingredients: the committee members; the SERS program; my stubborn curiosity.

Each committee member was purposefully chosen for the skills they could provide, the knowledge they could share, and the kind of human they showed themselves to be. Each member influenced various portions of this project in different ways that I am truly grateful and a better scholar for (see: Acknowledgements). The various fields each member represents and conducts research in, I think, are all reflected in at least a small way, within this dissertation.

This combination of perspectives and incorporation of multiple fields to respond to one research question or theme is what the SERS PhD is all about. SERS is described as transdisciplinary, the precise definition of this can be – and is – debated. What is true is that SERS fosters the kind of scholar and knowledge production that comes from blending fields and methods together in ways that might not be possible in other, more rigid, disciplines. Often, research outcomes involve advice and tools that actually reach practitioners. This was a personal desired outcome of this dissertation, and while a concrete tool was not created, a groundwork has been set that can be built on by future scholars for water/climate communication and for gender equity strategies in water management. This research has shown that how water is communicated (e.g., explicitly life-threatening or not), how an individual identifies (e.g., as environmental), degree and type of sexism (e.g., higher benevolent sexism vs. lower; hostile vs. benevolent), and

appraisal context (e.g., likeability vs. competency) all can contribute to psychosocial human responses. My dissertation contributes to terror management, gender psychology, and leadership studies, adding depth and nuance to those fields, and illustrates that deeper understanding is required as group dynamics are complex. Caution, care, and attention is needed in both water communication and gender equity efforts lest undesired behaviours be motivated by life-threatening reminders. In an ideal world, an additional study with professional water managers would provide essential insights to the dissertation, yet the complexity of such a study could require an additional doctoral degree and resources. While I did truly enjoy the doctoral process, a second PhD is not on my to-do list.

Looking back at what I was most interested in at the start of the doctorate and what I am most interested in now, themes are the same and different. My curiosity about our cultural views about death persists, in more informed ways, and I hope I can follow this thread to research on the gendered nature of death care and green burials. The dissertation has only made me more passionate about fostering death positivity in spaces where even the word ‘death’ is avoided. Working on the final manuscript reinvigorated my passion for gender and care work, and while water has a role in death care (e.g., washing rituals) and green burials (e.g., alkaline hydrolysis) and remains a place where I feel at peace, it may or may not be the centre theme for my research going forward.

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Appendix

Supplementary Material 1. Gender Interactions

Table S1A. Gender interactions for word-fragment DTA measure

Tests of Between-Subjects Effects

Dependent Variable: Word-Fragment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	24.026[a]	12	2.002	1.735	.057	.040
Intercept	218.525	1	218.525	189.387	<.001	.276
Gender_A	1.017	2	.508	.441	.644	.002
Group_A	12.332	4	3.083	2.672	.032	.021
Gender_A * Group_A	5.376	6	.896	.776	.589	.009
Error	573.466	497	1.154			
Total	2855.000	510				
Corrected Total	597.492	509				

a. R Squared = .040 (Adjusted R Squared = .017)

Table S1B. Gender interactions for image-description measure

Tests of Between-Subjects Effects

Dependent Variable: Image-Description

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	84.580[a]	12	7.048	1.589	.091	.039
Intercept	736.958	1	736.958	166.130	<.001	.260
Gender_A	1.759	2	.879	.198	.820	.001
Group_A	37.537	4	9.384	2.115	.078	.018
Gender_A * Group_A	32.412	6	5.402	1.218	.296	.015
Error	2098.245	473	4.436			
Total	9309.000	486				
Corrected Total	2182.825	485				

a. R Squared = .039 (Adjusted R Squared = .014)

Table S1C. Gender interactions for averaged-DTA measure

Tests of Between-Subjects Effects

Dependent Variable: Averaged-DTA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	74.822[a]	12	6.235	1.827	.042	.044
Intercept	1107.197	1	1107.197	324.417	<.001	.407
Gender_A	2.509	2	1.255	.368	.693	.002
Group_A	37.105	4	9.276	2.718	.029	.022
Gender_A * Group_A	17.016	6	2.836	.831	.546	.010
Error	1614.292	473	3.413			
Total	12559.694	486				
Corrected Total	1689.114	485				

a. R Squared = .044 (Adjusted R Squared = .020)

Supplementary Material 2. Age interactions

Table S2A. Age interactions for word-fragment DTA measure

Tests of Between-Subjects Effects

Dependent Variable: Word-Fragment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	227.860[a]	190	1.199	1.035	.391
Intercept	967.662	1	967.662	835.112	<.001
age	69.142	53	1.305	1.126	.267
Group_A	10.435	4	2.609	2.251	.063
age * Group_A	142.421	133	1.071	.924	.697
Error	369.632	319	1.159		
Total	2855.000	510			
Corrected Total	597.492	509			

a. R Squared = .381 (Adjusted R Squared = .013)

Table S2B. Age interactions for image-description measure

Tests of Between-Subjects Effects

Dependent Variable: Image-Description

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	866.354[a]	185	4.683	1.067	.308
Intercept	3223.154	1	3223.154	734.498	<.001
age	216.070	53	4.077	.929	.617
Group_A	44.857	4	11.214	2.556	.039
age * Group_A	595.072	128	4.649	1.059	.342
Error	1316.471	300	4.388		
Total	9309.000	486			
Corrected Total	2182.825	485			

a. R Squared = .397 (Adjusted R Squared = .025)

