The Role of Values, Norms and Affect in Relation to Water-scarcity Risk Perceptions and Water Conservation Behaviours in the Western Cape

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Abstract

The effects of accelerating climate change are already being felt globally. Sub-Saharan Africa is at high risk of extreme hydrological events, and increasingly severe and frequent droughts pose a threat to water security in the region. As the impacts of climate change are expected to increase, it is important to promote adaptation to drought events by studying the factors that can influence water saving behaviour. The present work studied how three categories of risk perception determinants namely values, social norms and affect, influenced water scarcity risk perceptions and water saving behaviour during the Western Cape drought of 2014-2017 in an urban population living in formal housing in the City of Cape Town. The outcomes of this study are two-fold. Firstly, this research provides evidence for the usefulness of a conceptual framework rooted in risk perceptions literature for understanding how affect, social norms and values fit together with risk perceptions to explain pro-environmental (water saving) behaviour. Secondly, the findings add to the literature on risk perception determinants, water scarcity risk perceptions, and water saving behaviour by showing that fear, self-transcending values, hedonism, and descriptive and prescriptive norms were important factors in shaping water scarcity risk perceptions and water conservation behaviour during the drought. In future drought contexts, the revised framework and the risk perception determinant findings could be drawn on to help understand how values, social norms and affect interact with water scarcity risk perceptions to influence water conservation behaviour.

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Anthropogenic (human-caused) climate change is acknowledged by the scientific community as one of the greatest threats to the planet and to all who inhabit it (Niang et al., 2014). Levels of greenhouse gases in the atmosphere, particularly carbon dioxide (CO_2), have increased by more than 40% from the baseline measurements of the pre-industrial age due to human activity (Betts, 2021). The increased gases in the atmosphere lead to a warming planet and a changing climate (Kaufmann et al., 2011). Serious meteorological impacts are predicted to occur around the world as a result of the changing global temperature. These impacts are already being seen in some regions, with instances of increased severity and frequency of extreme weather and hydrological events (Clarke, Otto, Stuart-Smith et al, 2022; Gudmundsson, Boulange, Do et al., 2021). The effects of extreme hydrological events will be felt most strongly in populations of developing countries, who are vulnerable to floods and droughts due to high levels of exposure to these events, and a lack of resources which results in a decreased ability to adapt (Mbow et al., 2019).

Many parts of Africa are particularly vulnerable to climate change-related drought, and are already experiencing compromised water security, with very serious deficits in supply in some regions (Isaacman & Musemwa, 2021). Sub-Saharan and Southern Africa are at especially high risk of the negative hydrological effects of climate change, including decreased precipitation and droughts (Serdeczny et al., 2016). The frequency and severity of droughts and floods will increase in many regions globally, but especially in Sub-Saharan Africa as rates of carbon dioxide equivalent (CO_2eq) emissions rise (Allen et al., 2018). If the rate of climate change continues on the current path, in the next 50 years deficits in water-supply could become five times worse than they are currently throughout most of Africa

(Naumann et al., 2018). Cities across Africa are at particularly high risk of compromised water security as they face the dual challenge of heightened water demand due to increasing urbanisation, and reduced water supply due to increasing climate change. Thus, cities should be a key focus area for drought adaptation research (van den Berg & Fikresilassie, 2021).

Changing public behaviour has been a commonly utilised and historically successful strategy for managing water scarcity in some cities (Miranda & Ferraro, 2017; Miyan, 2015). However, public behaviour is influenced by many factors. In situations where an environmental event poses a threat to personal safety, risk perceptions are one factor that can directly motivate behaviour (Gandure et al., 2013; Rankoana, 2016; Talanow et al., 2021). Values, the individually and constantly held personal beliefs that motivate action towards goals (Schwartz, 2012), social norms, the unwritten rules and expectations for behaviour in society (Lapinski & Rimal, 2005), and affect, the psychological term encompassing the mental experience and interpretation of associated bodily sensations that occur during the experience of emotion (Barret & Bliss-Moreau, 2009), are well-established predictors of risk perceptions and pro-environmental behaviours (Abrahamse, 2019; Smith & Leiserowitz, 2012; Roeser, 2012; van der Linden, 2017).

Therefore, research that ties together these three determinants of risk perceptions (values, social norms, affect) could be useful in understanding how individuals come to perceive water scarcity risk, and subsequently make decisions about related pro-environmental behaviours, specifically water conservation behaviours. However, there is a dearth of literature, especially in South Africa, that considers these three predictors simultaneously, and how they may relate to water scarcity risk perceptions, and how risk perceptions may influence water conservation behaviour. This research will add to the literature on water conservation behaviours by considering these variables at the same time, providing insight into how they may interact to influence water saving behaviour in South

Africa's water-scarce context. Further, there is currently no appropriate conceptual framework to help conceptualise how social norms, values and affect fit together to influence risk perceptions and water saving behaviour. This study aims to contribute towards addressing this gap by proposing a conceptual framework that can be applied to climate shock events, such as droughts, to understand how social norms, values and affect, and risk perceptions interact to influence pro-environmental behaviours.

This research will use a case study design to investigate the specific context of a drought event that occurred 2014-2017 in the Western Cape, the southernmost province of South Africa. The benefits of a case study design allow for the in-depth study of a specific event, that provides deep, salient information that can be drawn on in future similar events (Crowe et al., 2011). The Western Cape context encapsulates many attributes common across water stressed regions. It is drought prone, rapidly urbanising with increasing population growth, and there is increasing competition for water between industry, agriculture, cities and ecosystems. Thus, much generalisable knowledge can be gained from understanding the Western Cape. Considering South Africa, and the Western Cape in particular, are drought-prone and likely to face more droughts in the future (Botai et al., 2017; Weber et al., 2018) and there is a lack of specific research on the aforementioned variables, this study will contribute to the gap in the literature on risk perceptions and water saving behaviour, and also provide contextually relevant information for the Western Cape.

Research Aim and Objectives

The overarching aim of this research is to contribute to the literature on environmental risk perceptions and climate change behaviours, by investigating how affect, values and social norms relate to water-scarcity risk perceptions, and in turn, to water conservation behaviours.

Specifically, this study focuses on understanding how risk perceptions are operationalised by concern, worry and perceived likelihood of water scarcity risk, and how risk perceptions influenced water conservation behaviours such as changes to toilet flushing, showering and bathing, gardening and use of greywater, across residents of the City of Cape Town in the Western Cape of South Africa during a drought event that occurred 2014-2017. Consistent with the research aim, the study has three main objectives:

1. to propose and evaluate a new conceptual framework for understanding if, and how, the below factors impact water-scarcity risk perceptions and water conservation behaviour:
    - three different value categories/orientations (self-transcendence, self-enhancement and hedonism);
    - two types of social norms (prescriptive versus descriptive); and
    - affect; (here consisting of anger, fear, guilt and happiness)
2. to gain a deeper understanding into how the above determinants influenced risk perceptions and water saving behaviour during a drought event; and
3. to integrate and synthesize broader conclusions about the role of these specific determinants in risk perceptions of water scarcity events and water conservation behaviour.

Literature Review

Climate Change

Climate change is a defining feature of the 21st century, posing a grave threat to the planet's ecosystems and inhabitants. A significant portion of the global population will face serious threats to their lives and livelihoods as extreme weather events become increasingly frequent and intense. It is critical to understand the drivers and impacts of climate change in order to mitigate, and as is the focus of this thesis, adapt, to the effects of the changing climate, and as such, they will be unpacked below.

Anthropogenic climate change refers to human-caused long-term changes in the climate, including temperature change and changes to the weather patterns (Masson-Delmotte et al., 2018). While some variability in the climate is caused by natural forcing of the climate system from for example aerosol produced from volcanic explosions (Eyring et al, 2021) the scientific consensus states that a significant component of the climatic changes currently being observed are outside of the range of normal climate variability (Masson-Delmotte et al., 2018). These changes have been attributed to human activities that result in greenhouse gas emissions (Eyring et al, 2021). The introduction of greenhouse gases into the atmosphere changes the composition of the earth's atmosphere, altering the global radiative balance and leading to global warming (Kramer et. al., 2021).

The decade 2010 to 2019 was the warmest decade in recorded history, with the average global annual temperature 1.1℃ above pre-industrial levels (*WMO Confirms 2019 as Second Hottest Year on Record*, 2020). Globally, surface temperatures have increased by an estimated range of 0.8℃ to 1.3℃ (Masson-Delmotte, 2021) since pre-industrial times (1850-1900). Historically, most emissions have come from developed countries as they rapidly industrialised and developed into carbon-intensive economies (Evans, 2022) However, some developing countries are now among the highest emitters of greenhouse gases, and this trend

is expected to increase as they continue to industrialise and develop in order to meet the needs of their populations (Wei et al., 2016).

Rising global temperatures, warming oceans, rising sea-levels, decreases in sea ice and other changes have a wide array of impacts including placing ocean and terrestrial ecosystems at risk (Allen et al., 2018). Other impacts of climate change include long-term changes in weather patterns with more frequent and severe extreme events, sea level rise resulting in increased flooding and damage to habitats, and changes to ocean currents that threaten marine ecosystems and species extinction due habitat change (Hoegh-Guldberg et al., 2018).

Keeping global warming to 1.5℃ would avoid the most catastrophic effects of climate change (Shukla et al., 2022). To achieve this temperature increase ceiling, fossil fuel emissions need to be drastically reduced with urgent effect. Global greenhouse gas emissions would need to peak by 2025, and fall 43% below a business as usual baseline by 2030 (Shukla et al., 2022). However, realising this high-mitigation scenario timeously is unlikely, and even then, temperatures would only stabilise by the mid-century even if aggressive mitigation of greenhouse gases emissions started immediately (Vautard et al., 2014). Thus, even with the most immediate global mitigation efforts, livelihoods are already seriously threatened by the impacts of climate change.

Drought

Extreme hydrological events, such as drought, are likely to occur more frequently and at a more severe level due to climate change. This section of the literature review will unpack the various elements of drought, including the underlying causes of drought in relation to climate change, drought in Sub-Saharan Africa (SSA), the impacts of drought, and how climate change is exacerbating doughts. It will then unpack the observed changes in water security, South Africa's vulnerability to drought and the observed impacts, and then will

discuss the literature on droughts in urban areas, with a focus on increasing urban water demand management. Finally, this section of the literature review will provide a general overview of the literature on water conservation behaviours in the context of climate change-driven drought, discuss types of water conservation behaviour, look at water conservation behaviour interventions and unpack some challenges and opportunities for the adoption and promotion of water conservation behaviour.

Drought Overview

Drought is a complex phenomenon that can be caused by a multitude of factors. Natural climate variability including weather events such as El Niño or La Niña, oceanic cycles such as the Pacific Decadal Oscillation, topographical features of a region, and human activities such as water harvesting can all affect the amount of precipitation that falls in a given region (Ndayiragije & Li, 2022). However, while the increase in droughts in recent years is difficult to pin to one cause alone, the general consensus in the literature is that the droughts observed in current day are often anthropogenic in nature, and their frequency and intensity is influenced by human activities and human-caused climate change (Dai, 2012; Van Loon et al., 2016; Weber et al., 2018).

There are many human-caused drivers of drought, and they interact with natural causes of drought in a complex system. Human-driven land use change such as conversion of grasslands to croplands for farming can interfere with the hydrological cycle, and can cause decreased precipitation thereby leading to increased drought (Mirzabaev et al., 2019). Land use change can also result in soil erosion which reduces the amount of water soil can store, meaning that during dry conditions there is less water stored in the soil and this can exacerbate droughts (Mirzabaev, 2019). Anthropogenic climate change also contributes to increasing drought conditions, as changing weather patterns can lead to decreased precipitation in some regions and thus impacting the water supply (Hoegh-Guldberg et al.,

2018). The factors discussed thus far impact the supply of water, but demand for water also contributes to drought conditions. Water demand is increasing due to population growth, urbanisation and expansion of industry and agricultural processes that need water to function.

Anthropogenic droughts can interact with natural droughts and vice versa. For example, in an instance where a natural drought is occurring due to a climate variability event such as El Niño and natural water supplies are diminished due to decreased precipitation, the effects of land use change in that area could worsen the drought by further interfering with the hydrological cycle (Ndayiragije & Li, 2022). The converse scenario can also occur where human-driven drought, for example caused by increased demand for water due to a growing urbanised population, could be exacerbated if for example the precipitation in that area is reduced due to natural causes (Ndayiragije & Li, 2022). As drought-inducing human activities influencing both the supply and demand side of drought increase, and climate change continues to influence patterns of precipitation, it is likely that natural droughts will increasingly interact with human-caused drought drivers, resulting in more frequent and severe droughts (Hoegh-Guldberg et al, 2018). Some regions are more susceptible to drought, and more sensitive to the effects, than others.

Droughts in South Africa

Drought is a serious recurring climate hazard for many regions in SSA (Ayanlade et al., 2022) and has lead to devastation by causing and worsening environmental degradation, impoverishment, and unemployment in the region (Hellmuth et al., 2007). There is already a trend of increasing temperatures and decreasing precipitation patterns in arid and semi-arid areas of SSA due to anthropogenic climate change, and these drought-inducing patterns are likely to continue on this trajectory (Ghebrezgabher et al., 2016). South Africa is one of the countries in SSA that is especially susceptible to drought. The country has experienced several severe droughts, notably in the 1980s and 1990s, and most recently in 2014-2017

(Baudoin et al., 2017). South Africa's climate is semi-arid making it a water-stressed, drought-prone area, and the rainfall varies spatially and temporally (National Groundwater strategy, 2010). It is likely that the effects of climate change will increase the frequency, severity and duration of drought in the country in years to come (Asadieh & Krakauer, 2017; Trenberth et al., 2013).

South Africa is especially susceptible to drought for a few reasons: firstly, water demand in South Africa already exceeds the annual yield; secondly, the country has been experiencing climate change-related reductions in rainfall; and finally, the global increase in temperature causes increased evaporation from catchments and dams (Hedden & Cilliers, 2014). Furthermore, South Africa depends very heavily on surface water resources for water security (Lotter, 2017; Conrad & Carstens, 2017) and more than two thirds of South Africa's runoff gets stored in dams (Mwendera & Atyosi, 2018). Surface water is particularly vulnerable to drought as it depends directly on precipitation. All of these factors intensify the threat of drought.

Climate projections indicate that future droughts are likely to be very severe in the western parts of South Africa in particular (Naik & Abiodun, 2020). This western region has already experienced serious water scarcity, with the worst drought in 113 years occurring between 2014 - 2017 in the Western Cape Province (Botai et al, 2017). This event was aligned with decreasing precipitation during the preceding years, and the drought event coincided with an El Nino event that was unusually extreme, although El Nino does not have a clear link to winter rainfall in the province (Dube et al., 2022). Increased water demand in the City of Cape Town due to increasing urbanisation and population increase worsened the effects of the drought (Dube et al., 2022). The drought in the Western Cape will be unpacked in greater detail in the Methods section, as the 2014-2017 Western Cape drought is the case study for this research.

Droughts in Urban Areas

Drought literature is often focused on rural areas, and the negative effects on rural communities. However, urban drought (a point in time where the demand for water of a city outstrips the supply) (Zhang et al., 2019), is already a common occurrence globally. 79 cities around the world have suffered at least one urban drought event since 2000 (Zhang et al., 2019) and already, a quarter of cities suffer from chronic water shortages (McDonald et al., 2014). Urban water demand is fast tracked to outstrip supply globally by 2030 (Prinss et al., 2021), and by 2050, 933 million people (one third of the global urban population) living in cities will face water insecurity (He et al., 2021). Cities will need to be able to cope with increasing urban water demand, while simultaneously dealing with the added stress of climate change-induced changing precipitation patterns that threaten water supply (Saleemet al., 2021).

Globally, drought-related policies often only promote emergency actions that address drought in the short-term, while an isolated drought event is taking place (Cremades et al., 2021). For example, droughts in some Australian cities, California, and Cape Town, all saw the governments react at the city level by severely restricting water usage in urban areas at the time of the drought, and in some of the cases addressing supply by diverting water from natural environmental flows, such as from rivers (Low et al., 2015).

Some ways to increase urban resilience to drought in the long-term is improved urban water resource management, which includes river basin management and diversifying water sources (Brooke & Fenner, 2023) and addressing inefficient infrastructure (Abdulshaheed et al., 2017). All of these options address water supply, however, addressing the demand side of drought-causing factors by targeting water demand through promoting water conservation behaviours is also an important component of building cities' resilience to drought. Behaviour change is a key long-term necessary adaptation to climate change and its

associated effects, such as drought. Furthermore, this approach is advantageous due to its low associated cost. Additionally, considering the pressure that increasing urbanisation is putting on urban water supply (Zubaidi et al., 2020), and the advantages of water demand management, it is important to consider how best to promote water demand-side management during times of drought.

Water Demand Management

Water demand management (promoting decreased water usage) is a low-cost, low-regret adaptation option to drought (Parker & Wilby, 2012) and builds resilience at the household level (Bryan et al., 2017). Demand-side management strategies include measures that reduce baseline water-use (Addo et al., 2018), by focusing on improving water-use efficiency, increasing water supply restrictions, and establishing regulations to drive down water usage (Farley & Bremer, 2017). During drought periods, household water-use is often restricted including behaviours such as garden watering, car washing, filling swimming pools, and use of water for drinking, washing, toilet flushing (Walton & Hume, 2011). In addition to compulsory strategies, strategies such as awareness campaigns and public appeals can encourage voluntary water saving (Jorgensen et al., 2009; Seyranian et al., 2015).

In the face of drought, many cities have successfully utilised water demand management strategies to drive down residential water consumption through price and non-price mechanisms, such as tariffs and awareness campaigns, respectively (Hughes et al., 2013; Stavenhagen et al., 2018). Water demand side management interventions have been successful in areas like South East Queensland, Australia, where a particular intervention including water restrictions and rebate programs for water efficient devices and appliances successfully reduced household water usage (Walton & Hume, 2011).

Considering the low associated financial costs, demand management is of particular relevance to South Africa as a low-middle income country. It is therefore pertinent to

consider best practices in encouraging water conservation behaviour in the context of South Africa and the Western Cape's vulnerability to future droughts. Water conservation behaviour can be influenced by many factors, including attitudes towards water conservation (Syme et al., 2004), level of concern for the environment and awareness of water, and as is the focus of this research, risk perceptions (Talanow et al., 2021).