Table S2C. Age interactions for averaged-DTA measure

Tests of Between-Subjects Effects

Dependent Variable: Averaged-DTA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	645.678[a]	185	3.490	1.003	.485
Intercept	4719.870	1	4719.870	1357.018	<.001
age	173.844	53	3.280	.943	.590
Group_A	43.393	4	10.848	3.119	.015
age * Group_A	413.047	128	3.227	.928	.684
Error	1043.435	300	3.478		
Total	12559.694	486			
Corrected Total	1689.114	485			

a. R Squared = .382 (Adjusted R Squared = .001)

Supplementary Material 3. Delays

The first delay was the Positive and Negative Affect Schedule (PANAS), used in nearly half of all TMT studies as a delay task (Cox et al., 2018; Burke et al., 2010). The PANAS consists of a series of Likert-scale questions used to assess participants' mood (Watson et al., 1988).

This scale consists of a number of words that describe different feelings and emotions. Read each item and select the item on the scale that you most agree with. Indicate to what extent you feel right now.

1	2	3	4	5
Very slightly or not at all	A little	Moderately	Quite a bit	Extremely

1.	Interested	11.	Irritable
2.	Distressed	12.	Alert
3.	Excited	13.	Ashamed
4.	Upset	14.	Inspired
5.	Strong	15.	Nervous
6.	Guilty	16.	Determined
7.	Scared	17.	Attentive
8.	Hostile	18.	Jittery
9.	Enthusiastic	19.	Active
10.	Proud	20.	Afraid

The second was a 10 question Likert-scale self-esteem measure (Rosenberg, 1965), commonly used in TMT studies with two or more delay tasks (Burke et al., 2010).

Self-Esteem Measure (Rosenberg, 1965)

1	2	3	4
Strongly Agree	Agree	Disagree	Strongly Disagree

1. On the whole, I am satisfied with myself.
2. At times I think I am no good at all.
3. I feel that I have a number of good qualities.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I certainly feel useless at times.
7. I feel that I am a person of worth, at least on an equal plane with others.
8. I wish I could have more respect for myself.
9. All in all, I am inclined to feel that I am a failure.
10. I take a positive attitude toward myself.

The final delay task was an Environmental Identity measure (Clayton, 2003) chosen for use in future data analyses.

Environmental Identity (EID) scale – short version. (Clayton, 2003)

Please indicate the extent to which each of the following statements describes you by using the appropriate number from the scale below.

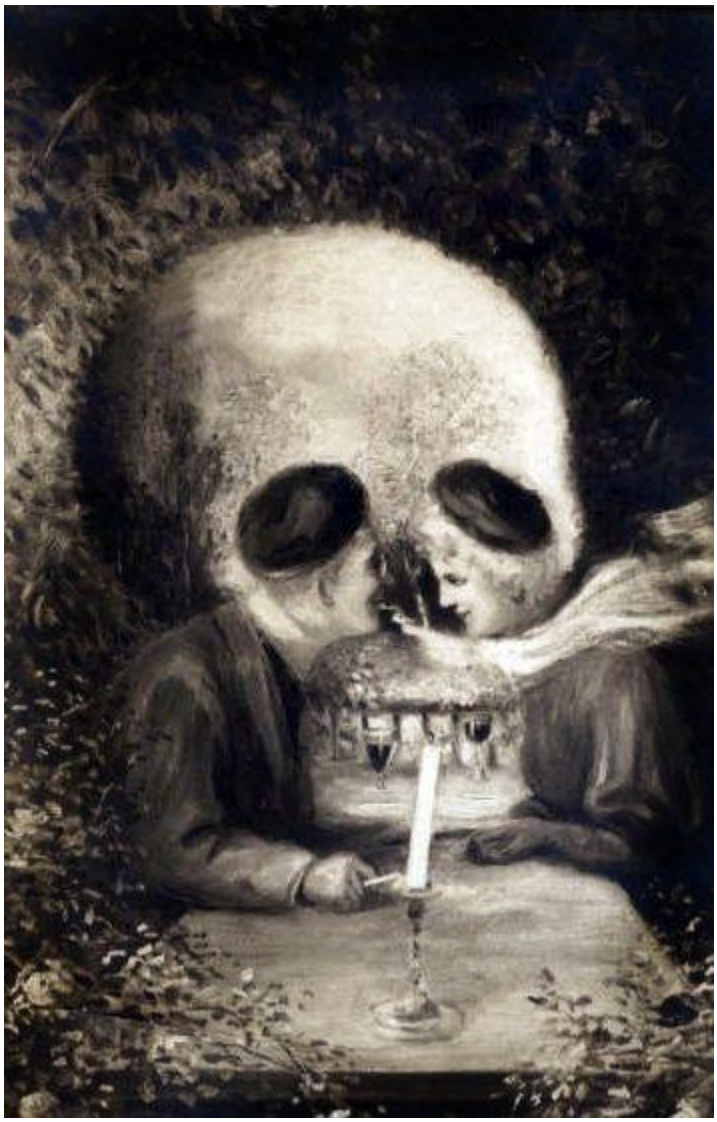
1	2	3	4	5	6	7
Not at all true			neither true of me nor untrue			completely true of me

1. I spend a lot of time in natural settings (woods, mountains, desert, lakes, ocean).
2. I think of myself as a part of nature, not separate from it.
3. If I had enough time or money, I would certainly devote some of it to working to protect the environment.
4. When I am upset or stressed, I can feel better by spending some time outdoors "communing with nature".
5. I feel that I have a lot in common with other species.
6. Behaving responsibly toward the earth -- living a sustainable lifestyle -- is part of my moral code.
7. Learning about the natural world should be an important part of every child's upbringing.
8. I would rather live in a small room or house with a nice view than a bigger room or house with a view of other buildings.
9. I would feel that an important part of my life was missing if I was not able to get out and enjoy nature from time to time.

10. I have never seen a work of art that is as beautiful as a work of nature, like a sunset or a mountain range.

11. I feel that I receive spiritual sustenance from experiences with nature.

Supplementary Material 4. Image-description task image



Supplementary Material 5. Descriptive statistics for independent variables

Word-fragment	*M*	*SD*
Overall	2.10	1.08
Control	1.93	1.04
Death	2.31	1.09
Drowning	2.33	0.96
Dehydration	2.01	1.13
Contaminated water	1.91	1.13
Image-description	*M*	*SD*
Overall	3.83	2.12
Control	3.37	1.82
Death	4.06	2.20
Drowning	3.97	2.25
Dehydration	3.59	2.19
Contaminated water	4.21	2.12
Averaged DTA responses	*M*	*SD*
Overall	4.73	1.87
Control	4.29	1.76
Death	5.12	1.87
Drowning	5.07	1.73
Dehydration	4.51	1.96
Contaminated water	4.62	1.92

Supplementary Material 6. Visualizing normality

S6A. Word-fragment measure visualizations

Figure S6Ai. Histogram of overall word-fragment responses

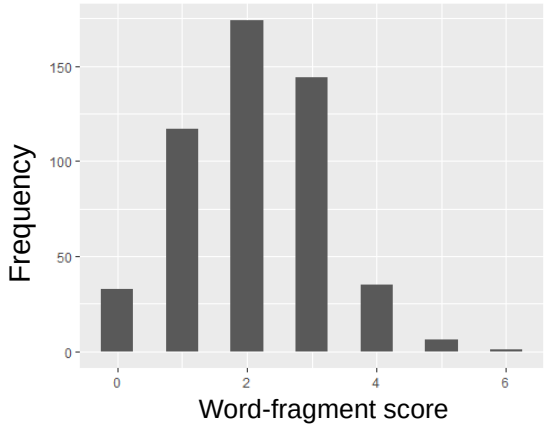


Figure S6Aii. Fitted residuals plotted for word-fragment responses

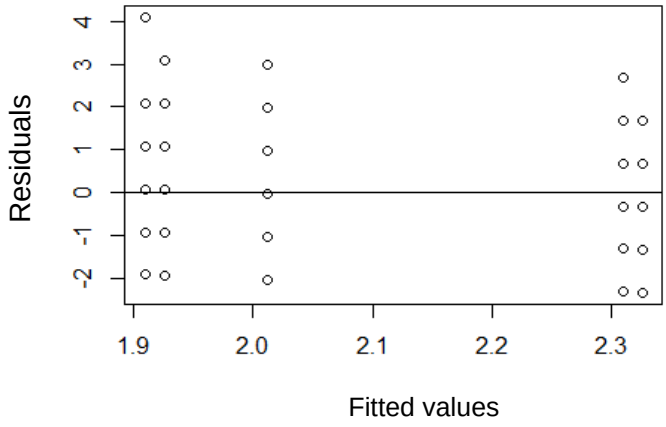


Figure S6Aiii. Q-Q plot for word-fragment responses

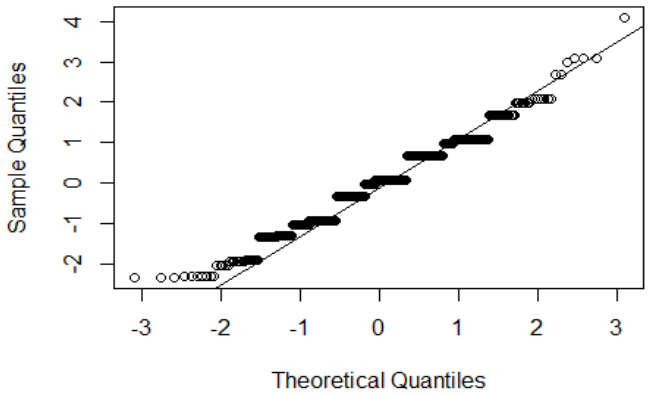
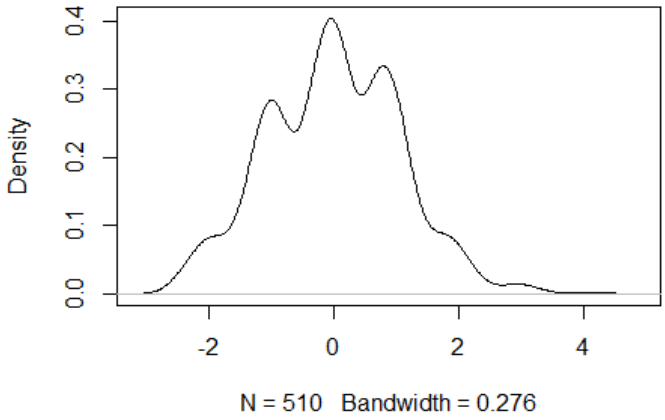