The Role of Risk Perceptions

This section examines risk perceptions' role in adaptive behaviours during droughts. It provides an overview of risk perceptions and their influence on pro-environmental behaviour, and then the literature on the link between risk perceptions and adaptive environmental behaviours, as well as the factors influencing both, is explored. Thereafter, the relevance of risk perceptions to water conservation behaviour is also discussed. Three predictors of risk perceptions and pro-environmental behaviour are then examined: values, social norms, and affect. The values section introduces Schwartz's theory of personal values, and the social norms section reviews the influence of social norms on behaviour, particularly in pro-environmental contexts. Lastly, the role of affect in environmental risk processing and its impact on risk perceptions and pro-environmental behaviour is discussed.

Risk Perceptions Overview

Paul Slovic's research posits that risk is a mental construct separate from real-world threats (Pidgeon et al., 2012). Within this framework, risk depends on subjective evaluation and is purely a perception. Risk can be quantitatively predicted by various factors, also known as risk determinants (Slovic, 1987). For example, an individual's perceived risk of an event could be predicted by the presence of factors such as self-efficacy and social trust, both known predictors of risk perception (Diotaiuti et al., 2021). According to Slovic (1987), cost-benefit analyses are performed during risk appraisal, and greater acceptance of risk occurs when the potential reward of the risk is perceived as high. Risks associated with activities

offering great rewards or pleasurable experiences, like extreme sports, are perceived as lower than risky activities with little promise of reward or pleasure (Gregory & Mendelsohn, 1993).

In terms of how risk perceptions work to influence behaviour, the literature around risk perceptions posit that the extent to which individuals are concerned about a risk event will determine their behaviour towards that event as they try to minimise the risk posed to themselves and others by modifying their behaviour (Wheeler et al., 2013). When risks threaten things that people value, they can spur individuals into taking certain actions to avoid the threat impacting their lives in an undesirable manner (Pidgeon, 2012). It is through this mechanism that risk perceptions drive behaviour - individuals align their behaviour in a way that minimises risks to things they value.

Risk perceptions have the ability to inform attempts to influence public behaviour and have been successfully used to inform responses to water scarcity and drought events at the policy level (Tucker et al., 2010). Due to their ability to influence behaviour, risk perceptions have been used in modifying public behaviours (Sheeran et al., 2014), and targeting or leveraging risk perceptions has been successful in promoting desired behaviour change (Ferrer & Klein, 2015). Thus, risk perceptions are of relevance to the drought management context of this thesis because they can potentially be harnessed to influence public behaviour such as water saving behaviour in response to a drought event.

Risk Perceptions and Pro-Environmental Behaviour

Risk theory has been used to understand how risk perceptions of climate change and specific environmental hazards (such as floods and droughts) are formed. It has also been used to determine how those perceptions go on to impact behaviour in response to these threats (Steg & de Groot, 2012; Steynor et al. 2020; van der Linden, 2015, 2017). Understanding how people perceive the risk of environmental crises to their personal safety is critical because getting a clear picture of risk perceptions can help explain actions taken by

people to adapt in response to these risk perceptions. This in turn can be helpful in informing contextual policies intending to promote adaptive behaviour (Wiid & Ziervogel, 2012).

The pro-environmental behaviour that individuals undertake is significantly impacted by risk perceptions of environmental threats such as climate change, especially by how one further perceives the gravity of the risks of climate change or an environmental threat to one's self (Hyland et al., 2015). Existing literature (e.g. Gandure et al., 2013; Rankoana, 2016; Talanow et al., 2021) indicates that perceptions of climate change risk can trigger and motivate adaptive behavioural responses. Environmental and climate change risk perceptions are often good predictors of pro-environmental and pro-climate change behaviours, including, but not limited to, waste recycling, lower energy use and green consumer behaviour such as buying eco-friendly products (Liobikienė & Juknys, 2016; Zander, 2018; Yu & Yu, 2017).

However, other findings have suggested that pro-environmental behaviours do not necessarily flow linearly from environmental and climate change risk perceptions and there are barriers and enablers to consider (Spence et al., 2011; Steynor et al., 2020; van der Linden, 2015). As certain factors can either enable or prohibit risk perceptions leading to changed behaviour, risk determinants are useful in understanding and predicting behaviour undertaken in response to a risk event (Wheeler et al., 2013). For example, if a person had high climate change risk perceptions but low self-efficacy, the low self-efficacy may pose a barrier to risk perceptions driving pro-environmental behaviour but a high self-efficacy may have the opposite effect (Valkengoed et al., 2023). Self-efficacy refers to the extent to which an individual feels they are capable of executing a desired action (Bandura, 1999).

There are many factors (risk determinants) that influence environmental risk perceptions and pro-environmental behaviours. For example, financial cost can influence which environmental behaviours one may engage in – often, people choose pro-environmental behaviours with the lowest financial cost to themselves (Huang et al., 2020).

Mitigation response inefficacy, where people feel that they have no power to mitigate the causes of climate change, can impact the extent to which people are willing to engage in pro-environmental behaviours (Xie et al., 2019). Age and gender can impact environmental risk perceptions, as women and younger adults generally have greater environmental risk perceptions (Subiza-Pérez et al., 2020).

However, the following specific socio-cultural and individual factors have been identified by the literature as some of the best determinants of environmental risk perceptions specifically, as well as pro-environmental behaviours generally: values, descriptive and prescriptive norms, and emotions (Carmi et al., 2015; Farrow et al., 2017; Ferrer et al., 2018; Hay et al., 2006; Janssen et al., 2014; Leiserowitz, 2006; Schultz & Wesley, 2014), and thus are the focus of this resarch. As risk perceptions help explain pro-environmental behaviour, these risk perception determinants are important to understand in order to predict and better understand the behaviour undertaken in response to risk events (Rankoana, 2016). These three determinants will be covered in detail in sections to come.

Although there is significant evidence that risk perceptions are important in understanding how, and if, people choose to engage in water conservation behaviour (Gandure et al., 2013), there is a dearth of literature looking at risk perceptions and the specific relation to water conservation behaviours in South Africa generally and particularly in the drought-prone and water-scarce Western Cape. Therefore there is a gap in the research on risk perceptions and pro-environmental behaviours, specifically in relation to drought, that this study will in part address.

Risk Perception Determinants

Values

In addition to risk perceptions, personal values play an important role in driving individual behaviour (Schwartz et al., 2012). Different personal values have been found to

impact how individuals choose to respond to events or threats and how they pursue their interests (Huang & Bargh, 2014). Furthermore, personal values are useful in understanding and predicting pro-environmental behaviour and have been used for this purpose in the past (de Groot & Steg, 2008; Liobikienė, 2012; Liobikiene & Juknys, 2016).

Schwartz's theory of basic values is an influential and pervasive theory in the field of personal values, and is one that has been used extensively to understand how values drive behaviour (Bobowik et al., 2011; Hanel et al., 2018; Krystallis et al., 2008; Schwartz et al., 2012). His theory defines values as personal principles that guide the life decisions and directions of people. For example, those who highly prioritise achievement and success will often be driven to pursue ambitious goals. According to Schwartz, our evaluations of good/bad and positive/negative in regards to people, events or actions are based on how these occurrences align with our values. That is, one will positively evaluate an event if that event promotes the protection of an important personal value, and negatively evaluate an event if it threatens that value (Schwartz, 2012).

Values will only influence behaviour if they are 'activated', which occurs where an opportunity appears to protect or promote a value (Schwartz, 2012). The triggering or ‘activation’ of values occurs via an affect-related mechanism, namely, when one’s values are threatened or violated, this triggers an emotional response, which in turn motivates people to act in such a way that will protect their value (Schwartz, 2012). This decision can be a conscious decision, or occur entirely outside of conscious thought. Thus, values strongly influence behaviour because people will organise their behaviour and lives around protecting and promoting their personal values, and therefore values can be thought of as personal goals that motivate action (Schwartz, 2012).

Schwartz’s theory of basic values consists of ten separate broad values, some of which are in conflict, and some of which are related and similar. Schwartz's basic values

framework includes four broad categories, organised by motivational similarities and dissimilarities (Schwartz, 2012). These four categories are: (a) openness to change (consisting of the values of stimulation and self-direction); (b) conservation (consisting of the values of security and conformity/tradition); (c) self-transcending (values beyond the self, explained further below); and (d) self-enhancing (values relating to one's self, explained further below). People can hold more than one value and opposing sets of values – but because values are prioritised differently, higher-priority values are the ones most likely to drive action (Schwartz, 2012).

Under the self-transcendence category, there are two broad values. First, benevolence, i.e. prioritising others with whom one is socially close over one's self; and second, universalism, i.e. promoting and displaying protection of the welfare of others (including those distant from oneself) and of nature over one's self (Schwartz, 2012). Under the self-enhancing category, the values are: achievement, i.e. personal success; and power, i.e. social status and control over people and resources. Self-transcending and self-enhancing values are also opposing value categories and are commonly evaluated in studies looking at pro-environmental behaviours. The value of hedonism (i.e. personal pleasure and gratification) is sometimes included under self-enhancement values in value frameworks drawing on Schwartz's theory of basic values, but is probably the least discussed in the literature on values, risk perceptions and pro-environmental behaviour (Schwartz, 2012). Despite this, there is evidence that hedonistic values are important for understanding pro-environmental behaviour (Steg et al., 2012).

Overall, self-transcendent values are positively associated with pro-environmental behaviours while the opposite is true of self-enhancing values (Abrahamse, 2019). Research conducted across six countries with significantly different cultures, languages and demographics indicates consistently that there is a relationship between self-transcendent

values and environmental concern, but a negative relationship for self-enhancing values (Schultz et al., 2005). Universalism (under self-transcendence) has been associated with higher risk perceptions of climate change, possibly suggesting that this value may be important to focus on when considering public climate change risk perceptions (Prati et al., 2012). Further, people with stronger self-transcending values tend to not only be more aware of environmental problems, but also tend to display increased levels of pro-environmental behaviours (Liobikienė & Juknys, 2016).Thus, there is an established pattern in the literature that self-transcendent values tend to operate in favour of pro-environmental behaviour and the opposite would be true of self-enhancing values (de Groot & Steg, 2009; Schultz et al., 2005).

Schwartz's theory of basic values contributes to understanding how self-transcending and self-enhancing values impact environmental risk perceptions and environmental behaviour, and is a key framework from which this thesis draws. Self-transcending and self-enhancing values have not been studied in conjunction in the South African (and particularly the Western Cape's) water-scarce context, and therefore this research partly addresses the gap in the literature regarding how all of these values relate to environmental risk perceptions and pro-environmental (particularly water conservation) behaviour.

Social norms

Social norms are the unwritten rules that govern behaviour in society (Lapinski, 2005). They are conveyed both by what other people do (descriptive norms) and by what people feel they are expected to do by others (prescriptive norms) and these mechanisms both influence behavioural choices (Lapinski et al., 2007; Nyborg et al., 2016). There is evidence that both prescriptive and descriptive norms are powerful influencers over pro-environmental behaviours and behaviour intentions (Roeser, 2012). Descriptive norms have been found to be especially reliable predictors of specific environmental behaviours, and further, that

invoking descriptive norms, i.e. explaining how other people engage in pro-environmental behaviour, is more effective in changing behaviour than, for example, providing information on how to engage in behaviours successfully (Nolan et al., 2008). Further, descriptive norms can be targeted in order to influence pro-environmental behaviour without needing to target prescriptive norms (Lapinski et al., 2007). However, there is also evidence that prescriptive norms can influence the effect that descriptive norms have on behaviour (Lapinski & Rimal., 2005).

Some examples of where prescriptive and descriptive norms can and have influenced pro-environmental behaviour include reducing household water and energy consumption, (Allcott, 2011; Brent et al., 2015; Schultz et al., 2005) increasing solar energy purchase for household consumption (Keizer et al., 2008), reducing littering and encouraging waste recycling (Fornara et al., 2011). In one study considering the willingness to reduce one's personal carbon footprint, people indicated that they would do so only if other people would do the same, illustrating how social norms can lead people to undertake behaviour they would not have without the influence of others (Barasi, 2019). As such, the literature shows that social norms appear to influence environmental behaviours significantly.

In the specific case of water conservation behaviour, it has been shown that city-level behaviour interventions that attempt to reduce household water consumption by, for example, encouraging water saving and stating that water saving is the right thing to do, are highly effective when people are given the average water usage of their neighbours, and result in significant reduction of water use (Ferraro et al., 2011; Ferraro & Miranda, 2011). This finding is prevalent in the literature (Beal et al., 2013; Reese et al., 2014; Schultz et al., 2005; Tiefenbeck et al., 2013), providing evidence that sharing others' water consumption with the public is an effective strategy to reduce water consumption. Furthermore, this strategy has been found effective across a range of countries (Datta et al., 2017; Schultz et al., 2019;

Torres & Carlsson, 2018). However, these interventions only work to reduce water consumption when people see that others are using less water than they are using themselves – otherwise they sometimes increase their consumption to match that of their neighbours (Ayres et al., 2012; Schultz et al., 2005).

Research on the usage of social norms in water conservation interventions has shown that interventions that include the use of social norms have longer-lasting effects on behaviour than those that do not. For example, in one intervention where households had their own water consumption compared to that of their neighbours, they continued to reduce their water consumption for four weeks after the intervention had ceased (Seyranian et al., 2015). Another source showed that in a different water reduction programme, households who were given information on their neighbours' consumption not only reduced their consumption to a greater extent than those receiving information only regarding the applicable water restrictions, but that these households kept saving water for longer than households who received a threat of a fine if they did not reduce water consumption (Jaeger & Schultz, 2017).

Despite the evidence that social norms are powerful determiners of pro-environmental behaviours, there is a relative lack of studies looking specifically at the intersection of social norms, water-scarcity risk perceptions and water conservation behaviours altogether, and this dearth is particularly prevalent in the South African context (Farrow et al., 2017). Considering the importance of social norms in influencing pro-environmental behaviour, more research is needed on the impact that prescriptive and descriptive norms have on water-scarcity risk perceptions and water conservation behaviours. Accordingly, this study will address, in some part, a gap in the literature in the South African context.

Affect

In addition to personal values and social norms, affect has been well established in the literature to reliably predict climate change risk perceptions (Leiserowitz, 2006; Smith & Leiserowitz, 2012; Sundblad et al., 2007), and is also a driver of behaviour (Damasio, 1998). It has been suggested that emotion, often derived from personal experience of risk events, is important in forming risk perceptions (van der Linden, 2015). Negative affect towards climate change predicts climate change risk perceptions, in that negative affect has been shown to influence the perceptions of climate change so that it becomes considered personally salient risk (Leiserowitz, 2006; Sundblad et al., 2007). Further evidence to this end shows that strong emotional reactions to environmental issues are associated with a higher likelihood of engaging in pro-environmental behaviors (Kollmuss & Agyeman, 2002). However, the role of emotions in driving behaviours is complex as when emotions are too negative or intense, they can trigger avoidance responses, leading individuals to avoid the stimulus that caused the strong negative emotion and resulting in avoided behaviour (Peloza et al., 2013). For instance, if the threat of drought or an environmental risk event feels overwhelming, individuals may avoid engaging with the threat due to excessive fear. Instead of taking actions to address the threat of the drought such as increasing their water saving, they may avoid thinking about or acting in regard to the drought entirely, resulting in avoided pro-environmental behaviour.

It is also important to consider the role of discrete emotions such as anger, guilt, fear and happiness in driving risk perceptions and pro-environmental behaviour change. Affect differs from discrete emotions in that it does not refer to a specific emotion such as fear or guilt, but rather indicates the direction of the valence feeling of that emotion - whether something is positively or negatively felt (van der Linden, 2017). The role of specific discrete emotions need to be considered individually, as they have been shown to have differential,

but important and highly influential, effects on risk perceptions and pro-environmental behaviour.

Anger. For instance, the experience of anger, which is an emotion associated with high feelings of control, often has more optimistic risk perceptions of a threat than fear, an emotion with low associated control (Lerner & Keltner, 2000). Previous research has indicated that anger is often associated with high certainty and control, which can sometimes mean that it is a greater driver of action than emotions associated with lower levels of control (Lerner & Keltner, 2000; Smith & Ellsworth, 1985) as it is an activating emotion. This finding has been consistent across laboratory and real-life studies (Fischhoff et al., 2012; Lerner & Keltner, 2000). In relation to pro-environmental behaviour, anger can predict engagement in pro-environmental behaviours and environmental activism (Stanley et al., 2021), in both personal (recycling, water usage reduction) and collective behaviour (protesting, signing petitions).

Guilt. Guilt is a strong emotional motivator of pro-environmental behaviours, and although other emotions, for example sadness, have also been correlated with environmental behaviours, guilt seems to result in more short-lived behaviour change than sadness or fear (Schwartz & Loewenstein, 2017). Guilt is often categorised as a 'negative' emotion that facilitates action such as compensatory efforts or reparation (Soscia, 2007; Tracy & Robins, 2007), and that has been shown to facilitate pro-environmental intentions and behaviour (Ferguson & Branscombe, 2010; Hurst & Sintov, 2022; Tam 2019).

Fear. When considering emotions and how they influence environmental risk perceptions, fear is one of the most researched emotions (Van Zomeren et al., 2010). As fear is an emotion that is associated with low control and high uncertainty, fear can also lead people to perceive risks as more serious than when experiencing other emotions (Johnson and Slovic, 1995). Fear has also been associated with less optimistic perceptions for future events

relative to anger (Lerner & Keltner, 2000). It is important to note that when it comes to influence behaviour, fear is a contentious emotion. Because of the lack of control associated with it, it can lead to an avoidance response where people avoid engaging with the threat at all (Peters et al., 2013; White & Albarracín, 2018; Witte & Allen, 2000), thus resulting in no pro-environmental behaviour taken. However, when fear is present in conjunction with self-efficacy, it can drive adaptive behaviour (Schwartz & Loewenstein, 2017).

Happiness. While the discrete emotions discussed thus far typically fall in the class of 'negative' emotions, positive emotions have also been shown to have important influences on risk perceptions and behaviour (Gasper & Clore, 2000; Johnson & Tversky, 1983), and notably pro-environmental behaviours (Taufik et al., 2016; Weber, 2020). 'Warm glow', a term sometimes used in a pro-environmental context describing the happy feeling when people feel good about themselves during or after engaging in a positive behaviour, predicts pro-environmental behaviours (Jia & van der Linden, 2020), sometimes more strongly than personal benefits related to the behaviour (Taufik et al., 2016). Positive emotions show a particularly strong influence on the behaviour of individuals who are already undertaking pro-environmental behaviours (Odou & Schill, 2020).

The importance of emotion in driving pro-environmental behaviours is evident, and the above discrete emotions discussed are of relevance to this thesis because of the differential roles they have been shown to play in influencing pro-environmental behaviour and environmental risk perceptions. However, there is a relative dearth of research looking specifically at the role of affect in driving environmental risk perceptions and pro-environmental behaviours such as water conservation behaviour, in the unique South African context where residents in formal housing use the majority of the residential water supply as elaborated on in Methods section. Thus, this poses a potential research direction valuable for

the international and local context by addressing in part the gap in the literature on affect, environmental risk perceptions and pro-environmental behaviour.