Figure S6Aiv. Kernel density plot for word-fragment responses



S6B. Image-description measure visualizations

Figure S6Bi. Histogram of overall image-description responses

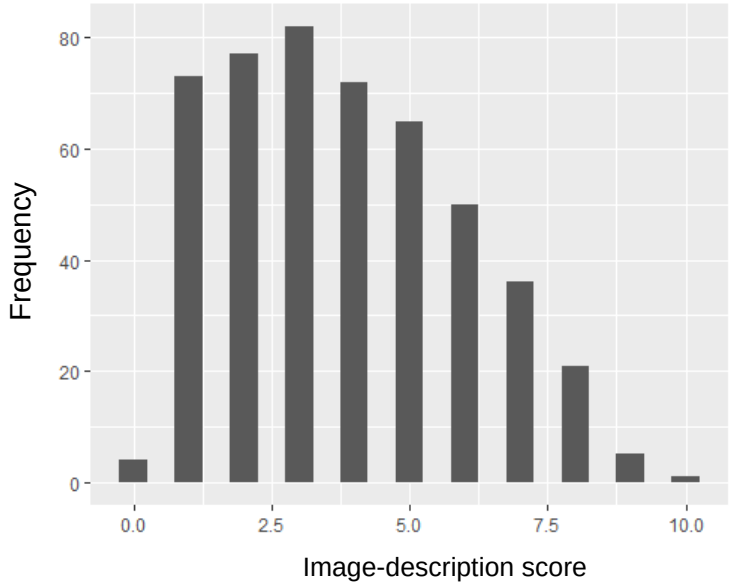


Figure S6Bii. Fitted residuals plotted for image-description responses

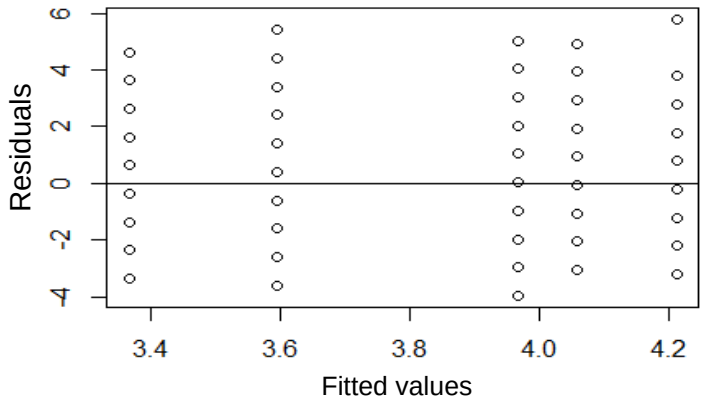


Figure S6Biii. Q-Q plot for image-description responses

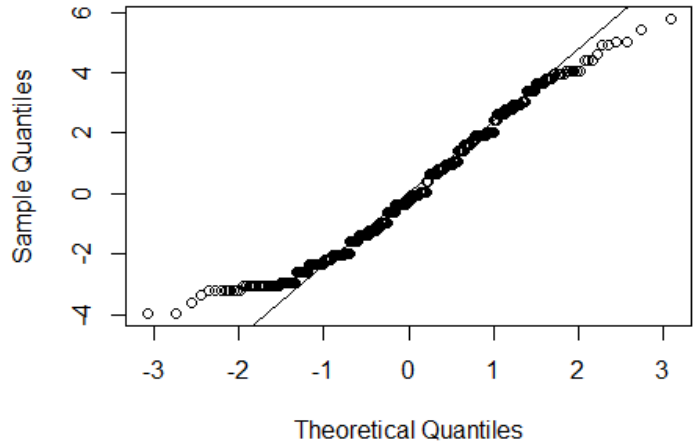
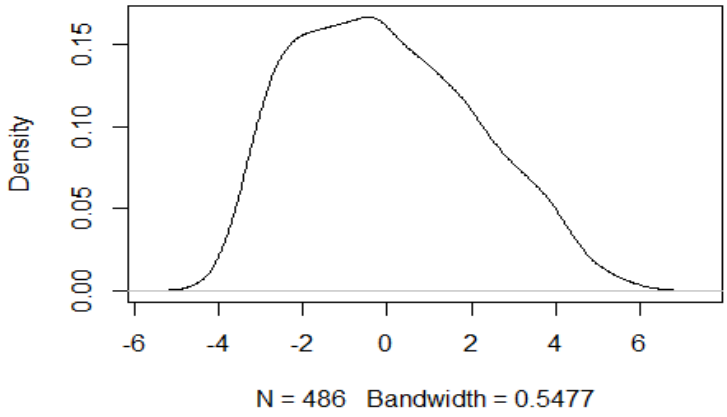