Summary

In the context of increasing effects from climate change, including urban drought, it is necessary to understand how risk perceptions impact water saving behaviour. The literature indicates that social norms, values, and affect are important for understanding risk perceptions and water saving behaviour, and this research looks to contribute to the gap in the literature regarding these variables.

Methods

A case study method was adopted for this research. A case study design refers to an in-depth, intricate and nuanced approach often used for studying a specific event or phenomenon in the environment in which it occurred (Crowe et al., 2011). This method was therefore appropriate because of the acute, single-event nature of the drought in question within the particular context of the Western Cape, as it allowed for deep research into the multiple facets of the experience of the drought (a 'real-life' experience).

Case Study Context: The Western Cape

The semi-arid Western Cape province of South Africa is at high risk of increasingly frequent drought events (Weber et al., 2018). The province is likely to see a decrease in mean total rainfall during the rainy season in years to come (Weber et al., 2018), and droughts are already a common occurrence in the region (Botai et al., 2017). In recent years (between 2014-2017) the province experienced the worst drought observed since 1904 (Botai et al., 2017). The Western Cape received rainfall below the mean annual average over the period 2015-2017 (Sousa et al., 2018) leading to a serious drought event. The result was that the 6 main reservoirs supplying the City of Cape Town (CoCT) (the capital city of the Western Cape) and surrounds were not receiving the usual run-off from nearby sources and in the context of a very large city with high water demand, the demand outstripped the supply (CoCT, 2015). The CoCT was seriously affected by the drought.

The CoCT government applied various approaches to drive down water consumption during the drought period (Calverley, 2022) to avoid "Day Zero" - the day when dam levels would contain only 13% of their full capacity, residential taps would be disconnected and water-rationing would commence (CoCT, 2015). Once Day Zero was reached, the city would have a water supply for approximately three additional months before the dams ran dry

completely and alternative water sources would have to be exploited. Water restrictions were instated, the most stringent of which occurred in 2018, when citizens were restricted to 50 litres of water per day from February to November 2018 (CoCT, 2017). Among other methods, communication campaigns were utilised to great effect. These campaigns included fear messaging around the looming Day Zero, a public water map where residents' usage could be viewed, and communications with tips on how to reduce water usage (Calverley, 2022). The CoCT's water saving campaigns were largely successful, resulting in a 50% reduction of water usage from baseline, and thus Day Zero was avoided (Dugard, 2021).

Although it is difficult to draw a causal relationship between climate change and this drought as there are many factors that influence hydrological events, the anthropogenic forcing of the climate more than doubled the likelihood of such an extended drought event occurring (Otto et al., 2018). The CoCT successfully avoided Day Zero for the 2014-2017 drought but, as the effects of climate change and subsequent threats to water security increase, droughts like that observed in 2014-2017 are expected to increase in frequency in the Western Cape region (Sousa et al., 2018). Therefore, the CoCT's future water security is under threat.

Another important element of this case study is the housing context of CoCT. In South Africa, apartheid left a spatial legacy from when people were systematically segregated by race in many ways, once of which included housing opportunities. As a result, 'non-whites' (a term used by the apartheid state) had to move to the outskirts of cities for housing (Strauss, 2019) that was informal, often cramped, and whose service delivery was neglected by the city (Strauss, 2019). This spatial inequality still exists in South African cities, including in the CoCT. Access to water in previously 'non-white' areas is less reliable and accessible than in the inner-city and in more affluent areas. As a result, residents of informal settlements often rely on communally shared public taps for their water supply (DWS, 2018),

and consequently residents living in informal housing account for only 4% of the total domestic water usage in CoCT (Ziervogel, 2019). Therefore, in the context of the Western Cape drought, this case study focuses on water usage in formal housing in CoCT as it is much higher than water usage in informal housing in informal settlements (Savelli et al., 2021).

In light of the drought that occurred in the Western Cape between 2014-2017, and the likelihood of such an event occurring again, this thesis will take the form of a case study design in exploring how values, social norms and affect influenced water scarcity risk perceptions and water saving behaviour of people living in formal housing in the CoCT.

Research Design

Theoretical Framework

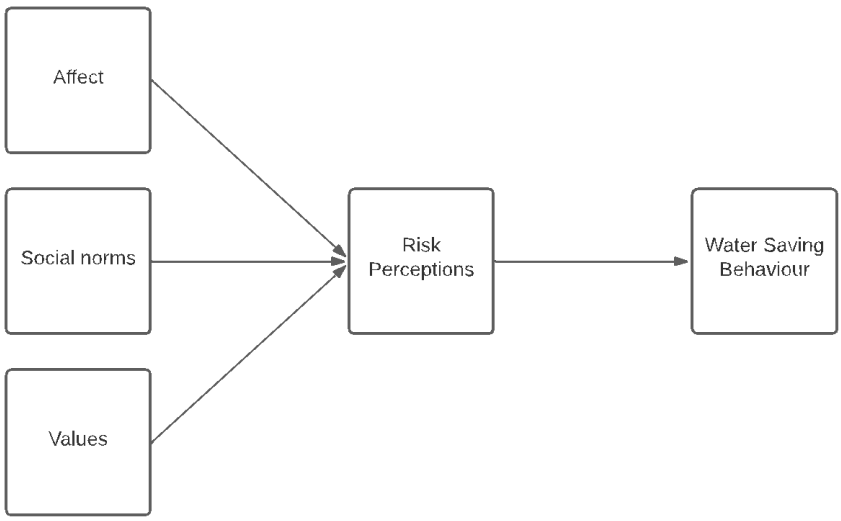
There is no existing theoretical framework that conceptualises how values, affect, social norms and risk perceptions fit together to influence pro-environmental behaviour. Some existing models of behaviour change, such as the Risk Perception Attitude framework, Protection Motivation Theory and the Extended Parallel Process Model, have included risk perceptions as a factor when trying to predict behaviour. However, none of these models simultaneously consider how risk perceptions are formed, and their influence on behaviour (Paek & Hove, 2017). Van der Linden's Climate Change Risk Perception Model integrates risk perception determinants into his model for predicting risk perceptions – cognitive factors, experiential factors and socio-cultural influences (van der Linden, 2015). However, the purpose of this model is to understand factors that form risk perceptions only, and thus it does not consider pro-environmental behaviour explicitly.

As there is currently no appropriate conceptual framework to help conceptualise how social norms, values and affect may simultaneously influence risk perceptions and water saving behaviour, this study aims to contribute towards addressing this gap by proposing a conceptual framework that can be applied to climate shock events, such as droughts, to

understand how social norms, values and affect, and risk perceptions interact to influence pro-environmental behaviours. A framework is illustrated below in Figure 1, showing how three selected risk perception determinants (social norms, values and affect) are conceptualised as shaping risk perceptions, and then that those risk perceptions influence water saving behaviour. If this framework is useful in providing insight into how the determinants, risk perceptions and water saving behaviour fit together, it could be drawn upon when promoting water conservation behaviour in the context of threatened water security.

Figure 1.

Affect, Social Norms and Values Shape Risk Perceptions which Predict Water Saving Behaviour



This framework underpins the research design for this study.

Mixed Methods Design

A mixed-methods design was adopted for this study, using both quantitative and qualitative methods. The quantitative component addressed objective 1, which was evaluating a conceptual framework in understanding how values, social norms and affect impact water-scarcity risk perceptions and behaviour by using statistical tests. The qualitative component

addressed objective 2, which was gaining a deeper understanding into how the selected risk perception determinants were shaped among the target population, and how the determinants influenced risk perception and water saving behaviour during the drought that occurred between 2014-2017.

A mixed-methods design was most appropriate for this research because one of the key foci was understanding linkages and relationships between different variables. Drawing on quantitative data can identify existing relationships, but qualitative data can help explain those linkages, and give deeper insight into the findings. Further, combining statistics with thematic analyses can help capture experiences and reflections that shed light on nuanced social situations with many influential factors, such as the social element of the drought event (Jogulu & Pansiri, 2011). Primary quantitative data were collected via individual responses to questionnaires on personal values, perceived social norms, emotional response, risk perceptions and water saving behaviour regarding the 2014-2017 drought in CoCT. Online interviews via Zoom were conducted to collect qualitative data on participants' memories and experiences of the drought particularly in regard to values, social norms, emotional response to the drought event, as well as their risk perceptions and water conservation behaviour at the time of the drought.

The study was cross-sectional (where data is collected from many individuals in one point in time), and utilised an observational study design that investigates and measures the independent and dependent variables within a scenario at the same time (Setia, 2016). A cross-sectional design was appropriate for the purposes of this research due to the limited time in a Master's degree, as well as the study's aim to consider the relationship between the studied variables at a specific period of time (2014-2017 drought in CoCT). The study looked at the water-related risk perceptions and behaviours, values, norms and emotions of different

households in a set location (CoCT) at one point in time, thus operating in the style of a case study.

Quantitative Component Design

Research Sample, Sample Size and Selection. The sampling procedure used two types of non-probability sampling, a method where the sampling does not use randomisation and there is not precisely an equal chance of given members of the population to be selected. Non-probability sampling is often used successfully in case study research design, as the aim of case study is to investigate a specific event or phenomenon in depth, and not to produce generalisable results necessarily (Shak et al., 2013). The study used convenience sampling, a widely and commonly used method of sampling that involves selecting suitable participants that meet basic criteria (such as age and demographics). This method is inexpensive, and less time consuming than random sampling, and therefore is often successfully used in student research (Taderhoost, 2016). As cost and time pressure are constraints of a Master's thesis, convenience sampling was selected for this study (Taherdoost, 2016). Furthermore, there was an element of exploratory research in this study, as the framework had not been tested before and the elements studied had not been done so in conjunction – therefore, convenience sampling was acceptable to gain some preliminary insights into a topic as it is often useful and used for identifying patterns and trends that can be further researched in a better-resourced study (Taherdoost, 2016). There was also an element of snowball sampling, which is when some participants are used to recruit other participants to participate, in order to increase sample size (Taherdoost, 2016). Snowball sampling was used to increase the pool of participants in the study, when an insufficient number of participants came of the original convenience sampling.

In terms of selection criteria, participants needed to reside in formal residential housing in CoCT for inclusion in the study, as this demographic uses the majority of the

water supply in the city (Viljoen, 2015), and thus their water conservation behaviours were the most relevant for the study's purpose. Respondents were asked to provide information on the behalf of their households as a whole. Participants were all over the age of 18 to avoid problems of consent. Participants who could not speak English were excluded from the study, due to limitations of the study in terms of capacity for translation. Further, those who were unable or unwilling to provide information regarding their water consumption through their own estimates were excluded as this measure was important for establishing water conservation behaviour. Quantitative data were collected from 112 respondents from 40 suburbs in CoCT.

Quantitative Questionnaire Design. All participants were given a screening measure which consisted of a yes/no question regarding being over the age of 18. Demographic information was collected when participants were asked to indicate their age bracket and the suburb they live in. All study variables (risk perception determinants, risk perceptions, and water saving behaviour) were measured with a 1-5 Likert scale for ease of comparison. Likert-type scales are useful for measuring unobservable constructs (like feelings, perceptions and attitudes) (Jebb et al., 2021) and are popularly utilized as scales of measurement in the social sciences (Croasmun & Ostrom, 2011; Joshi et al., 2015). Therefore, Likert-type scales were considered appropriate for use in this study as many of the variables that were measured (for example risk perceptions, affect, and perceived social norms) are unobservable constructs. Cronbach's Alpha, a statistic commonly used to measure reliability in scales that have been created or chosen for research (Taber et al., 2017), was computed and considered when using Likert-type scales for confirming internal consistency reliability (Croasmun & Ostrom, 2011). The scales' respective Alpha coefficients are discussed in the Results section.

In terms of the variable measures, water conservation behaviour was measured with a 7-item scale measuring types of water saving behaviours from length of showers taken, to

frequency of greywater use, as this scale length sufficiently covered a range of types of water saving behaviours (refer to questionnaire in Appendix A). Risk perceptions were measured on a 4-item scale assessing three key elements of risk perception - perceived likelihood, seriousness and concern/worry (van der Linden, 2015). Four items were sufficient to cover the three key elements of risk perceptions mentioned. Social norms consisted of two subcomponents with four items each - prescriptive and descriptive norms, assessed and considered separately. Global affect was measured on a scale with 4 items; Fear, anger, happiness, and guilt, where each discrete emotion had one corresponding item.

The Schwartz Personal Values Questionnaire 21 (PVQ-21) was used to measure the three personal values of interest in the study - self-enhancing values, self-transcending values and hedonistic values (refer to Appendix A). The PVQ-21 is a shortened version of the original PVQ, which is a questionnaire designed to measure the importance that a person places on a range of individual personal values (Schwartz, 2012). The PVQ-21 was preferable for this study as the original PVQ and SVS contain significantly more items than the PVQ-21 (57 items in total), and surveys with too many items have been shown to have lower completion rates (Kost & Correa da Rosa, 2018). This scale possesses high established convergent and discriminant validity among the values (Schwartz, 2012), high test-retest reliability (Schwartz, 2012) and adequate internal reliability (Schwartz, 2012) and thus was suitable for use.

Qualitative Component Design

Research Sample, Sample Size and Selection. Participants for the qualitative component of research were required to meet the same criteria as for the quantitative component. That is, they needed to reside in formal housing in Cape Town, needed to speak English, and needed to be over the age of 18, and be willing to provide estimated information about their water consumption. For the sampling procedure, convenience sampling from the pool of

quantitative participants was used, for ease of access and due to the time pressure of a Master's thesis. Furthermore, it was advantageous that the quantitative participants had already been exposed to the focus, themes and nature of the research, as they needed less introduction than if they had not been exposed. The number of participants was not presupposed and qualitative interviews were conducted until no or very few new themes arose to the point of what is reasonable within the context of the constrained time limit for a Master's thesis.

Questionnaire Design. The qualitative interview guide was informed by risk perceptions theory and thus encompassed the selected risk determinants for this study. Questions covered the following broad themes: risk perceptions of water scarcity, water saving behaviour, personal values, social norms, and affect (see Appendix B for the full interview guide).

Data Collection

Quantitative Data Collection

The quantitative survey was created using Google Forms, and included the measures discussed above and elaborated on in the Results section (see Appendix A). After ethical clearance was obtained from UCT Environmental and Geographical Sciences Research Ethics Committee (see Appendix C), the researcher found social media community groups that would accept join requests and were sufficiently large (more than 1000 members) to provide a wide pool for responses, and requested to join them. After being accepted into the group, the researcher posted an advertisement including details of the study and survey, what would be required from participants, and provided contact details should further information be desired. The groups that accepted the join requests included Hout Bay Complete, Hout Bay Organised, Higgovale/Oranjezicht Community group, and Atlantic Seaboard Community Forum. Quantitative data were collected over a five week period, from the 13th of July until the 26th of August 2021. The researcher also asked participants to share the survey on their

own social media accounts/channels, and to send it to their contacts. The researcher further asked 11 of her peers to circulate the survey on their own social media accounts/channels.

The online survey included an introduction to the study, screening measures and an online consent form. Participants were not asked to give their names, to ensure anonymity. After completing the survey, participants were provided with contact information in the case that they had any questions. There was also an option to request a summarised copy of the final thesis findings. All data collected was stored on a password protected cloud service (Google) to which only the researcher had access in order to ensure confidentiality.

Qualitative Data Collection

Participants were recruited from the pool of those who had completed the quantitative research, until no significantly different themes arose which resulted in a final number of 10 participants. The participants were interviewed over a 6 week period on Zoom (from the 6th of September until the 1st of October 2021), in interviews that ranged from 30 minutes to 50 minutes. Otter.ai software was used to transcribe the interviews, and interviews were additionally recorded on a password-protected phone as an audio file as an extra copy. Otter.ai files were immediately downloaded and stored on the password-protected computer.

Data Analysis

Statistical Data Analysis of Quantitative Results

The Statistical Package for the Social Sciences (SPSS) version 27 was used to analyse the data gathered in this study. PROCESS 4.0. Statistical package was used to conduct multiple mediational analyses. The level of alpha was set at $p<0.05$, as is convention (Andrade, 2019).

Standard assumptions were checked before running inferential analyses. Assumptions of normality, homoscedasticity, linearity were all met. Some Mahalanobis distances were greater than cut-off of 15 as set by convention (Leys et al., 2018), however the Cooks

distances (Cook, 1977) were not greater than 1 for any case, thus there are no influential cases in the dataset. The Durbin Watson statistic was 1.895, thus confirming independence of observations (Field, 2005). The data were also standardised before running the multiple linear regressions. Thus, all assumptions were met and no data cleaning or transformations were needed.

There were twelve variables included in the quantitative component of the study, of which the dependent variable was water saving behaviour, and the independent variables included: values (self-enhancing, self-transcending and hedonistic values); social norms (prescriptive and descriptive norms); affect, which was treated as a global score of the discrete emotions fear, guilt, happiness and anger; and the individual, discrete emotions. Risk perceptions operated as both an independent and dependent variable depending on the separate analysis conducted. That is, sometimes it was a predicting variable, sometimes it was an outcome variable, and sometimes it was a moderating/mediating variable.

Weights were applied to the data in order to deal with the overrepresentation of respondents from one suburb (Hout Bay). Then, descriptive and correlational analyses were performed on all 12 variables (predictor: values, norms, global affect, discrete emotions including anger, fear, sadness and happiness, and risk perceptions) and the outcome variable (water-use behaviour). Secondly, all assumptions for linear regression were tested. No data transformations were required.

Thirdly, all the statistical analyses were run. Two multiple linear regressions were run:

(i) outcome variable: water saving behaviour, and predictor variables: values (self-transcending, self-enhancing, and hedonism), social norms (prescriptive and descriptive), affect (global score, and fear, anger, sadness and happiness), and risk perceptions

(ii) outcome variable: risk perceptions, and predictor variables: values (self-transcending, self-enhancing, and hedonism), social norms (prescriptive and descriptive), affect (global score, and fear, anger, sadness and happiness).

Three mediation analyses were run, to test if:

(i) social norms mediated the relationship between risk perceptions and water saving behaviour,

(ii) personal values mediated the relationship between risk perceptions and water saving behaviour, and

(iii) affect mediated the relationship between risk perceptions and water saving behaviour.

Mediation analyses look to test whether a third factor variable influences the relationship between the independent and dependent variable, and seeks to explain that process. That is, it seeks to establish a causal link. The Hayes Process for mediation was used for this analysis, using the PROCESS tool for SPSS (Hayes, 2013).