Figure S6Biv. Kernel density plot for image-description responses



S6C. Averaged-DTA measure visualizations

Figure S6Ci. Histogram of overall averaged-DTA responses

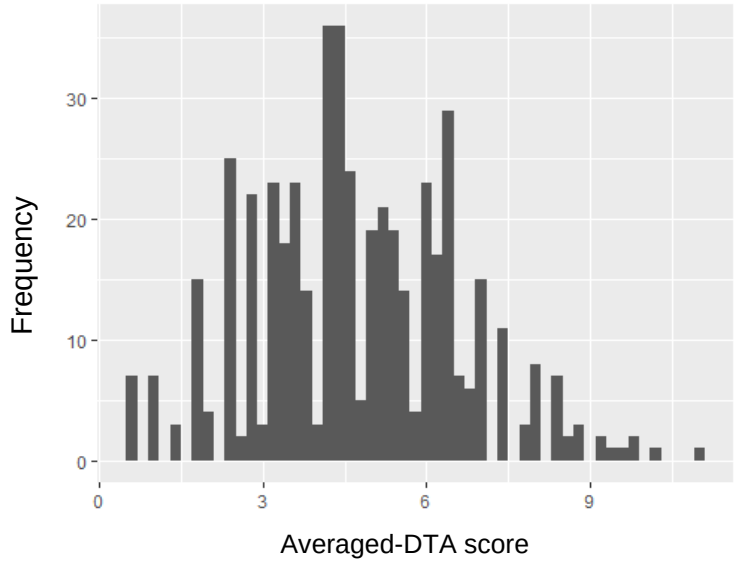


Figure S6Cii. Fitted residuals plotted for averaged-DTA responses

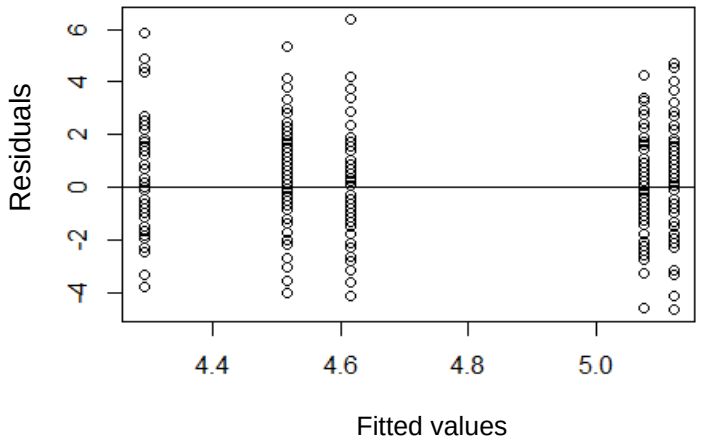


Figure S6Ciii. Q-Q plot for averaged-DTA responses

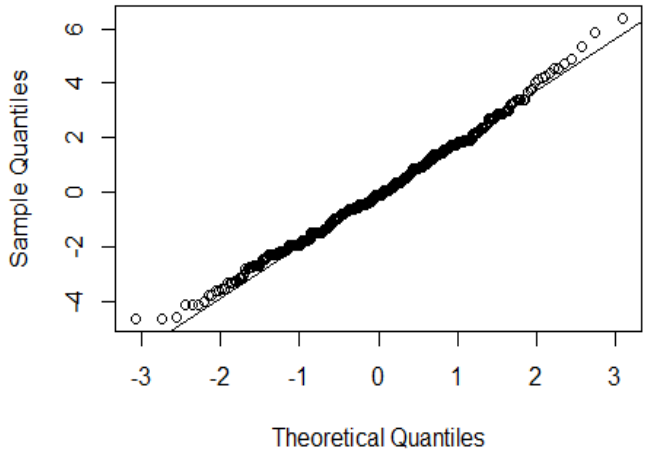
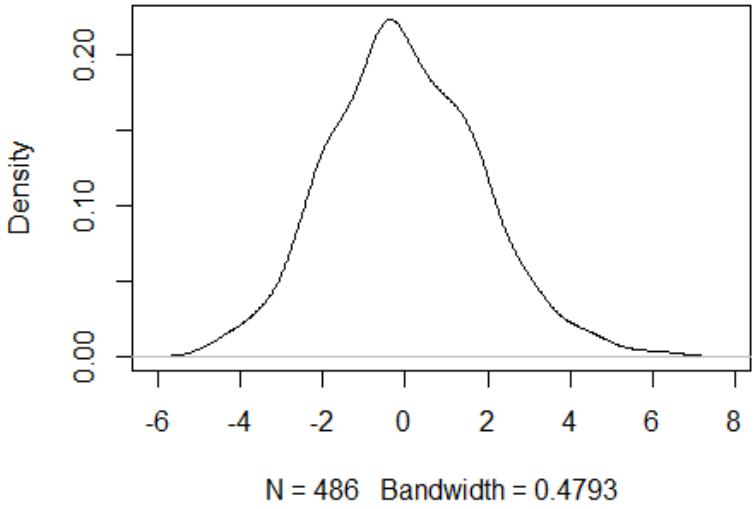


Figure S6Civ. Kernel density plot for average-DTA responses



Supplementary Material 7. Overview of select theories and models behind pro-environmental behaviour change.

Theory or model	Key Points	Key Source
Norm Activation Model (NAM)	- Activated norms stimulate behaviors (or non-behavior) - Norms are influenced by awareness and sense of responsibility (Onwezen et al., 2013) - Belief in efficacy of behavioral outcome and self-efficacy play role in norm activation (Steg & Nordlund, 2019)	(Schwartz, 1977)
Theory of Planned Behavior (TPB)	- Intention influences behavior; intent relies on beliefs one holds about the behavior, subjective norms about the behavior, and perceived control - However, does intent equal behavior? - May explain what is involved in adopting a behavioral *intention* rather than behavior *change* itself (C. J. Armitage & Conner, 2001) o Meta-analysis found TPB explained 12% difference between reported intention to engage in PEB and actual behavioral action	(Ajzen, 1991)
Protection Motivation Theory (PMT)	- Threat appraisal (perceived severity + perceived vulnerability - benefits from undesired behavior/non-behavior) and coping appraisal (self-efficacy + desired behavior effectiveness - desired behavior cost) determines behavioral outcome o High threat appraisal (lack of desired behavior is personally threatening) + high coping appraisal (belief that engaging in desired behavior will remove threat) = desired behavior - Can help identify barriers and motivators toward PEBs (Shafiei & Maleksaeidi, 2020) - Meta-analysis found overall moderate success among health behaviors (Floyd et al., 2000), however very few studies examine PEB empirically and explicitly (Kothe et al., 2019)	(Maddux & Rogers, 1983; R. W. Rogers, 1975)
Value-Belief-Norm Theory (VBN)	- Connected norm-activation theory (Schwartz, 1977) with ecological worldview influences; base values contribute to environmental beliefs o With awareness of consequences and personal responsibility, personal norms are created that lead to an obligation to act and engage in behavior	(Stern et al., 1999)

Theory or model	Key Points	Key Source
	- *Values* affect PEB through creation of ecological self-identity, leading to habitual, more persistent behaviors, explaining change more than TPB	
Goal-Framing Theory (GFT)	- Three goal frames determine how one understands a scenario and how one responds to that scenario - Goal frames include: hedonic (to act in one's self-interest or to feel better); gain (to gain more or protect existing resources); normative (to act according to norms or 'appropriately') - All frames may be active at once, with different strengths, dependent on personal values; the strongest influences how information is processed and acted on	(Lindenberg & Steg, 2007)
Stage Model of Self-Regulated Behavior Change (SSBC)	- Connects NAM and TPB to create framework to specifically explain PEB change - Four stages towards behavior: pre-decisional; pre-actional; actional; post-actional o First three based on cognitive awareness and intention - Desires and goals considered before intention for a specific behavior or goal - After intention decided, path towards behavior is focused and options are limited as an implementation plan is created - Lastly, individual commits to the action and the behavior is performed	(Bamberg, 2013)
Social Identity Model of Pro-Environmental Action (SIMPEA)	- Climate crises are collective problems so require collective solutions - Social identity is crucial; this model incorporates collective, ingroup identity as part of the sense of self that is valuable in influencing norms and goals that are in turn important in influencing behaviors - Ingroup identity, norms, and goals, along with belief of collective efficacy affect evaluations of environmental problems and influence pro-environmental actions in private and public realms	(Fritsche et al., 2018)

Supplementary Material 8. Mechanical Turk (MTurk) details and screening processes.

MTurk allows rapid and efficient access to a geographically widespread participant pool that closely matches American and Canadian general demographics. Scholars have found that demographics of American and Canadian MTurk workers are relatively similar, though somewhat younger and more educated than either country's general population (Weinberg et al., 2014); this variation in age and education did not lead to significantly different results when compared to a population-based sample (Weinberg et al., 2014). Past research indicated little to no difference between online versus in-lab study results (Vail et al., 2019; Arechar et al., 2018; Dance, 2015; Finlay et al., 2015; Horton et al., 2010; Dandurand et al., 2008). MTurk is not without criticism, as concerns about data quality have surfaced in recent years (Aguinis et al., 2021; Chmielewski & Kucker, 2020). To address these concerns, we followed recommendations proposed by Aguinis et al. (2020). For example, participants were limited to those with an MTurk rating ≥80%, meaning the participants completed past studies thoroughly and consistently passed attention checks and other quality control measures. In addition, responses were screened to ensure participants followed instructions and completed measures appropriately. For example, responses were removed if the participant did not write more than three words in the open-answer intervention questions, if it was clear the response was a source other than the participant (e.g., copied from a website or textbook), or if any scales were left unanswered.

Supplementary Material 9. Participant removal reasons and descriptive statistics by group.

Attrition and removals

Total participants recruited	600	
Exclusion reason		
Software screened out	11% (66)	
Intervention error	12% (73)	
EID incomplete	1% (6)	

Descriptive statistics

	Male	Female	Other	N/A	Age	
					Range	Mean
Control	50%	46%	3%	2%	23-73	40
Mortality Salience	47%	49%	2%	2%	23-77	43
Drowning	56%	42%	1%	-	21-68	39
Contaminated Water	45%	53%	-	1%	21-67	38
Dehydration	55%	42%	3%	-	24-71	38
Total	50%	47%	2%	1%	21-77	40

Supplementary Material 10. Intervention questions adapted from Mortality Attitudes Personality Survey (MAPS; Rosenthal, 1986).