Then three moderation analyses were run, to test if:

(i) social norms moderated the relationship between risk perceptions and water saving behaviour,

(ii) personal values moderated the relationship between risk perceptions and water saving behaviour, and

(iii) affect moderated the relationship between risk perceptions and water saving behaviour.

Moderation analyses look to test the influence of a third variable on the relationship between the independent and dependent variable, but rather than establishing a causal link, it tests for the conditions under which such an effect occurs. That is, it seeks to establish whether a

moderating variable strengthens, weakens, or reverses the relationship. Baron and Kenny's approach was used for the moderation analyses (Baron and Kenny, 1986).

Qualitative Data Analysis

A thematic analysis approach to the qualitative data analysis was chosen. Thematic analysis is a commonly and successfully used qualitative method that can be used across many different types of research questions, and can offer a high quality, flexible approach to qualitative research (Nowell, Norris & Moules, 2017). One of its advantages is that it can be useful for establishing differences and similarities in a sample of research participants, and can reveal unforeseen insights into personal or collective experiences (Nowell et al., 2017). As establishing differences and similarities of individual's experiences during the Western Cape drought, and investigating personal insights from the event, was of interest to this study, thematic analysis was considered an appropriate method for this study's qualitative data analysis.

A mix of inductive and deductive methodology was used, because of the need to address the pre-conceived research objectives, but also because of the desire for some flexibility to note other meaningful themes that became evident in the analysis. The steps taken to conduct the analysis included (Saldanha, 2013): (i) becoming familiar with the data, (ii) when checking transcriptions, noting down key themes and observations/ideas, (iii) flagging and coding into categories meaningful pieces of texts that could have relevance for the overall research, (iv) organising certain codes under categories, some deductive (for example categories of values, norms and affect) and some inductive where the need arose, (v) revising the codes where necessary, and shifting categories. NVivo software was used for the coding process.

Ethical Considerations

Permission to conduct the proposed study was obtained from the University of Cape Town Science Faculty Ethics Committee on 13 July 2021 (Appendix C). Online consent forms were given to all respondents prior to the start of the survey. The form explained the rationale and purpose of the study. The consent form assured the participants of confidentiality of their information and data, and explained that their participation was voluntary and that they could withdraw their consent at any stage of the study. Participants were informed as to what the exact requirements were in terms of completing the questionnaires, and given the contact information of the main researcher and main supervisor for any queries. There were very few practical risks posed to participants. Participating in the study did not cost participants anything apart from their time. It was possible that participants could have experienced social desirability bias and/or guilt about their water conservation habits. It was also possible that answering questions of an emotional nature may have presented some minor psychological disturbances. To address this, the questionnaires were administered in the least triggering and judgemental format possible, for example the researcher was mindful of not implying value judgements about certain types/amounts of water usage, or stronger desirability of some values over others. They were also reminded that all their data was confidential and would be stored in a password-protected cloud. Participants were also offered a copy of the final results of the study.

Limitations

Two of the key limitations of this study lay in the sampling. Firstly, only four Facebook groups were joined which limited the residential areas of participants. Two of these were in the same suburb, Hout Bay, and the other three were across suburbs in Cape Town's city bowl (Oranjezicht and Higgovale). The formal housing components with these suburbs are relatively affluent, with good municipal service delivery, and thus may have resulted in

less variation in the responses than if a wider range of suburbs were targeted, especially as the Facebook groups were the main channel for survey responses.

Secondly, using social media platforms may result in a dominance of responses from younger adults for a number of reasons: firstly, younger people may be more concerned about environmental issues (Subiza-Pérez et al., 2020), such as water scarcity, and thus more inclined to complete the survey. Secondly, there are a greater number of younger people on Facebook, which was the only platform used for data collection for this research. The age group 18-24 make up 26.1% of South African Facebook users, and 25-34 account for 32.2% for a cumulative 58.3%, whereas only 15.2% of users fall within the 35-44 age bracket. Sixty eight percent of social media users are 34 and younger in South Africa (Statista, 2021). Therefore, people under the age of 34 are more likely to be exposed to surveys advertised on social media platforms. Further, as the researcher advertised the survey on a community group for the area where she lived and grew up in, her peers (largely people she attended school with) may have been more likely to complete the survey, and to act on the request to forward it to their peers to help her obtain the number of responses she needed.

A further limitation of the research was its retrospective nature, in that participants were asked to recall and reflect on their experiences and recollections of the Western Cape drought event that had transpired some years before the data collection (precisely speaking, 4 years prior). Having to recall their experiences could have meant that participants could not entirely accurately recall, for example, their behaviour, feelings, or risk perceptions from the time of the drought and that therefore the data was not as accurate as it may have been had it been collected during the drought.

Some of the measures were created by the researcher, and although they were subjected to item-analysis (discussed in the Results section), and reliability/internal consistency testing, it was outside of the scope of the study to establish test-retest reliability.

This could have meant that the measures did not have strong test-retest reliability, and this lack of knowledge was a limitation.

Results

This chapter will present the research results. The sample characteristics will be presented first, followed by the reliability results for the measures used in the data collection. Then, descriptive statistics for all 12 variables (values, norms, global affect, discrete emotions including anger, fear, sadness and happiness, and risk perceptions, and water-use behaviour) will be presented. Thereafter, the chapter presents the findings from the inferential quantitative research, together with the relevant themes arising from the qualitative research. The inferential and qualitative results will be organised and presented by theme, with quantitative results presented first and the qualitative results second within each theme.

Sample Characteristics

The survey generated 112 responses from 40 Cape Town neighbourhoods (Table 1). Hout Bay is over-represented (N =36), likely because the local Facebook community group was more successful at advertising the survey link than other community groups. Also, the researcher is a Hout Bay local and thus her post may have received more attention on the Hout Bay platform because she was known to some members of the community. As mentioned in the methodology section, weights were applied to the data to ensure a more representative sample without overrepresentation from certain suburbs (see Appendix D). The age brackets that respondents were provided with were: 18-24, 25-30, 30-40, 40-50, 50-60, 60-70 and 70-80, and the majority of responses came from those in age groups 18-24 (N = 25; 22.3%) and 25-30 (N = 46; 41%). Thus, the majority of responses came from those 30 or under (N = 71) (63.4%).

Measures

The measures created by the researcher were tested for internal consistency/reliability by using Cronbach's alpha. Acceptable levels of Cronbach's alpha range between 0.6-1.0, for Likert-scale instruments (George & Mallery, 2003). The water-use behaviour variable was

measured with a 7-item scale, and the internal reliability (Cronbach's Alpha = 0.65) was modest but nonetheless acceptable for this sample especially considering the low number of items in the scale, that the research findings are not to be used in a clinical setting where a higher alpha is required, and a modest alpha has been considered acceptable for use in published journal articles (George & Mallery, 2003). Risk perceptions were measured on a 4-item scale and the internal reliability was acceptable (Cronbach's Alpha = 0.72). The social norms measure consisted of two subcomponents with four items each - prescriptive and descriptive norms, assessed and considered separately. The total internal reliability for both norms was acceptable(Cronbach's Alpha= 0.76). For prescriptive norms, the original alpha value was low (Cronbach's Alpha= 0.59), and this score was improved by performing item-analysis. Item-analysis is a method where individual test items are examined to assess how well they measure the construct that the measure assesses as a whole. Item analysis can often identify weak items or questions, and removing the weak items can increase the internal consistency of the measure. The score improved from 0.59 to 0.65 on the removal of one item following item analysis, rendering the scale acceptable. Descriptive norms had a good internal reliability, approaching a high alpha value (Cronbach's Alpha= 0.79), thus this measure was satisfactory and needed no adjustments or item removal.

The Schwartz Personal Values Questionnaire 21 (PVQ-21) was used to measure the three personal values of interest in the study - self-enhancing values, self-transcending values and hedonistic values (refer to Appendix A. The PVQ-21 is a widely used measure that has been psychometrically tested across cultural groups and countries and literature states that the alpha values of the 10 higher order values (including those used in this study) are sufficient (Schwartz and Ciecuich, 2021). Global affect was measured on a self-made scale with four items (fear, anger, happiness, guilt – each discrete emotion had one corresponding item), and the internal reliability was modest (Cronbach's Alpha= 0.64) but acceptable for this study

(George & Mallery, 2003). However, for some of the analyses the individual discrete items were included in the analyses in their individual single-item form.

Descriptive Statistics

Table 1 shows the descriptive statistics for the variables. As shown in the table, prescriptive norms (M=3.36, SD =0.81) had a higher mean than descriptive norms (M=2.8, SD =0.65), indicating that participants experienced higher levels of prescriptive than descriptive norms. Out of the values scores, in general participants had higher levels of hedonistic values (M=3.78, SD =0.54) than self-transcending values (M=3.46, SD =0.81), but higher levels of self-transcending than self-enhancing values (M=3.5, SD =0.87).

Correlational Analyses

Table 2 shows the correlations between the different study variables. Both descriptive (0.56, $p<0.001$) and prescriptive norms (0.56, $p<0.001$) were strongly positively correlated with water saving behaviours, showing that, as social norms regarding water saving behaviours increased, so did self-reported water conservation behaviour.

Hedonism was negatively correlated with water saving behaviour, suggesting a trend that as hedonism increases, water saving behaviours decrease (-0.31, $p<0.001$). Risk perceptions were only moderately positively correlated with water saving behaviour (0.22, $p<0.05$), suggesting that there is only a moderate trend of higher levels of water saving behaviour when risk perceptions are higher, than when they are lower.

Table 1

Descriptive Statistics for Study Variables

Variable	Mean	Maximum	Minimum	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error
1. Water saving behaviour	3.88	5.00	2.29	.67	-.02	.23	-.88	.45
2. Risk perceptions	3.87	5.00	1.50	.75	-.58	.23	-.09	.45
3. Prescriptive norms	2.88	4.75	1.50	.65	.09	.23	-.46	.46
4. Descriptive norms	3.36	5.00	1.67	.81	-.08	.23	-.30	.45
5. Hedonism	3.78	5.00	2.75	.54	.47	.23	-.36	.45
6. Self-enhancing values	3.55	5.00	1.00	.87	-.65	.23	-.11	.45
7. Self-transcending values	3.46	5.00	1.00	.81	.14	.23	1.08	.45
8. Global affect	4.04	5.00	2.00	.72	-.48	.23	.24	.45
9. Anger	4.07	5.00	2.00	.72	-.81	.23	1.28	.45
10. Fear	3.75	5.00	1.50	.72	-.84	.23	1.01	.45
11. Happy	2.98	4.75	1.50	.70	.21	.23	.05	.45
12. Guilt	4.41	5.00	3.20	.40	-.18	.23	-.94	.45

Note. N = 112

Table 2

Correlations for Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Water saving behaviour												
2. Risk perceptions	.22*											
3. Prescriptive norms	.54**	.20*										
4. Descriptive norms	.56**	.02	.52**									
5. Hedonism	-.31**	-.01	-.05	-.03								
6. Self-enhancing values	-.19*	-.05	-.17	-.25**	.21*							
7. Self-transcending values	.04	-.09	.03	.06	.02	-.17						
8. Global affect	.38**	.48**	.39**	.21*	-.16	-.06	.16					
9. Anger	.30**	.34**	.24*	.11	-.25**	-.09	.03	.79**				
10. Fear	.23*	.49**	.31**	.16	-.09	-.02	-.03	.69**	.39**			
11. Happy	.27**	.24**	.30**	.20*	-.07	-.16	.29**	.75**	.54**	.29**		
12. Guilt	.28**	.26**	.27**	.12	-.07	.09	.20*	.63**	.40**	.16	.36**	

Note. * indicates correlation is significant at the 0.05 level (2-tailed); ** indicates correlation is significant at the 0.01 level (2-tailed). N = 112

Inferential Statistics and Qualitative Data

Risk Perceptions

Quantitative Results. The quantitative findings on risk perceptions showed two main findings: (a) risk perceptions predicted water saving behaviour, and (b) fear predicted risk perceptions. A simple linear regression showed that risk perceptions predicted water saving behaviour (β = .180, p =0.036), as did descriptive norms (β = .467, p <0.001). The overall regression was statistically significant (R^2 = [0.097], F(1, 109) = [12.845], p <0.001). The other variables that predicted water saving behaviour were descriptive and prescriptive norms, and hedonism, which will be discussed in their respective sections below. Global affect was removed from this analysis due to issues of multicollinearity.

Table 3

Multiple Linear Regression Predicting Water-saving Behaviour

Variable	B*	SE*	*B**	*t**	*p**	95% CI
Self-transcending values	-2.062	1.143	-.165	-1.804	.074	-4.330, .206
Hedonism	-2.504	.656	-.335	-3.817	<.001*	-3.806, -1.202
Self-enhancing values	-.508	.690	-.066	-.736	.463	-1.878, .862
Descriptive norms	.852	.150	.467	5.681	<.001*	.554, 1.150
Prescriptive norms	.226	.171	.136	1.324	.189	-.113, .565
Guilt	.707	.624	.106	1.134	.260	-.531, 1.945
Anger	.020	.702	.003	.029	.977	-1.373, 1.414
Happiness	.442	.533	.076	.829	.409	-.616, 1.500
Fear	-.233	.460	-.042	-.507	.613	-1.146, .680
Risk perceptions	.278	.131	.180	2.125	.036*	.018 .538

Note. Dependent Variable: GlobalWSB. N =112. CI = confidence interval (lower and upper limits). * indicates $p < 0.05$; ** indicates $p < 0.001$. *B is the unstandardised regression coefficient. *SE is the standard error of the regression. *B* is the standardised regression coefficient. *t* is the t-statistic which is the significance test for coefficient (larger *t* stronger evidence). *p* is the significance level.

Table 4

Multiple Linear Regression Predicting Water Scarcity Risk Perceptions

Variables	B	SE	*β*	*t*	*p*	95% CI
Self-transcending values	.064	.877	.008	.073	.942	-1.676, 1.804
Hedonism	-.122	.503	-.025	-.242	.810	-1.120, .877
Self-enhancing values	-.031	.530	-.006	-.059	.953	-1.082, 1.020
Descriptive norms	-.046	.115	-.039	-.397	.692	-.274, .182
Prescriptive norms	.169	.130	.157	1.30 0	.197	-.089, .427
Guilt	.914	.666	.212	1.37 2	.173	-.408, 2.236
Anger	.941	.834	.226	1.12 9	.262	-.713, 2.596
Happiness	.207	409	-.055	-.506	.614	-1.017, .604
Fear	1.46 1	.513	.404	2.85 1	.005*	.444, 2.478

Note. Dependent Variable: GlobalRP. N =112. CI = confidence interval (lower and upper limits). * indicates $p < 0.05$. *B is the unstandardised regression coefficient. *SE is the standard error of the regression. *B* is the standardised regression coefficient. *t* is the t-statistic which is the significance test for coefficient (larger *t* stronger evidence). *p* is the significance level.

A multiple linear regression investigating the predictors of risk perceptions was also significant and explains 24.6% of the variance in the model, $R_2 = [0.246]$, $F(9, 99) = [24.6]$, $p<0.001$). The only significant predictor in this model was fear, ($\beta = 0.404$; $p=0.005$) with a positive relationship, indicating that as fear increased, so did risk perceptions of water scarcity and drought as shown in Table 4. Global affect was also removed from this analysis due to issues of multicollinearity.

Qualitative Results.

Day Zero Campaign and Risk Perceptions. Five out of 10 interviewees indicated that the Day Zero campaign was effective in increasing risk perceptions. The Day Zero campaign was when the city launched a communications campaign emphasising the possibility of reaching Day Zero and what that would look like and mean for citizens, and how far away the city was from reaching that day.

One of the reasons the Day Zero campaign was reported by participants as very effective was due to the sense of urgency that the campaign induced. The following quote from a research participant illustrates how one interviewee felt that the Day Zero campaign was effective in making them worried and increasing their perceptions of drought risk because of the solid, tangible date given to them for when the city's taps would run dry:

> And the Day Zero sort of campaign that was run, I felt was really effective in actually giving you a visual of the dates of when Cape Town, if we continue on this current trajectory, will run out of water. That date was also important because it wasn't like the way people describe climate change where it's, oh you know, if we don't do this now it's going to affect us in 20 years or 10 years, or even 5 years. It [the timeline] is too long, but when it's July, and you say that in October we're going to run out of water, it's effective. (Respondent 4, Gardens)

The following quote from a research participant shows how the Day Zero campaign made the interviewee worried and scared about their future water security, and the effect it would have on daily lives:

> Because then there was certainly a sort of a Day Zero public education program, and it was all over the news and everyone was talking about it all the time. And it's obviously a terrifying thought to think that we would have to drive somewhere and get a 5-litre bottle of water every day or whatever [because it could no longer be accessed from the taps]. (Respondent 8, Oranjezicht)

Infographics and statistics that were given out as part of the Day Zero campaign, aiming to illustrate the seriousness and urgency of the drought, were impactful in increasing risk perceptions (as indicated by seven out of 10 interviewees). Infographics and statistics indicating the low levels of dam water storage led to respondents perceiving the risk that the drought posed to them with increased seriousness. The quote below shows how one research participant remembered the impact of the communication of statistics on their perceptions of how serious the drought was:

> So, when there were numbers telling us the dams are at X percent, that was quite effective in making it clear how close we were to zero. Yeah, so numbers had a big impact. (Respondent 1, Claremont)

The Relationship Between Water-Scarcity Risk Perceptions and Fear. Across all interviews but one (nine out of 10 interviewees), it was clear that the drought was a highly emotional experience, and that fear was the most frequently felt emotion (eight out of 10 respondents). Interviewees' accounts of their experiences of fear during the drought gave great insight and explanation into how emotion and risk perceptions interacted. In terms of how fear was formed or induced during the drought, four out of 10 interviewees stated that during the drought the images of dried-up dams and the threat of Day Zero communicated through the Day Zero campaign were 'scary'. The below quote shows how one research participant found the photographs scary and how they made the drought threat feel tangible for them, showing how fear increased their risk perceptions of the drought:

> I mean, those images… you know, seeing photographs of Theewaterskloof[1] just as a desert was quite scary. And I think I remember, it really brought it [the seriousness of the drought] to life. (Respondent 6, Hout Bay)

[1] Theewaterskloof dam is one of the largest municipal storage dams in CoCT.

Four out of 10 interviewees indicated that they felt afraid because of what they perceived the consequences of the drought could be. Two respondents said that they were scared of having to queue to collect water every day[2], and two feared future competition over water/natural resources. One interviewee reported being afraid of what CoCT residents would do, and how they would maintain their lives, if water ran out completely.

The Effect of Affect on Water Conservation Behaviour

Quantitative Results. None of the affect measures, including fear (β = 22; p =.613), happiness (β = .076; p =.409), anger (β = .003; p=.977) and guilt (β = .106; p =.260) predicted water conservation behaviour, as can be seen in Table 3.