Intervention		Prompts for participant intervention responses. - **bolded text** indicates what wording was changed in interventions, as specified in each row
Mortality Salience		Jot down, as specifically as you can, what you think will happen to you as you **physically die and once you are physically dead.** Please briefly describe the emotions that the thought of **your own death** arouses in you.
Control		…visit the dentist for a painful procedure and once you are physically there. …of visiting the dentist for a painful procedure…
Water	Drowning	…are drowning and once you are physically drowned. …your own drowning…
	Dehydration	…are suffering extreme thirst and once you are physically dehydrated. …your own extreme thirst…
	Contaminated Water	…are drinking heavily contaminated water and once you have consumed heavily contaminated water. …your own pollution by contaminated water…

Supplementary Material 11. Environmental Identity response distributions and means.

Figure S11A. Histograms of Environmental Identity response score distributions across participant groups.

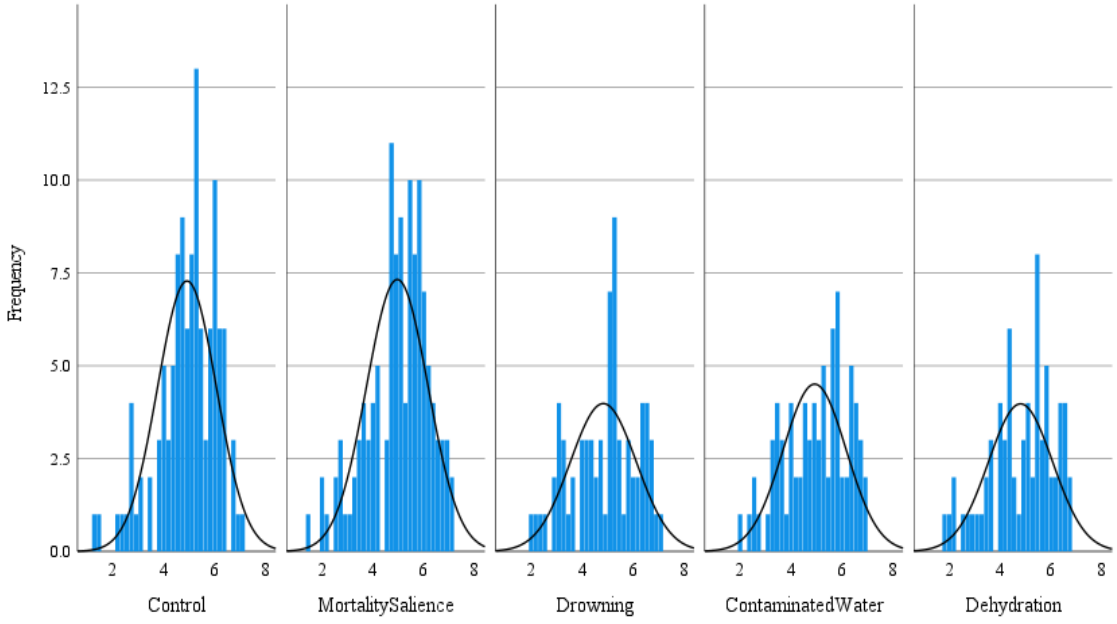
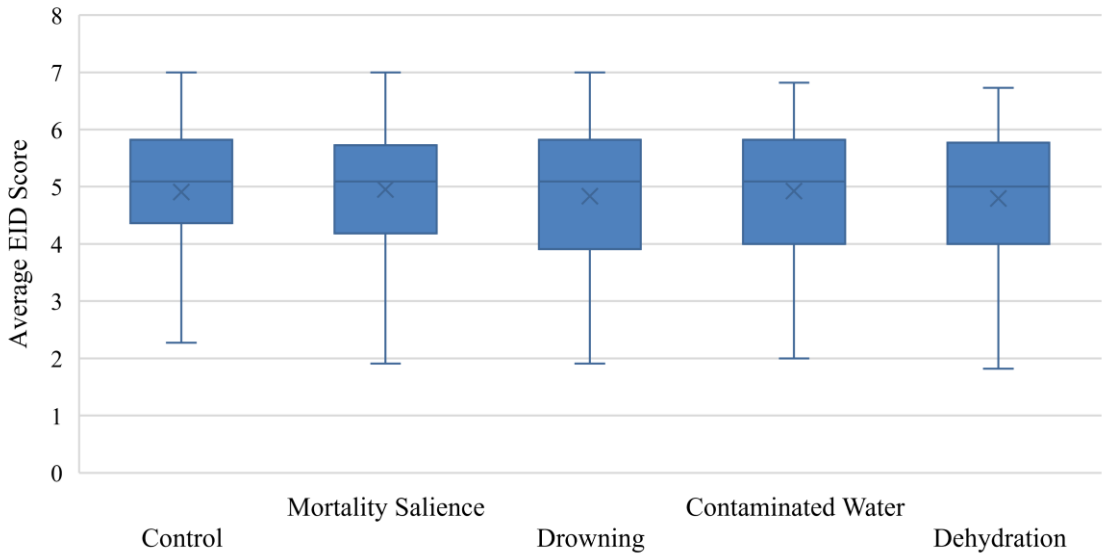


Figure S11B. Boxplot of average Environmental Identity response score across participant groups.