Qualitative Results. Apart from influencing risk perception, respondents reported that fear was also a key motivator of behaviour. Three out of 10 interviewees reported that they remembered fear strongly motivating them to save water, with two of the three reporting that fear was a greater motivator than altruistic or moral reasons.

The quote below illustrates how one research participant reported that they perceived fear as a greater motivator for water saving behaviour during the drought than any altruistic motives:

> I think fear was probably more of a motivational factor for a lot of people than any sort of altruistic reasons, yeah. (Respondent 8, Oranjezicht)

[2] This was one of the measures the government had in place should Day Zero have arrived – city residents would be expected to queue in designated points to collect an individual water allocation.

The quote below shows how one research participant remembered being motivated to save water for altruistic reasons, but ultimately found fear a greater, more powerful motivator:

> I don't think that the moral thing motivated me. No, not that it didn't motivate me because it did quite a bit. You know, I was conscious of it. But it was still like fear motivated me more? (Respondent 5, Claremont)

The other emotions considered for this research: guilt, happiness, anger and global affect, did not appear to influence water saving behaviour.

The Effect of Social Norms on Risk Perceptions and Water Saving Behaviour

Quantitative Results. The results show that prescriptive norms moderated and mediated the effect of risk perceptions on water saving behaviour and that descriptive norms predicted water saving behaviour (β=0.467; p<0.001) (see Table 5).

Prescriptive norms mediated the effect of risk perceptions on water saving behaviour as the indirect effect of prescriptive norms on water saving behaviours was significant (Effect= 0.06, se = .02, p = 0.009,95% C.I. (0.004, 0.142). That is, prescriptive norms had an indirect effect on water saving behaviour, and caused risk perceptions to lead to increased water saving behaviour as was found in a mediation analysis. Descriptive norms did not mediate the effect of risk perceptions on water saving behaviour (Effect = 0.008, se = .04, 95% C.I. (-.074, .09).

Prescriptive norms also moderated the impact of risk perceptions on water saving behaviour (see Table 5), whereby in cases where prescriptive norms were medium or high, as risk perceptions increased, water saving behaviour increased. However, where perceived prescriptive norms were low, water saving behaviour was similar across the levels of risk perceptions. This is illustrated in the interaction graph below (Figure 2). Descriptive norms, however, did not moderate the impact of risk perceptions on water saving behaviour.

Table 5

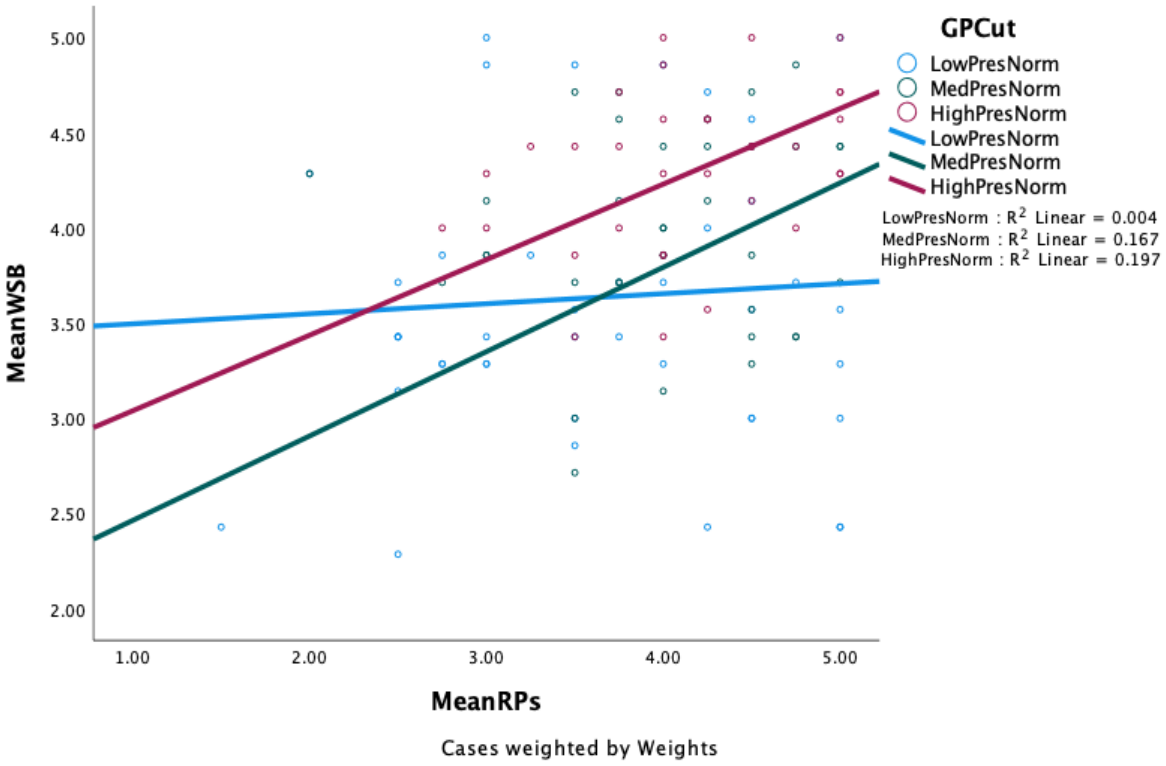
Hierarchical Moderation Analysis: Water Saving Behaviour

Block	Variable	B	SE	*B*	*t*	*p*	95.0% CI
1		.284	.079	.324	3.584	<.001*	
	Risk perceptions					*	.127, .441
2	Risk perceptions	.166	.075	.190	2.228	.028	.018, .314
						<.001*	
	Prescriptive norms	.364	.070	.446	5.236	*	.227, .502
3					-		-1.268, -.022
	Risk perceptions	-.645	.314	-.736	2.052	.043	
					-		-1.425, .119
	Prescriptive norms	-.653	.390	-.799	1.677	.096	
	Prescriptive norms x			1.77			.065, .449
	risk perceptions	.257	.097	4	2.654	.009*	

Note. Dependent Variable: MeanWSB. N =112. CI = confidence interval (lower and upper limits). * indicates $p < 0.05$; ** indicates $p < 0.001$.

Figure 2

Scatter Plot showing the Interaction Between Prescriptive Norms and Risk Perceptions



Note. LowPresNorm refers to low presence of prescriptive norms (data points falling within the first tertile of the data); MedPresNorm refers to medium presence of prescriptive norms (falling within the second tertile of the data); and HighPresNorm refers to high presence of prescriptive norms (falling within the third tertile of the data).

Qualitative Results.

The Effect of Descriptive Social Norms on Behaviour. Descriptive norms influenced water saving behaviour - respondents indicated that seeing others' conservation efforts motivated their own efforts, a theme that occurred across all interviews. One research participant (Respondent 3) indicated that seeing people queue up to collect water from springs was helpful because it motivated their own conservation, and five research participants noted that they observed high levels of neighbourly compliance in terms of how neighbours were using water in their gardens. All participants indicated that seeing others conserve water promoted their own motivation to conserve, and one participants' (Respondent 6) account below further indicates that they found the neighbourly water consumption information supplied to them as especially helpful:

> If I remember correctly you would get your own water usage but you also had something which showed the kind of neighbourhood water usage… I don't think it was a pressure from the neighbourhood, it was just the fact that you were being provided with information that enabled you to gauge [your own usage compared to that of the neighbourhood]… You know it wasn't heavy handed, and the intention was to encourage rather than to expose. (Respondent 6)

The Effect of Prescriptive Social Norms on Water Saving Behaviour. Across all interviews (n=10), the influence of prescriptive norms on behaviour was a strong theme in the data and was characterised by indications of clear and direct pressure and expectations to change one's water-use behaviour during the drought. All interviewees felt that direct social pressure was effective in positively influencing their behaviour. As illustrated by an excerpt (below) from Respondent 7's interview, interviewees felt expectations to conserve in their homes (and also in the workplace, as revealed by other interviews) from family, peers, workplace, government and neighbour/s/hoods, with pressures to save water ranging from social, to moral and financial. The 'blocks' spoken about below refer to where the apartment block had a suggested/requested limit to residents' water usage as set by the governing body:

> There were definitely strong expectations [to save water], socially, environmentally and morally, but also our apartment had blocks put on water restriction. There were also physical monetary limitations. So [there] were actually real pragmatic expectations as well as just a mental, social pressure and environmental pressure from society [to save water]. (Respondent 7, Tamboerskloof)

Regarding how some of the above-mentioned pressures were communicated, three out of 10 interviewees reported that their neighbourhoods had clear expectations regarding water-use behaviour, recalling that people were directly asked to reduce their consumption (through

WhatsApp groups, emails, or direct requests), and that these pressures did drive them to save water.

Social inclusion. A theme of social inclusion as a motivator for water saving behaviour arose from the qualitative interviews. All interviewees expressed experiencing a strong sense of community during the drought, through seeing others take action. That is, they felt that people had really come together as a united front and took collective action to do their part in addressing the drought, and that this sense of community created an expectation (prescriptive norm) to save water. The quote below shows how one respondent felt inspired by their community to save water as they perceived their community to care about each other:

> There were so many people that inspired me [to save water] and made me feel like I was part of a community that really cared about each other. (Respondent 1, Claremont)

However, respondents expressed that they found the effects of the community expectations to be positive and that they felt empowered and encouraged to change their behaviour by the sense of unity.

Social exclusion. Social exclusion, in the form of shaming, was also reported. Six out of 10 interviewees indicated that they observed people shaming others for not complying with restrictions, and thus from deviating from the expectations of community and collective action. Shaming included behaviours such as complaining about other people's behaviour to others, calling others out on their behaviour when they were perceived to be doing the "wrong thing", and neighbourhood WhatsApp groups mentioning streets by name that had not been conserving as expected, and direct comments on one's own and others' behaviour, criticising people's excessive water usage. The quote below shows how one interviewee

recalled other people calling out water wasting behaviour, and that they engaged in this themselves:

> People would call you out for doing the wrong thing, taking a shower that was too long or, you know, doing laundry when you didn't need to. And leaving a tap running kind of thing. I would do it. (Respondent 2, Vredehoek)

The Effect of Values on Risk Perceptions and Water Saving Behaviour

Quantitative Results. The quantitative findings on values have two salient results: (a) self-transcending values moderated the relationship between risk perceptions and water saving behaviour and (b) hedonistic values predicted water saving behaviour (see Table 6). Hedonism negatively predicted water saving behaviour, meaning that as hedonistic values increased, water saving behaviour decreased ($\beta = -.335$; $p<0.001$).

Self-transcending values moderated the relationship between risk perceptions and water saving behaviour – that is, where self-transcending values were high, there was a stronger relationship between risk perceptions and water saving behaviour than when self-transcending values were low (see Table 6). Self-transcending values were the only values to have a moderating effect. The interaction effect is illustrated in the graph below (Figure 3).

Table 6

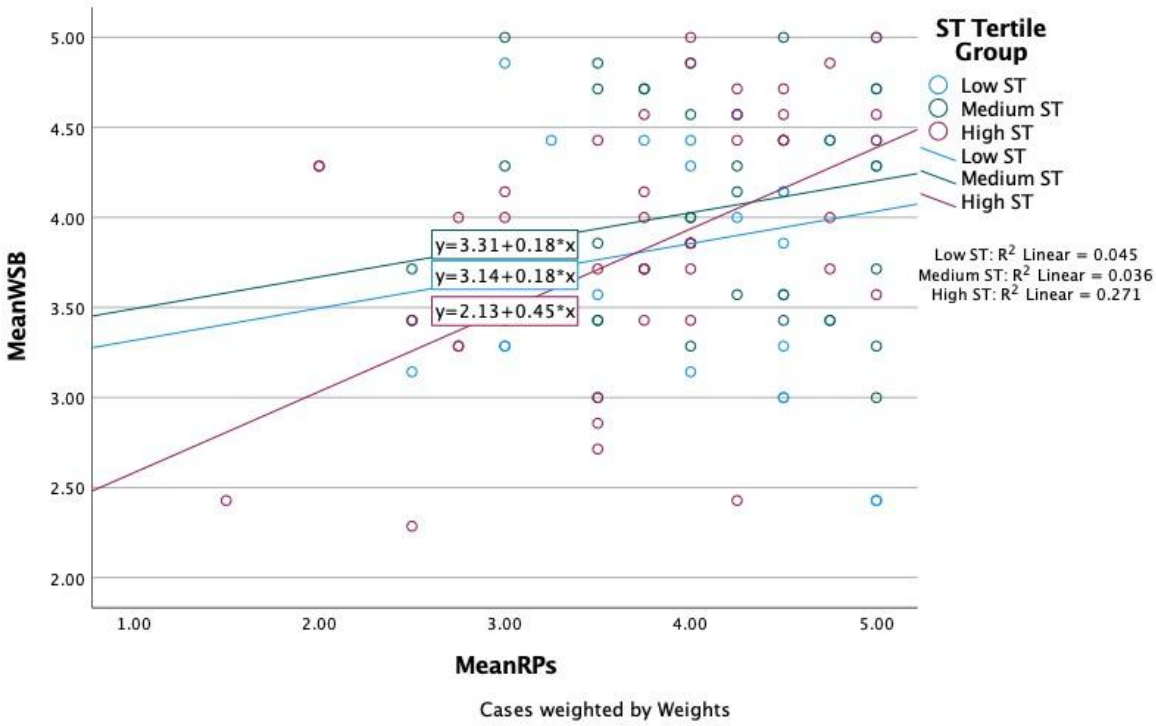
Hierarchical Moderation Analysis: Water Saving Behaviour

Block	Variable	B	SE	*B*	*t*	*p*	95.0% CI
1	Risk perceptions	.284	.079	.324	3.584	<.001**	.127, .441
2	Risk perceptions	.285	.080	.325	3.570	<.001**	.127, .443
	Self-transcending values	.020	.161	.011	.123	.902	-.299, .339
3	Risk perceptions	-.067	.179	-.076	-.373	.710	-.421, .287
	Self-transcending values	-1.795	.845	-1.013	-2.125	.036*	-3.470, -.121
	Self-transcending values x risk perceptions	.476	.217	1.106	2.188	.031*	.045, .907

Note. Dependent Variable: MeanWSB. N =112. CI = confidence interval (lower and upper limits). * indicates $p < 0.05$; ** indicates $p < 0.001$.

Figure 3

Scatterplot showing the interaction between self-transcending values and water saving behaviour



Note. . LowPresNorm refers to low presence of self-transcending values (data points falling within the first tertile of the data); MedPresNorm refers to medium presence of self-transcending values (falling within the second tertile of the data); and HighPresNorm refers to high presence of self-transcending values (falling within the third tertile of the data).

Qualitative Results.

The Effects of Self-Transcending Values on Risk Perceptions and Water Saving Behaviour. Self-transcending values (wanting to act in a way that promotes the common good) appeared consistently across the majority (n=8) of interviewees' stories, in terms of wanting to safeguard the water security of others. Interviewees drew on concern for others' welfare to explain their own motivations for changing behaviour, expressing that they wanted to avoid causing harm to others (the city running out of water) through their own actions (wasting water).

Six out of 10 interviewees expressed particular concern that one's own actions could lead to greater suffering for others in South Africa. The quote below shows how one interviewee wanted to avoid running out of water because they were especially concerned about how socially disenfranchised populations in South Africa, a highly unequal country, would suffer much more from the drought than they would, and that this motivated them to change their behaviour to save water:

> I guess the motivation was just like, you know how much inequality there is in South Africa and you're very lucky to have a shower and a sink and to have running water. And I guess I was also just thinking about the people that were not as lucky as I was … I know that there are people that would suffer from the drought, way more than I would. So, I wanted to avoid that. I didn't want anyone to suffer because of me. (Respondent 10, Gardens)

The Effects of Hedonistic Values on Risk Perceptions and Water Saving Behaviour. Hedonistic influences on behaviour related to the inconveniences that drought restrictions imposed. While some behaviour change inconveniences were deemed minimal and allowed for continued water saving (e.g. turning off the tap while brushing one's teeth), other behaviours were deemed unpleasant and more inconvenient. Seven participants felt that they had difficulty retaining what they considered to be more extreme water saving measures, which generally seemed to consist of catching greywater from bath or shower water in buckets for toilet flushing, and the reuse of other greywater, and that the behaviours they had retained were the ones that were more convenient, such as turning off the tap while brushing teeth, or not flushing the toilet more than necessary.

The following quote provides insight into a perception of the types of behaviours people have reverted back to, and those that they have retained, and why:

> Like, obviously there was the toilet flushing, which was also very much at large, with society in general, which I actually feel like has stayed, yeah. It [toilet flushing] makes sense and it doesn't cause you a huge inconvenience, right? I think it's just convenient, I got used to it. (Respondent 2, Vredehoek)

There were no themes arising regarding the effect of one's self-enhancing values on risk perceptions, and water saving behaviour.

Discussion

Chapter Introduction

As a result of accelerating climate change, hydrological events of increasing severity and frequency pose a serious threat to water security in Sub-Saharan Africa (Niang et al., 2014; Serdeczny et al., 2016). South Africa needs to increase drought adaptation efforts considering the already occurring, and predicted, changes in precipitation (Asadieh & Krakauer, 2017; Trenberth et al., 2013). In order to understand and predict responses to future drought events, and to promote adoption and retention of water conservation behaviour, this study drew on the theory around risk perceptions, behaviour models (Paek & Hove, 2017), and van der Linden's (2015) work on climate change risk perceptions to gain insight into water saving behaviour during the Cape Town drought of 2014-2017.

The main objectives of this study were:

(i) to evaluate the usefulness of a proposed theoretical framework (see Fig.4 again below) in explaining how values, social norms and affect influenced water scarcity risk perceptions and water conservation behaviour,

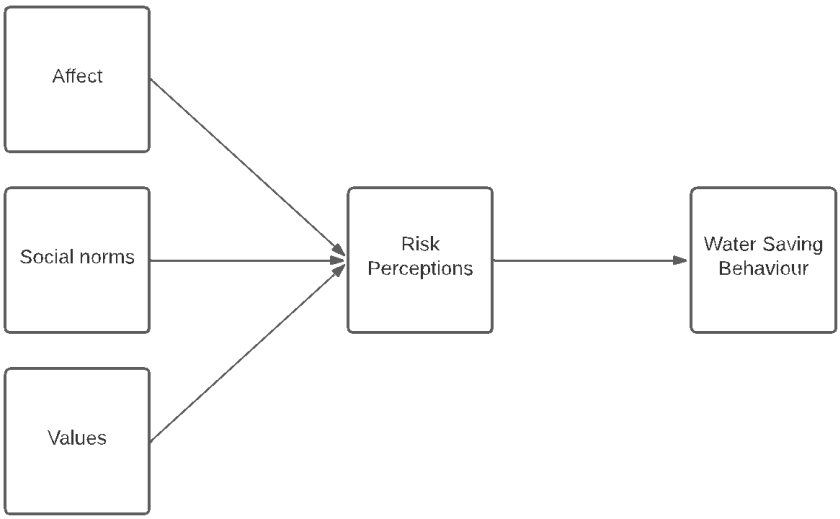
(ii) to provide understanding of how values, social norms and affect were shaped, and how they influenced risk perceptions and water saving behaviour, and

(iii) to integrate the findings to draw broader conclusions about the role of these specific determinants in risk perceptions of water-scarcity events and water conservation behaviour.

This study proposed a framework (see Fig 1 again below) as outlined in the methods section to help conceptualise how selected risk perception determinants (affect, social norms and values) and environmental risk perceptions fit together to influence water saving behaviour during the drought.

Figure 1

Affect, Social Norms and Values Shape Risk Perceptions which Predict Water Saving Behaviour



However, the main findings revealed that the relationships between the three risk perception determinants, risk perceptions, and water saving behaviour were more complex than originally thought and as presented by the original framework displayed in Figure 1. The main findings showed that:

(a) fear was significantly positively related to water scarcity risk perceptions;

(b) risk perceptions predicted water saving behaviour;

(c) self-transcending values moderated the relationship between risk perceptions and water saving behaviour;

(d) prescriptive norms moderated the relationship between risk perceptions and water saving behaviour;

(e) prescriptive norms mediated the relationship between risk perceptions and water saving behaviour;

(f) descriptive norms predicted water saving behaviour; and

(g) hedonism predicted water saving behaviour.

The complexity of the findings were not expected in the original framework which proposed a linear relationship that flowed from risk perception determinants to risk perceptions and then to water saving behaviour. The reality is that these factors all worked together in a much more intricate, complex way to influence risk perceptions and water saving behaviour. Therefore, the original framework needs to be revised to properly reflect the findings in order to aid and represent how the risk perception determinants, risk perceptions, and water saving behaviour fit together, as will be done in this discussion.

The discussion will first unpack the main findings as part of future drought management potential as adaptive water conservation behaviour by integrating the quantitative and qualitative results. Then, in light of the main findings, the discussion will propose a revised framework as a tool for conceptualising how the selected risk perception determinants (social norms, values and affect) and water scarcity risk perceptions influenced water saving behaviour during the drought.

Risk Perception Determinants, Risk Perceptions and Water Saving Behaviour

This section will discuss the main findings of this research in the following order:

1. The role of fear in influencing water scarcity risk perceptions and water saving behaviour
2. The role of social norms in influencing risk perceptions and water saving behaviour
3. The role of hedonistic and self-transcending values in influencing water saving behaviour
4. The effect of risk perceptions on water saving behaviour

In each section, the quantitative findings are discussed first, and then the qualitative findings are used to expand on the quantitative findings.

The Role of Fear in influencing Water Scarcity Risk Perceptions

Fear was a significant predictor of risk perceptions. This finding is consistent with the literature on specifically fear and risk, which is that fear can be a strong determinant of risk perceptions (Whitmer & Sims, 2021). The qualitative work also showed that risk perceptions were strongly shaped by fear, and provided greater insight into how fear that shaped risk perceptions was formed, and will be unpacked below.

Day Zero Awareness Campaign. The government's awareness campaign promoting the 'Day Zero' narrative, the day that the CoCT would run out of water, was a powerful fear-inducer during the drought. As detailed in the methods chapter, Day Zero was the day that the CoCT's residential taps would be shut off and residents would have to queue for a daily water allocation. The results revealed the Day Zero awareness campaign to be a powerful, influential narrative that successfully influenced risk perceptions and behaviours taken. Awareness campaigns are one of the tools that governments draw on in environmental crisis times (Katz et al., 2016), however the literature around the efficacy of water saving awareness campaigns in driving down demand is mixed (Moglia et al., 2018). The effectiveness can range from 2-21% reduced demand (Baumann et al., 1998; Fielding et al., 2012; March et al., 2013).

Some research has noted that campaigns that draw on social norms have strong results (Ferraro et al., 2011), and campaigns with an educational element (how to address environmental crises) have had particular success (Martínez-Espiñeira & García-Valiñas, 2014). Relative to other awareness campaigns, Day Zero was highly successful - resulting in a 50% demand reduction of water (Dugard, 2021). One of the reasons that the Day Zero campaign was so effective, according to the results, was its appeal to fear.

Fear Appeal. Fear appeals can be defined as persuasive messages that through emphasising a threat or danger induce fear with the intention of either diverting or

encouraging behaviour away from the threat (Maddux & Rogers, 1983). Although emotions are recognised as very important in influencing environmental risk perceptions and behaviour (de Miranda Coelho et al., 2016; Vining & Ebreo, 2002), the effects of fear on behaviour are contentiously discussed in the literature, which shows that presence of fear of an event does not always result in pro-environmental behaviour in response to the event (de Miranda Coelho et al., 2016; O'Neill & Nicholson-Cole, 2009). Sometimes, fear can produce an avoidance response in the face of environmental hazards, which results in low levels of adaptive behaviour as the person will avoid the issue in entirety because the associated fear emotions are so unpleasant (Kals & Maes, 2002). However, there is also some evidence showing that fear appeals can be very successful in encouraging adaptive behaviour, and can have a stronger effect on behaviour than emotion-neutral appeals (Cismaru et al., 2011; Kidd et al., 2019; McKay et al., 2004; Nelson et al., 2011; Whitmer & Sims, 2021), under certain conditions (to be discussed further below).

In this study, the fear appeal was shown to be highly effective in inducing fear while avoiding an avoidance response. While it has been shown that fear appeals can have a perverse effect and result in an avoidance response, they are sometimes useful in cases where self-efficacy and perceived threat are high (Peters et al., 2013; White & Albarracín, 2018). Negative effects of fear and fear appeals have been noted mostly in cases where self-efficacy is low (Witte & Allen, 2000). It is possible that the Day Zero campaign, appealing to fear, had such great success in promoting adaptive behaviour because of high levels of self-efficacy induced from the city's Day Zero campaign which contained clear instructions on how to change behaviour.

Some of these highly publicised instructions and pieces of advice included suggesting a breakdown of where to proportionately use allocated water per day such as 3 litres for drinking, 10 litres for showering, re-using laundry water for toilet flushing, fitting low-flow

showerheads and taps, and finding and fixing leaks on property and 2 minute showers (Edmond, 2019). During the time of the drought, there was also accessible and publicised messaging emphasising that undertaking behaviour, and reducing water on an individual level would indeed help combat the drought – which could have raised levels of self-efficacy. High levels of self-efficacy induced from these instructions and messaging may have been present in the CoCT and have therefore combatted a negative avoidance response in the face of fear given that, as stated above, literature has shown that fear appeals do not tend to induce an avoidance response when self-efficacy levels are high (Peters et al., 2013; White & Albarracín, 2018; Witte & Allen, 2000).

As expanded on above, the Day Zero awareness campaign's fear appeal was effective at inducing fear that positively influenced risk perceptions and behaviour. The campaign induced fear in two main ways, as shown from the results: the timeline/countdown to Day Zero, and the visual images of effects of the drought, for example dried up dams.

Countdown to Day Zero. The public countdown to Day Zero (displayed on online dashboards, in newspapers, and billboards) induced fear because of the certainty and tangibility it conveyed. Respondents found that the fear induced by the countdown induced fear of potential effects of the drought and increased their sense of urgency regarding the drought, which then encouraged them to increase their water saving efforts. This corresponds with literature suggesting that when a risk is uncertain or intangible, uncertainty of a risk does lower the likelihood of adopting pro-environmental behaviour, and certainty has the converse effect (Barrett & Dannenberg, 2009). Thus, the countdown to Day Zero was an effective part of the campaign – the fear it induced led to increased risk perceptions of the drought, which reportedly increased water saving behaviour. The results also indicate that the Day Zero campaign was effective in inducing fear that increased drought risk perceptions through the associated visual images that were part of the campaign.

Visual Information. At the time of the drought, fear was strongly induced by visual information – that is, visual representations of the drought that were heavily publicised as part of the Day Zero campaign. This included images of the dried-up water storage dams shared via mass or social media. The images made the crisis more real for respondents and made the drought appear more urgent and serious, and increased fear. Seeing images made the drought more real and tangible, showing the power of images in driving a risk event home and influencing risk perceptions. This finding is consistent with literature showing that shocking images of drought used to induce climate change-related fear have been found to influence intentions to engage in pro-environmental behaviour (Hartmann et al., 2018).

Discrete Emotions. Although fear was a predictor of, and played a role in influencing, water scarcity risk perceptions and water saving behaviour, it was unexpected and in contrast with the literature which indicates that the other discrete emotions such as: guilt (Schwartz & Loewenstein, 2017), anger (Lerner & Keltner, 2000), and happiness (Jia & van der Linden, 2020) and global affect (Ferrer et al., 2018; Hay et al., 2006; Janssen et al., 2014) did not influence risk perceptions and behaviour. The retrospective nature of this research could have influenced this result as fear is an emotion that can have long-lasting effects, and thus its effects on risk perceptions and behaviour, could have been more easily recalled post-drought than the other emotions (anger, guilt, and happiness) (Gonzalez & Martínez, 2014). It is also possible that the measure used to measure affect did not pick up on the other discrete emotions apart from fear, and this will be discussed in detail in the Limitations section.

Overall, this research shows the effectiveness of awareness campaigns that incorporate fear appeals in influencing risk perceptions and behaviour. The findings suggest that fear-driven campaigns work by inducing fear, which leads to increased risk perceptions, adding to the literature in this area, possibly indicating why the ‘Day Zero’ campaign was so

successful in reducing water usage during the drought. Furthermore, this research corroborates the wider literature stating the important role that emotions and in particular fear play in shaping environmental risk perceptions and pro-environmental behaviour, and show how this held true in a water scarcity context.

The Role of Social Norms in influencing Risk Perceptions and Water Saving Behaviour

The results indicate that both prescriptive norms and descriptive norms were important influencers of water saving behaviour during the drought. This section will:

1. Discuss the findings on descriptive norms influencing water saving behaviour, and
2. Discuss how prescriptive norms and water scarcity risk perceptions interacted to influence water conservation behaviour.

Descriptive Norms. The quantitative results showed that descriptive norms were a predictor of water saving behaviour, which is consistent with the literature stating that descriptive norms are strong and reliable predictors of pro-environmental behaviours (Farrow et al., 2017; Fornara et al., 2011) and that providing people with information on descriptive norms (how other people behave) can have a greater influence on behaviour than providing information on how one can go about undertaking such behaviours (Nolan et al., 2008). The qualitative results gave greater insight into how descriptive norms were induced, and how they drove increased water saving behaviour through invoking a sense of community.

Community. Participants indicated that a strong motivator of water conservation behaviour during the drought was the sense of community they felt, created by the perception of a collective, united front that was working towards a common goal of saving water. Participants reported that physically observing others (neighbours, family, friends, colleagues) conserve water, and knowing that others were also reducing their water usage, created a strong sense of community and encouraged one's own efforts during the drought.

This finding supports the existing literature which indicates that observing others' behaviour is an important mechanism through which descriptive social norms can influence behaviour (Nolan et al., 2008). Notably, it was the observed presence of conformity, rather than environmental norms specifically, that was recalled to influence respondents during the drought. This finding is in accord with Kinzig et al. (2013) who argue that strictly pro-environmental norms and values are not required for pro-environmental behaviour change, and that norms of conformity are powerful in producing behaviour change (Kinzig et al., 2013).

Water usage information of neighbourhoods was also provided by the city in order to publicise and make visible the efforts of others – in this study, this information was received well and not as a form of shaming. Respondents emphasised that they did not receive the neighbourhood consumption information negatively and overall they felt that it was helpful and not heavy-handed, and more encouraging than as a means to shame. Other research conducted in CoCT during the drought also found that the supply of information on neighbour's water consumption was effective at increasing water saving behaviour (Brick et al., 2017).

These findings indicate that in times of drought, and perhaps other environmental crises, descriptive norms could promote adaptive behaviour and could be capitalised upon when trying to promote adaptive behaviour and are in agreement with the literature in this regard (Saugato et al., 2015; Javey & Sorokina, 2019; Torres & Carlsson 2018; Datta et al., 2017). In particular, the providing of information on neighbour's consumption was a highly effective tactic and was received well, and similar provision of information may be received well in future droughts in CoCT. This finding adds to the literature by showing that in future drought events in CoCT, descriptive norms of conformity could be harnessed to promote adaptive behaviour.

Prescriptive norms. The quantitative results showed that where prescriptive norms are higher, the relationship between risks perceptions and water saving behaviour becomes significantly stronger. This means that in cases where there are greater instances of clear pressures and social expectations regarding water conservation behaviour, risk perceptions impact behaviour, but not in cases where prescriptive norms are low. This corresponds with some literature showing that where there are high levels of social norms regarding a preventative behaviour, there are correspondingly high rates of the preventative behaviour (Kittel et al., 2021). This finding adds to the literature by expanding on how social norms and risk perceptions interact to influence water saving behaviour, which thus far has only shown that prescriptive norms predict or influence risk perceptions and water saving behaviour, without much of an indication as to how this occurs.

The qualitative results showed that participants felt pressured to save water in response to explicit requests and expectations to reduce water usage from a variety of people (family, friends, peers) and in multiple places (work, home, neighbourhood). These pressures effectively encouraged participants to increase their water saving behaviour, corroborating literature showing that prescriptive norms are influential in the context of risk perceptions, and water saving behaviour (Carmi et al., 2015; Farrow et al., 2017; Ferrer et al., 2018; Janssen et al., 2014). While there is some evidence showing that prescriptive norms effectively drive conservation behaviour and are a useful and effective way to change behaviour (Biel & Thøgersen, 2007; Cialdini, 2007; Göckeritz et al., 2010; Niemiec et al., 2020), there appears to be a greater supply of research on the use of descriptive norms in effectively promoting pro-environmental behaviour. This research adds to the literature on prescriptive norms, showing that they are an important influencer of water conservation behaviour. The qualitative findings also showed that community exclusion and shaming was a prevalent form of prescriptive norms during the drought.

Shaming. Community exclusion, namely shaming, was an important theme within the broader theme of prescriptive norms. Participants reported that individuals were shamed for violating water restrictions, or poor water saving efforts, through various channels such as social media, direct explicit comments on individuals' behaviour. The literature in the field has shown shaming to be effective in environmental crisis events, in promoting adaptive behaviour change, and in drought events elsewhere (Joselow, 2018). Public shaming and social exclusion can be a punishment for violating norms (Creanza et al., 2017; Ostrom, 2000) and a negative social reaction to someone's actions can strongly influence that person's behaviour (Waring et al., 2017).

When considering how community shaming may be adaptive in an environmental crisis, there is some evidence that punishing deviant behaviours through social disapproval can assist in maintaining and enforcing norms (Fehr & Fischbacher, 2004; Fehr & Schurtenberger, 2018). In instances where individuals deviating from social norms experience shaming and exclusion, they may change their behaviours in order to conform and fit back in – if they desire social acceptance (Jetten & Hornsey, 2014; Heerdink et al., 2013). Therefore, in cases where the norms are adaptive, social exclusion and shaming may be advantageous in enforcing and upholding adaptive behaviours. Thus, the inclusion and exclusion properties of community and shaming may have exerted influence on behaviour that could have resulted in greater uptake and maintenance of water conservation (adaptive behaviour). Therefore, this finding shows how community and shaming may promote adaptive behaviour during drought and should be taken into consideration for drought management.

The findings on the influence of social norms (descriptive and prescriptive) in this context show that descriptive norms predicted water saving behaviour, and that prescriptive norms were an important influencer of water saving behaviour under conditions of perceived

high risk in the context of the Western Cape drought. These findings are in support of the literature, which agrees that social norms are important influencers of behaviour (Allcott, 2011; Beshears et al., 2015) and can promote adaptive behaviour during environmental crisis events (Rode et al., 2015; Roth et al., 2015) including droughts (Grecksch, 2021; Jaeger & Schultz, 2017; Lede et al., 2019). Thus, during a future water crisis event in CoCT, the government could utilise social norms appeals, by emphasising prescriptive norm and descriptive norms by for example creating platforms to communicate expected or appropriate water saving behaviour, thereby harnessing prescriptive norms, and capitalising on descriptive norms by further encouraging water saving behaviour by making others' water saving visible.

The Role of Hedonistic and Self-Transcending Values in influencing Water Saving Behaviour

The results indicate that both hedonistic and self-transcending values influenced water saving behaviour. This section will:

1. Discuss the findings on hedonistic values and water saving behaviour, and
2. Discuss how self-transcending values and water scarcity risk perceptions interacted to influence water conservation behaviour.

Hedonistic values. The results showed that hedonism was a barrier to water conservation behaviour, in that higher levels of hedonism predicted lower levels of water conservation behaviour. Behaviours that posed high levels of factors associated with hedonistic traits (such as convenience) such as collecting greywater for toilet flushing were considered more difficult and tedious to engage in. Behaviours were reported as more bothersome to adopt during the drought, and difficult to retain, and were more likely to be referred to and considered as 'extreme' measures. However, behaviours that were more

comfortable and convenient were reported as easier to adopt and retain, for example closing the tap while brushing teeth.

These findings indicating that hedonism was associated with low levels of water saving behaviour due to associated discomfort and inconvenience are consistent with research showing that those with higher hedonistic values will decide to behave in a way that causes the least discomfort and inconvenience to themselves (Nordlund & Garvill, 2016; de Groot & Steg, 2009, 2010). As hedonism negatively predicted water saving behaviour, the results are further consistent with the literature in this area, which suggests that higher presence of hedonistic values (such as valuing convenience) can hinder pro-environmental behaviour (in this case water saving behaviour), because such behaviours may come at a personal cost to one's convenience and comfort (Steg & de Groot, 2012; Steg et al., 2012).

This is an important finding as of the three types or categories of values considered in this research (hedonistic, self-transcendent and self-enhancing values), hedonistic values are the least discussed in the literature (Schwartz, 2012) on how values influence risk perceptions and pro-environmental behaviour. Therefore, this finding adds to the literature by showing how hedonism plays a role in influencing pro-environmental behaviour. That is, high levels of hedonism pose a barrier to adaptive behaviour where that behaviour poses inconvenience and discomfort. Understanding this can help understand types of behaviour most likely to be adopted based on hedonistic factors and provide insight into how to address barriers in order to promote adaptation and retention of water saving behaviour by minimising inconvenience to residents, and focusing on emphasising more convenient water saving behaviours.