Supplementary Material 12. Water decision-making vignette featuring female or male decision-maker.

*Participant saw either female (Jennifer) or male (John) version; boldface present in original

Jennifer/John Jones is a Water Management Specialist **in charge of water treatment and delivery decisions** in a mid-size, North American city. Jennifer/John graduated from post-secondary education in 2005 and has been at her/his current workplace for 10 years. S/he is familiar with the water needs and demands of her/his city clients, and aware of water mismanagement risks.

As is typical for a city of its size and age, **water delivery pipes are being replaced and upgraded in Jennifer/John's city**. S/he has led several successful replacement projects and is leading an upcoming project. This project has new features to consider that promise cost-savings in material and labour. Jennifer/John must choose between:

a) **replacing** water delivery pipes in the **same manner as previous, successful projects**,

or

b) **opting for a new material** that can be installed with a more direct route from water source to client **providing cost-savings.**

This new option, however, **carries a greater risk of water contamination** due to the area it travels through (underneath agricultural areas). Also, the new material has not been as thoroughly tested as the material used in previous projects. The new project, at a shorter length and faster install, would **reduce material and labour costs by 50% of the previous project costs.**

Jennifer/John knows that the material may be safe and reliable, even if it has not been thoroughly tested. S/he also knows that the water contamination risks to her/his clients could be severe; potential contaminants could cause nausea, diarrhea, or even fatalities among vulnerable populations. S/he also knows that the city politicians have been looking to reduce costs on all fronts. After reviewing all the information available, **Jennifer/John decides to use the new material for the upcoming project.**

Supplementary Material 13. Decision-maker appraisal measures.

SM13A. Likeability scale

*(R) indicates reverse scored item

For the following scale, consider the vignette you have just read and the decision-maker featured. Indicate on the scale how much you agree or disagree with the following statements about the decision-maker.

1	2	3	4	5	6	7	8
Not at all							Extremely

I agree that the decision-maker is:

1. Friendly
2. Polite
3. Moody (R)
4. Cold (R)
5. Tolerant
6. Obnoxious (R)
7. Rude (R)
8. Mean (R)
9. Warm
10. Pleasant
11. Honest
12. Intelligent
13. Hostile (R)
14. Reliable
15. Greedy (R)
16. Prejudiced (R)

SM13B. Competence scale

After reading the sustainability vignette, indicate the extent to which you agree with the following statements.

1	2	3	4	5
Not at all		Somewhat		A great deal

1. I believe I would work at a high level of performance under the decision-maker
2. Overall, I like the decision-maker
3. I would enjoy working with the featured decision-maker
4. I believe this decision-maker can contribute to society
5. I would get along with the featured decision-maker
6. I admire the decision-maker
7. The featured decision-maker's beliefs are in agreement with my own
8. I find the featured decision-maker similar to my ideal decision-maker
9. I trust the decision-maker
10. I believe the decision-maker made the right choice
11. I would follow the decision-maker's guidance
12. I think the decision-maker is capable in their role

Supplementary Material 14. Ambivalent Sexism Inventory (Glick et al., 1996).

*(R) indicates reverse scored item; boldface [added, not boldface for participants] indicates Benevolent Sexism item

Relationships Between Men and Women

Below is a series of statements concerning men and women and their relationships in contemporary society. Please indicate the degree to which you agree or disagree with each statement using the following scale: 0 = disagree strongly; 1 = disagree somewhat; 2 = disagree slightly; 3 = agree slightly; 4 = agree somewhat; 5 = agree strongly.

1. **No matter how accomplished he is, a man is not truly complete as a person unless he has the love of a woman.**
2. Many women are actually seeking special favors, such as hiring policies that favor them over men, under the guise of asking for "equality."
3. **In a disaster, women ought not necessarily to be rescued before men. (R)**
4. Most women interpret innocent remarks or acts as being sexist.
5. Women are too easily offended.
6. **People are often truly happy in life without being romantically involved with a member of the other sex. (R)**
7. Feminists are not seeking for women to have more power than men. (R)
8. **Many women have a quality of purity that few men possess.**
9. **Women should be cherished and protected by men.**
10. Most women fail to appreciate fully all that men do for them.
11. Women seek to gain power by getting control over men.
12. **Every man ought to have a woman whom he adores.**
13. **Men are complete without women. (R)**
14. Women exaggerate problems they have at work.
15. Once a woman gets a man to commit to her, she usually tries to put him on a tight leash.
16. When women lose to men in a fair competition, they typically complain about being discriminated against.

17. A good woman should be set on a pedestal by her man.

18. There are actually very few women who get a kick out of teasing men by seeming sexually available and then refusing male advances. (R)

19. Women, compared to men, tend to have a superior moral sensibility.

20. Men should be willing to sacrifice their own well being in order to provide financially for the women in their lives.

21. Feminists are making entirely reasonable demands of men. (R)

22. Women, as compared to men, tend to have a more refined sense of culture and good taste.