Self-transcending Values. While self-transcending values did not predict water saving behaviour, the quantitative findings show that they moderated the relationship between risk perceptions and water saving behaviour, showing that when self-transcending values are present, risk perceptions predict water conservation behaviour. Self-transcending

values lead to increasing water saving behaviour when water-scarcity risk perceptions were present. While more literature is needed on how risk perceptions influence the relationship between self-transcending values specifically, there is literature stating that self-transcending values are important predictors of risk perceptions and pro-environmental behaviour individually, indicating that self-transcending values are important for risk perceptions (Carmi et al., 2015; Farrow et al., 2017; Ferrer et al., 2018; Hay et al., 2006; Janssen et al., 2014; Leiserowitz, 2006; Schultz, 2013; Prati & Zani, 2012), and pro-environmental behaviour (Abrahamse, 2019; Liobikiene & Juknys, 2016). The literature until now has shown that self-transcending values predict risk perceptions and water saving behaviour individually, but these findings show specifically how these factors interact to influence water saving behaviour, thereby adding to the literature.

Universalism. The qualitative findings corroborated the quantitative findings, also showing that self-transcending values were strong influencers of water saving behaviour, as evidenced by respondents' accounts. Respondents expressed that a desire to promote the welfare (here operationalised as water security) of others and not just one's self during the drought, motivated them to 'do their part' to address the drought risk by changing their behaviour. A more specific aspect of this motivation was not wanting to worsen the situations of, or cause harm to, others that are already in vulnerable socio-economic positions, which illustrates further how care for others influenced water saving behaviour. The literature on the topic is in agreement with the findings reported here, that self-transcending values have been found to be a very important predictor of pro-environmental behaviour across many types of pro-environmental behaviours (Ling & Xu, 2020; Liobikienė & Juknys, 2016). For example, Liobikinė and Juknys (2016) showed that people with stronger self-transcending values were more likely to adopt environmentally friendly behaviours, and that self-transcending values were an important predictor of pro-environmental behaviour.

That concern for the welfare of others served as a motivation for water conservation behaviour during the drought (as purported by respondents) is in accord with literature that indicates that people with stronger self-transcending values display increased levels of pro-environmental behaviours (Abrahamse, 2019; Liobikiene & Juknys, 2016; Liobikienė & Juknys, 2016). Thus, respondents reporting that their behaviour was driven by wanting to promote the greater good of everyone, and not just themselves, aligns with Schwartz's theory of personal values which states that people often choose to behave in a way that promotes their personal values (Schwartz, 2012).

The claims of wanting to change behaviour to promote the wellbeing of others aligns more with the universalism aspect (promoting and displaying protection of the welfare of others and of nature) of self-transcending values than the benevolence aspect (prioritising others with whom one is socially close), and seemed to drive behaviour more than benevolent tendencies, given that respondents did not talk about the welfare of others with whom they are socially close. There are a few studies looking at the effect of universalism specifically on pro-environmental behaviour, showing that stronger universalism values successfully predict pro-environmental behaviour (Thogersen & Olander, 2002), and are better predictors of such behaviour than benevolence (Katz-Gerro et al., 2017). More research investigating how universalism in particular can drive pro-environmental behaviours is needed, but the research presented here suggests that universalism values have stronger effects on pro-environmental behaviour than benevolence values.

This research therefore adds to the literature on self-transcending values and pro-environmental (here, water saving) behaviour and provides evidence that, in the context of this reseach, universalism appears to have had a greater influence over pro-environmental behaviours than benevolent values.

Self-enhancing values. Self-enhancing values were not significant in the quantitative findings nor were they referenced or mentioned in the qualitative results in relation to water saving behaviour. This is not in accord with the literature which shows that self-enhancing values tend to be associated with lower levels of water saving behaviour (Abrahamse, 2019). One reason for the discrepancy could be due to a social desirability bias i.e. that respondents may have adjusted their answers to the questions to do with self-enhancing values as these values are generally not socially desirable. This could have altered replies and warped the results as respondents may have portrayed their personal values in a more favourable light. This effect has been found in such instances and even in anonymous web-based surveys (Andrade, 2020). Responses were recorded using a self-report measure and thus there may have been a biased reporting of one's values with possible underreporting of self-enhancing values, known as the self-presentation effect (Paulhaus & Holden, 2010).

Thus, self-transcending values, and universalism values in particular, appear to be adaptive in environmental crisis contexts as they influence behaviours that address the risks posed to society. Hedonistic values may promote maladaptive behaviour, or pose a barrier to adopting and/or retaining adaptive pro-environmental behaviour. These findings add to the literature around the role of self-transcending values, and specifically universalism, in promoting pro-environmental behaviour. These findings also have practical implications, as they suggest that promoting and framing behaviour change in a way that emphasises how water saving behaviour (and possibly other pro-environmental behaviours), results in universal outcomes (i.e. in "good" outcomes for everyone), could be a powerful and non-forceful way to promote the adoption and retention of adaptive behaviour in future drought contexts. Further, the findings on hedonism offer insight into barriers to pro-environmental behaviour – in future, minimising discomfort and inconvenience caused by conservation

behaviours and emphasising more convenient behaviours could encourage greater adoption of pro-environmental and water saving behaviours.

The Effect of Risk Perceptions on Water Saving Behaviour

High risk perceptions predicted high levels of water saving behaviour, which is in accord with the literature on climate change-related risk perceptions, which has shown that environmental risk perceptions strongly influence and predict behaviour (van der Linden, 2015; Liobikienė & Juknys, 2016; Yu & Yu, 2017). More specifically, the findings corroborate the literature stating that risk perceptions can be good predictors of water saving behaviour (Egerer et at., 2018; Greiner et al., 2009; Kiriscioglu et al., 2013; Talanow et al., 2021). This finding adds to the body of literature investigating how risk perceptions influence behaviour in response to a climate change-related threat (Steg & de Groot, 2012; Steynor et al., 2020; van der Linden, 2015, 2017; Wiid & Ziervogel, 2012).

The findings are in accord with the general sentiments present in the literature, which shows that when risk perceptions of a climate crisis event are heightened, they can promote adaptive behaviour, for example changes in a person's behaviour in a way that tries to minimise the threat posed to the person (Gandure et al., 2013; Pidgeon, 2012; Rankoana, 2016; Talanow et al., 2021; Wheeler et al., 2013). Therefore, these findings contribute to the literature by indicating that risk perceptions 1. influence behaviour 2. are good predictors of water saving behaviour , and 3. heightened risk perceptions can promote adaptive behaviour such as increased water saving in the context of environmental crisis events. In general, this study supports the literature showing that when risk perceptions are high, people may align their behaviour in a way that minimises the risk posed to themselves (in this case, reducing water usage in order to neutralise the threat of water scarcity posed by the drought) (Pidgeon, 2012; Wheeler et al., 2013).

Revised Framework

While the finding that risk perceptions predicted water saving behaviour is important, the results further revealed how the selected risk perception determinants differentially influenced the relationships between risk perceptions and water saving behaviour, and this is a strong contribution to the literature on risk perceptions and water saving. That is, the findings showed that there is a lot of detail and complexity in how risk perceptions influence behaviour, and the original framework proposed was reductionist, and did not take into account the complexity of the relationships between the variables. Whereas, originally, the framework results showed a linear and simple relationship between (i) risk perception determinants (affect, social norms, and personal values) and risk perceptions, and (ii) risk perceptions and water saving behaviour, the results discussed in the section above show that the relationships between these variables are complex. Accordingly, the effect of risk perceptions on water saving behaviours cannot be isolated, because the variables of prescriptive norms and self-transcending values influence the relationship that risk perceptions have with water saving behaviour. Therefore, the originally proposed framework whereby risk perception determinants shape risk perceptions, and then risk perceptions go on in isolation to influence water saving behaviour, is not the best way of understanding the data or the relationship between the risk perception determinants, risk perceptions and water saving behaviour.

This study therefore proposes a revised framework that is more specific and granular, showing where variables within categories fit within the framework (for example, variables are broken down into prescriptive and descriptive norms). The diagram below (Figure 4) shows a revised framework, proposing a better way to understand how risk perception determinants and risk perceptions interacted to influence water saving behaviour. The revised framework, signified by the corresponding letters (a) through (g) illustrates how:

(a) fear predicted water scarcity risk perceptions;

(b) risk perceptions predicted water saving behaviour;

(c) self-transcending values moderated the relationship between risk perceptions and water saving behaviour;

(d) prescriptive norms moderated the relationship between risk perceptions and water saving behaviour;

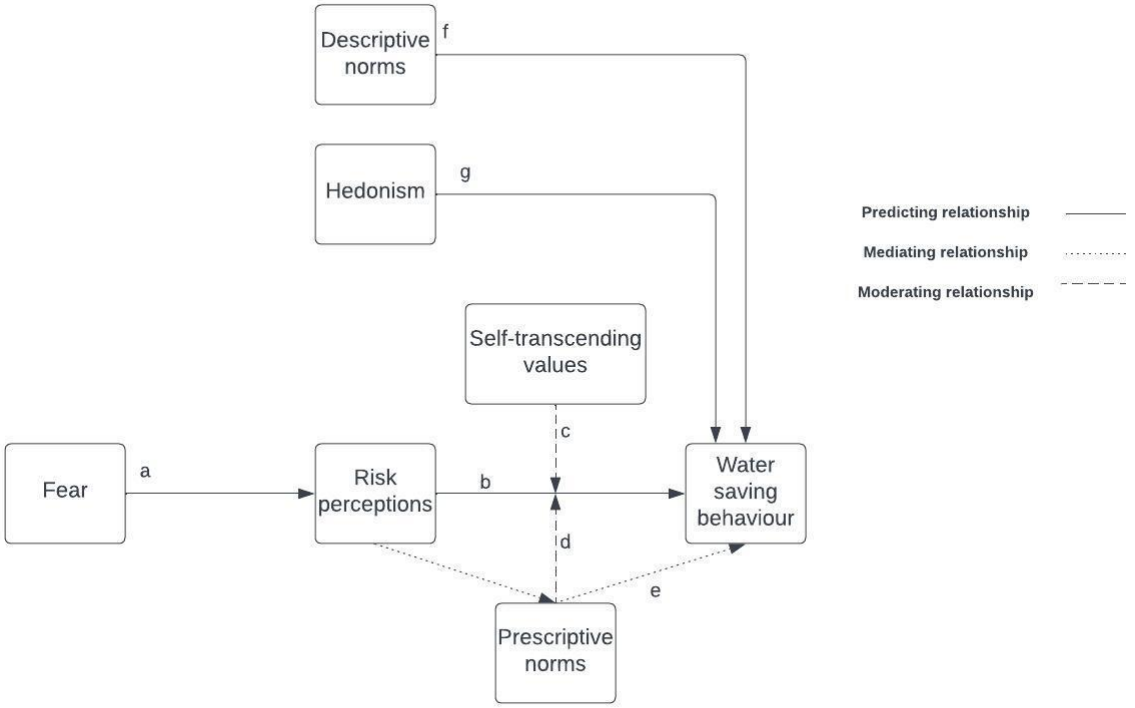
(e) prescriptive norms mediated the relationship between risk perceptions and water saving behaviour;

(f) descriptive norms predicted water saving behaviour; and

(h) hedonism predicted water saving behaviour.

Figure 4

Diagram illustrating a revised framework showing how risk perceptions are formed, and the factors that predict and influence water saving behaviour



The revised framework is useful in understanding water saving behaviour in a drought context as it provides a structure for understanding and representing how and where fear, risk perceptions, hedonism, prescriptive and descriptive norms, and self-transcending values fit together to influence water conservation behaviour. Therefore, in future drought contexts in the Western Cape, this framework may be useful for aiding understanding around how certain factors may influence water conservation behaviour and how it can be increased.

For example, the revised framework suggests fear can be targeted to increase risk perceptions, and the heightened risk perceptions will in turn increase water conservation behaviour. It also shows that prescriptive norms and self-transcending values are important and could possibly be targeted to influence the relationship between risk perceptions and water conservation behaviour. The revised framework also shows that descriptive norms predict water saving behaviour and that during future drought contexts one could facilitate

ways for descriptive norms to increase water saving behaviour. Hedonistic tendencies can pose barriers to water saving behaviour and this influence could be kept in mind in future drought contexts, by minimising inconvenience posed by behaviours and emphasising convenient behaviours. Therefore, the revised framework shows how the important factors interact and influence each other and work within a system, and furthermore highlights entry points for where interventions could assist to increase water conservation behaviour.

The revised framework presents a valuable contribution to the literature by deepening understanding of risk perception determinants, and how they interact with risk perceptions to influence water saving behaviour. The framework goes beyond corroborating the existing literature in this area, by providing deeper insight and more nuanced understanding then the predictive relationships between these variables illustrated in the literature. It provides a detailed, complex breakdown of where and how these selected factors intertwine and interact, revealing a complex framework with interrelated moving parts. The amended framework may be of particular use in future drought contexts, as it could allow for prediction and comprehension of factors likely to hinder or promote water saving behaviour, and further suggest strategic intervention points. Ultimately, this framework is useful for both researchers and practitioners to understand how these values, affect, social norms and risk perceptions influence water saving behaviour in times of environmental crisis and can help meaningfully inform their work and decisions.

Conclusion

In the context of worsening climate change leading to an increased frequency and severity of extreme hydrological events, this study aimed to contribute to the literature surrounding environmental risk perceptions and pro-environmental behaviours. It specifically looked to investigate how three identified risk perception determinants (social norms, values and affect), and risk perceptions influenced water saving behaviours among residents of the City of Cape Town, a city in the Western Cape province of South African during the 2014 - 2017 drought.

This research had three main objectives/aims:

1. to evaluate the usefulness of a proposed conceptual framework (see Fig.4) in explaining how values, social norms and affect influence drought risk perceptions and water conservation behaviour;
2. to provide understanding into how values, social norms and affect were shaped during the drought in the target population, and fit together with risk perceptions to influence water conservation behaviour; and
3. to integrate the findings to draw broader conclusions about the role of social norms, values and affect, and risk perceptions of droughts, on water conservation behaviour.

In addressing the first objective, the research showed that the originally proposed framework (Fig. 1), in which it was hypothesised that 1.) the selected risk perception determinants would shape risk perceptions, and 2.) risk perceptions would then go on to predict behaviour, did not accurately represent the findings. It was clear from the results that the original framework was rudimentary and overly simplified and did not capture the complex nature of the variables in question.

Thus, in light of the main results, a revised framework was proposed. The revised framework illustrates the complexity of the relationships between variables, and where all selected variables fit into the framework. The revised framework showed that descriptive norms predicted water saving behaviour, prescriptive norms influenced the relationship between risk perceptions and water saving behaviour, hedonism was a negative predictor of water saving behaviour, and that self-transcending values influenced the relationship between risk perceptions and water saving behaviour. This study therefore contributed to the literature on risk perceptions and water saving behaviour by proposing a conceptual framework that can be used to understand risk perception determinants, risk perceptions and water conservation behaviour during drought events, and that could be tested elsewhere for similar purposes in further case studies, or in broader studies.

Regarding the second objective, the research provided deeper insights into how the risk perception determinants were shaped, and further explanation into how they interacted with risk perceptions and water saving behaviour during the drought. These findings show that fear, prescriptive norms and self-transcending values were adaptive during the Western Cape drought as they influenced people's risk perceptions and behaviour in a way that reduced their water consumption. Firstly, fear and risk perceptions interacted to increase water saving behaviour during the drought. The results suggest that the CoCT's fear appeal as part of the Day Zero campaign was successful in changing behaviour, therefore contributing to the debate regarding the efficacy of fear appeals when considering the drivers of adaptive behaviour in the face of climate risk events (de Miranda Coelho et al., 2016; O'Neill & Nicholson-Cole, 2009).

Secondly, both descriptive and prescriptive social norms were important in understanding water scarcity risk perceptions and water saving behaviour. Descriptive norms predicted increased water conservation behaviour, and prescriptive norms influenced the

relationship between risk perceptions and water conservation behaviour. Community inclusion and exclusion dynamics, namely shaming, were reported as frequently occurring and an important influencer of behaviour during the drought period. The findings corroborate the research around social norms, showing that both descriptive and prescriptive norms can drive water saving behaviour (Sparkman et al., 2020), and provide insight into how this influence occurs.

Thirdly, values were important for understanding risk perceptions and water saving behaviour. Self-transcending values influenced the relationship between risk perceptions and water saving behaviour. Further, a desire to protect and promote everyone's welfare led to adopting adaptive water saving behaviour to reduce water consumption, adding to the literature on values and water saving behaviour. Hedonism was a barrier to water saving behaviour, and issues of convenience were a strong hedonism-related component that influenced whether water conservation behaviour was adopted or not. The finding that hedonism predicts water saving behaviour contributes to addressing the gap in the literature about hedonism and pro-environmental behaviours by showing that hedonism can hinder adoption of pro-environmental behaviours (here, water saving behaviour).

Overall, the findings of this research corroborate and build on the existing literature and theory around risk perceptions and pro-environmental behaviour. There is a dearth of research considering the risk perception determinants simultaneously, how they relate to water scarcity risk perceptions, and how risk perceptions influence water conservation behaviour. This study contributes toward addressing the gap in the literature regarding the interaction of social norms, values and affect in influencing risk perceptions and water saving behaviour in the Western Cape by considering these variables simultaneously, and providing further insight into the variables that underlie water saving behaviour.

The findings from this research could be used by practitioners to improve drought management in future drought contexts, by identifying strategic intervention points for city government to target in order to increase water saving behaviour, by capitalising on factors that increase water conservation behaviour and minimising those that may hinder behaviour. For example, government could increase risk perceptions by invoking fear through awareness campaigns that emphasise a deadline, and reinforce the seriousness of the crisis through visual images, while also increasing self-efficacy by clearly indicating the changes residents can undertake. Similar interventions could be drawn from the other results on prescriptive and descriptive norms, self-transcending values, and hedonism.

Limitations

This study had a number of limitations which may have impacted the findings, and that could be addressed in future research. One key limitation of this research was a biased and unrepresentative sample. There was a strong overrepresentation of young people (early-mid 20s) living in Hout Bay. This bias is most likely because the researcher lived in Hout Bay at the time of data collection and circulated the survey on a community group (among other community groups) where she may be known to the members. Furthermore, when more responses were needed than had been collected from the Facebook post, her peers were asked to circulate the survey on their own social media platforms. It is therefore possible that many people in the sample might have had similar traits to the researcher - a tertiary education, have been either students or young working professionals, or have gone to a private or semi-private schools. This bias could have resulted in answers, viewpoints and perspectives that were unrepresentative of wider demographics - for example, higher levels of education have been associated with increased pro-environmental behaviours (Meyer, 2015), and therefore there may have been an overrepresentation of levels of pro-environmental behaviour.

However, this problem was mitigated as far as possible by weighting the answers, and assigning equal weighting to each suburb.

The overrepresentation of younger age brackets could have also impacted the findings, as younger people are often more concerned about environmental issues than older people (Lauchlan & Moran, 2020; Subiza-Pérez et al., 2020) such as water scarcity. Hence, the overrepresentation of younger people in the sample may have led, in part, to the observed high levels of risk perceptions and water conservation behaviour.

A further limitation of the study was that certain demographic information (income and wealth, race/ethnic group) was not recorded and thus not present in the analysis. Considering the segregated history of South Africa and the remaining spatial inequalities (Strauss, 2019), it would be interesting to understand how different communities perceived the drought and behaved with regard to water consumption. As the study mainly had participants from relatively affluent areas, there may have been higher levels of water saving than what was actually representative of the population of CoCT. Wealthier populations have increased water usage due to water consumption associated with gardens, swimming pools, and home appliances, thus they may have high levels of water conservation behaviours as their baseline usage is higher, and thus easier to reduce. Therefore, this study is likely to have missed out on a number of nuances regarding how risk perception determinants, risk perceptions and water conservation behaviour interact in different socio-demographic and socio-economic groups, and such insights could have been useful for understanding how different communities may react to drought risk.

While the above limitations related to the sample are salient and it is important to consider how they may have impacted the results, the case study design of this research means that the issues of generalisability are less important than for a study looking to generalise findings to the general population, and not a contained population in the CoCT.

The case study looked to specifically investigate risk perception determinants, risk perceptions and water conservation behaviour in the context of the CoCT, and thus does not rely on generalisable results. However, the limitations regarding an unrepresentative sample of CoCT residents are important to consider.

An additional limitation was the oversimplified rudimentary nature of the original framework, which although broadly guided by the literature, did not sufficiently pull on findings from the literature about the variables in question to propose a useful framework. This resulted in an inaccurate and basic initial framework that did not match up with the results and had to be heavily revised. This was a missed opportunity to leverage existing research for greater reflection and deeper insights into relationships between these variables and not solely their presence and direction.

A further limitation was the retrospective nature of the research. Although retrospective research still contributes to the literature, as memories of experiences in relation to current day behaviour and reflecting on how experiences impact current day behaviour is helpful, people's memories of experiences, and how those experiences were shaped, can become altered over time (Diamond et al., 2020). For this study, such alterations could have meant that participants did not fully accurately recall, for example, their feelings from the time of the drought, or how they perceived the risk of the drought at the time it was occurring. Therefore, the data collected for this study might differ from what it might have been if it had been collected during the drought.

The self-report measures of the survey questionnaire may have resulted in a social desirability bias, whereby for example participants may have presented their responses to the survey and the interviews to reflect more favourably on them. This constitutes a limitation to the study because the results may have been impacted by respondents overstating their levels of self-transcending values, and/or water saving behaviour. This could have resulted in the

unexpected results showing that self-enhancing values did not predict water saving behaviour, as participants may have underreported self-enhancing values. On the other hand, the results are in line with other literature in the field, stating that self-transcending behaviours are associated with high levels of water saving behaviour, hence the self-report measure may not have influenced the results greatly.

A final limitation of the study was that discrete emotions were measured with only one question, instead of multiple, which would have been a more rigorous choice because a one-item scale has low content validity (the extent to which a measure assesses all elements of the construct being measured – here emotion) and internal-consistency reliability (how consistently items measure the same construct) (McCrae et al., 2011). This single-question measurement of fear came about because the analysis was planned to use a global score of affect, made up of the discrete emotions of fear, guilt, happiness and sadness. However, the results showed that only fear had an effect on risk perceptions and none of the other discrete emotions influenced water saving behaviour. The lack of a reliable, valid fear score could have meant that the result showing fear to predict risk perceptions was inaccurate. Yet, the finding on fear was corroborated by the qualitative findings and by other similar research on fear showing its importance for risk perceptions, indicating that the fear score may have been reliable enough for the purposes of this study, even though it could be strengthened in future research. However, it is possible that the findings showing that other discrete emotions did not predict risk perceptions or behaviour were inaccurate, in that their effects were not accurately captured by the measure. This is especially plausible considering that the literature in this area shows that usually these emotions often can influence risk perceptions and behaviour, and therefore the results were not in accord with the literature.

Recommendations for Future Research

Future research could strengthen and build on the findings of this study by replicating the research in a way that addresses the study's limitations and weaknesses, considers the framework in a post-drought water saving context, and clarifies the role that self-efficacy may have had in preventing an avoidance response in the target population. These changes would add to, and deepen, the usefulness of the research.

In view of the limitations discussed, a similar study could be conducted that improves the validity (the measure's accuracy), reliability (the reproducibility of the results), and the generalisability of the results. This study could be replicated with a sample more representative of the CoCT residing in formal housing, to get a representative view of the demographic that consumes the most water in the CoCT (as compared to residents in informal housing). Furthermore, considering the segregated history of South Africa and the remaining spatial inequalities where access to nature is greater among wealthier, white populations (Turok, 2021), it would be interesting to understand how different communities (those residents in formal vs those residents in informal housing) experienced the drought. The study could also be replicated within an ongoing climate crisis event such as a drought, so that the results are not retrospective, thus potentially increasing the accuracy of the results. The affect measure could be more robust in a future study, and better formulated with many items measuring each discrete emotion, in order to obtain a more detailed and accurate understanding of the influence of general affect and discrete emotions in a climate crisis context. The study could also be conducted on a higher number of respondents in an effort to address the limitation of a small sample size.

A further recommendation could be to include self-efficacy into the framework. The literature has shown that self-efficacy has been essential in understanding behaviour in cases of fear and high risk perceptions, and in the context of the results it may be a mediating

variable or enabling factor, explaining why fear appeal did not induce an avoidance response during the Day Zero campaign. Therefore, self-efficacy could be included in a future study to assess where it should fall within the framework.

The framework could also be tested in different geographical locations, and for droughts in different cities. As the nature of this research was a case study and generalisable results were not the intended outcome, a broader study may help to establish more generalisable results. This could help determine whether the framework is useful for understanding risk perceptions and drought in different contexts and also whether the risk perception determinants, risk perceptions and behaviour fit into the framework in the same manner as the results from the CoCT. This could enhance the literature on risk perceptions and water saving behaviour in water scarce contexts and also contribute to drought management in different contexts, thereby supporting global adaptation to the ever increasing threat the effects of climate change pose to society and the planet.

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Appendices

Appendix A

Survey Consent form

Project Title: Investigating the role of values, norms and affect in relation to water scarcity risk perceptions and water conservation behaviour, submitted in partial completion of Masters degree in Climate Change and Sustainable Development at the University of Cape Town, Department of Environmental and Geographical Sciences

Invitation to participate, and benefits: You are invited to participate in a research study conducted with residents of the City of Cape Town. The study aim is to better understand how different factors (for example, social norms) relate to people's perceptions of water scarcity and water conservation behaviours. I believe that your experience would be a valuable source of information, and hope that by participating you may gain useful knowledge about water conservation.

Procedures: During this study, you will be asked to complete an online survey where you will need to rank your responses to questions. It should take you approximately 10 minutes to complete. Please answer every question in this survey.

Risks: There are no potentially harmful risks related to your participation in this study.

Feedback: You can receive feedback about the results of this research once the study has been completed in December 2021. Please indicate at the bottom of the form if you would like to receive feedback.

Disclaimer/Withdrawal: Your participation is completely voluntary; you may refuse to participate, and you may withdraw at any time without having to state a reason and without any prejudice or penalty against you. Should you choose to withdraw, the researcher commits not to use any of the information you have provided without your signed consent. Note that the researcher may also withdraw you from the study at any time.

Confidentiality: All information collected in this study will be kept private in that you will not be identified by name or by affiliation to an institution. Confidentiality and anonymity will be maintained as your name will be replaced with a number.

What signing this form means: By selecting "yes" on the question below, you agree to participate in this research study. You confirm that the aim, procedures to be used, as well as the potential risks and benefits of your participation have been explained to you in detail, using this form. Refusal to participate in or withdrawal from this study at any time will have no effect on you in any way. You are free to contact me, to ask questions or request further information at any time.

Contact details
Principal researcher: Aimée Tredoux
aimee.tredoux@gmail.com

Supervisor: Dr Lorena Pasquini
lorena.pasquini@gmail.com

*Required

1. I agree to participate in this research *

Mark only one oval.

- Yes
- No

2. I would like to receive feedback about the results

Mark only one oval.

- Yes
- No

3. If you would like to receive feedback about the results please leave your email address below

Screening question

"Formal" housing consists of: dwellings or brick structures on separate stands; flats or apartments; town/cluster/semi-detached houses; units in retirement villages; rooms or flatlets on larger properties provided they are built with sturdy materials. This information is required because those who reside within formal housing use significantly more water than those in informal housing and thus the water use behaviour of citizens residing in formal housing is relevant to this study.

4. Are you over 18, and currently residing in formal housing in Cape Town? *

Mark only one oval.

- Yes
- No

Information

Please complete this brief section gathering some more information about your age and location. All your responses are anonymous and confidential.

5. In which age bracket do you fall?

Mark only one oval.

- 18-24
- 24-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-80
- 80-90
- 90-100

6. Where do you live in Cape Town (please indicate your suburb)?

_____

Water usage

This section of the questionnaire will ask you about your and your household's water usage. All your responses are anonymous and confidential.

How often do you (and members of your household) perform the following activities:

7. Collect grey water leftover from showering, washing up or similar, for use elsewhere

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always

8. Only run the washing machine if it is full

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always
- N/A

9. Turn off taps when brushing teeth

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always

10. Flush the toilet only when necessary ("let it mellow when it's yellow")

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always

11. Reduce water use when showering (Have the shower running 4 minutes or less in total, per day)

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always
- N/A

12. Be water-wise in the garden (e.g. use grey water, water less, water using a bucket, rarely water the garden, switch to less water-intensive vegetation)

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always
- N/A

13. Reduce water use when bathing (don't fill the tub all the way)

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always
- N/A

Risk perceptions

This section gathers information about how you perceive the risk of drought and water-scarcity in the Western Cape. All your responses are anonymous and confidential.

14. Do you believe that the Western Cape will face another water shortage event (like the 2015-2017 drought) in the next 10 years?

Mark only one oval.

- not at all likely
- not very likely
- somewhat likely
- quite likely
- very likely

15. How likely do you think the risk of further droughts happening in the WC might be?

Mark only one oval.

- not at all likely
- not very likely
- somewhat likely
- quite likely
- very likely

16. How worried are you about the effects of climate change on the water supply to the Western Cape?

Mark only one oval.

- not worried at all
- not very worried
- somewhat worried
- quite worried
- very worried

17. Do you worry that the water demand in the Western Cape will outstrip the supply in the next 10 years?

Mark only one oval.

- not worried at all
- not very worried
- somewhat worried
- quite worried
- very worried

Social norms

This section asks you questions in order to gather information on any social norms that may apply to you regarding water usage behaviour. All your responses are anonymous and confidential.

18. I feel that I am expected to save water at home

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

19. How often do you think your friends save water at home?

Mark only one oval.

- never
- rarely
- sometimes
- often
- always

20. I feel social pressure from my friends not to waste water in my garden and/or house

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

21. How often do you think your friends flush the toilet sparingly?

Mark only one oval.

- Never
- occasionally
- sometimes
- often
- always

22. I am expected to flush the toilet sparingly at work and/or at home

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

23. How often do you think your friends are water-wise in their homes and/or gardens?

Mark only one oval.

- never
- Occasionally
- Sometimes
- Often
- Always

24. How often do you think your friends collect grey water for use elsewhere?

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always

25. I feel that I am expected to collect grey water for use elsewhere at work and/or home

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Personal values

This section gathers information on your personal values - things that are important to you in your life. All your responses are anonymous and confidential.

26. It's very important to me to help the people around me. I want to care for other people.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

27. Religious belief is important to me. I try hard to do what my religion requires.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

28. I think it is important that every person in the world be treated equally. I want justice for everybody, even for people I don't know.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

29. Thinking up new ideas and being creative is important to me. I like to do things in my own original way.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

30. I like surprises and am always looking for new things to do. I think it is important to do lots of different things in life.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

31. Having a good time is important to me. I like to “spoil” myself.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

32. It is very important to me to show my abilities. I want people to admire what I do.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

33. It is important to me to be rich. I want to have a lot of money and expensive things.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

34. It is important to me to live in secure surroundings. I avoid anything that might endanger my safety.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

35. I believe that people should do what they're told. I think people should follow rules at all times, even when no-one is watching.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

36. I thinks it's important not to ask for more than what you have. I believe that people should be satisfied with what they have.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

37. It is important to me always to behave properly. I want to avoid doing anything people would say is wrong.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

38. It is very important to me that my country be safe from threats from within and without. I am concerned that social order be protected.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

39. It is important to me to be in charge and tell others what to do. I want people to do what I say.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

40. Being very successful is important to me. I like to impress other people.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

41. I seek every chance I can to have fun. It is important to me to do things that give me pleasure.

Mark only one oval.

- Strongly disagree
- Disagr
- Neutral
- Agree
- Strongly agree

42. I look for adventures and likes to take risks. I want to have an exciting life.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

43. It is important to me to make my own decisions about what I do. I like to be free to plan and to choose my activities for myself.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

44. I strongly believe that people should care for nature. Looking after the environment is important to me.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

45. It is important to me to be loyal to my friends. I want to devote myself to people close to me.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

46. It is important to me to listen to people who are different from me. Even when I disagree with them, I still want to understand them.

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Affect

This section gathers information regarding how you feel about drought and water usage behaviour in the Western Cape. All your responses are anonymous and confidential.

47. I feel scared about the water-scarce context in the Western Cape

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

48. How happy do you feel when you engage in activities that save water?

Mark only one oval.

- Unhappy
- Neutral
- Somewhat happy
- Very happy
- Extremely happy

49. I feel angry when I see others engaging in what I would consider to be irresponsible water conservation behaviour

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

50. I feel guilty when I waste water

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Appendix B

Qualitative research component

Introductory questions:

(Read through consent form - introduce context of water-scarcity, climate change, Western Cape drought)

1. What area are you living in currently, where did you grow up?
2. What is your occupation?
3. Were you living in Cape Town during the drought?

Variable: Environmental Risk perceptions

Question	Prompts	Scale	Objective/s covered	Rationale
What do you understand by the term environment?	What does it mean to you, and what role		**1,2,3**	**Necessary to assess understanding and is an opportunity to clarify what is meant by environment in this study.**

	does it play in your life?			
Can you tell me a bit about what you understand by climate change, and your thoughts about it.			**1,2,3**	Same as above. Also useful to understand attitudes/knowledge of climate change.
Can you tell me about any environmental concerns you might have at the current moment?	(do you have any?) Are some concerns bigger than others?		**1,2,3**	Aims to understand risk perceptions of environmental threats
If you think to the time period surrounding and during the WC drought, do you think your environmental concerns have changed since then?	How? Why? What were they at the time vs now?		**1,2,3**	Interesting to see how (perceived) risk perceptions may have changed over time, relevant to behaviour change.

Variable 2: Water conservation behaviour

Question	Prompts	Variable	Objective/s covered	Rationale
Can you tell me a bit about what you think about water conservation/water saving behaviour?	What do you think about it? (is it necessary)			Need to ask about perceptions of/attitudes towards water conservation behaviour, is relevant for behaviour taken.
Can you tell me about water conservation during the drought, versus water conservation in the present day.	How do you know it's different/the same? How do you feel about these observations? Are there specific factors that you think resulted in these changes?			Interesting to understand perceptions of how general behaviour has changed, I think is relevant for individual behaviour.
Can you tell me a bit about the impact of the drought on your and other people's thinking and behaviour around water conservation?				Interesting to know perceptions of others perceptions and behaviour, and to reflect on 'lessons learned'.

Variables 3 and 4: Social norms

1. To investigate how different types of social norms (prescriptive versus descriptive) impact environmental risk perceptions and water conservation behaviour

Question	Prompts	Variables	Objective/ s covered	Rationale
Did you experience a shift in what was considered 'normal' behaviour during the water crisis?"	(do you think there is pressure, what kinds of things tell you that you feel pressure, how do you feel these pressures? What kinds of things do you think there is pressure to do?			Important to understand if pressure is felt, how it is experienced, by whom is it applied, what kinds of things are there pressure to do?
Can you tell me a bit about your experiences/insights about social pressure during the drought period specifically?	(Did you feel social pressure to change behaviour, who did you feel pressure from, what were the pressures (what did you need to do), what kind of things			Same as above but also interesting to understand how it differed in a critical risk period.

	happened that made you feel pressure (comments, discussing others behaviour,)			

Variables 5 and 6: Values

2. To investigate how 2 different categories of values identified in the literature (self-transcendent –universalism and benevolence; self-enhancement –power and achievement and hedonism) impact environmental risk perceptions and water conservation behaviour

Question	Prompts	Variable	Components	Objective/s covered	Rationale
If you think of your own personal values and what you think is important – do you see that as something that has influenced the environmental actions you described earlier?" OR					NB to establish what one values most, also establishes if the environment is valued, and how. Interesting to establish the level of importance of values.

These are some of the most important personal values: Eg. kindness, justice, security, wealth, achievement, power, recognition for your actions, environmental protection, tradition, . Which of these do you feel are very important to you?	(could you maybe pick a few values and give example?)				
Can you tell me how you think you take actions to protect and promote these values in your life?	Could you give examples? Are there some values that you take less action on?				Useful to understand if one thinks that they take action on what they value or are aware of not doing so.
Can you tell me about if, how, and why you value the environment?	Where does this rank in your values?				Good to know why the environment is valued - also triangulates question at beginning of survey.

Can you tell me about any actions that you to protect the environment?	Are you happy with the actions you currently take, ie. are they in line with your values? (the strength of your values)				Useful to establish perceived actions taken and if satisfied with them or not.

Variable 7: Affect

Objective →

3. To investigate how affect impacts environmental risk perceptions and water conservation behaviour

Question	**Prompts**	**Variable**	**Objective/ s covered**	**Rationale**
Are there some events such as floods or drought or etc that bring different or different intensity of feelings?				Understanding the types of feelings that rise is important, I am also interested in knowing about different feelings or intensity of feelings.

Can you tell me your personal thoughts and feelings about climate change?				I want to establish this as I think it's important and relevant for feelings about pro-environmental behaviour.
If you think back to the drought, can you tell me a bit about how you felt through the different stages of this time period? (Did anything worsen or relieve your feelings?)	(the beginning, middle versus end of drought, or any time that stood out)			Useful to understand people's feelings at different points in the risk event
Can you tell me about how you feel when you are confronted with information about environmental threats?				I want to know how people feel when they have to engage with information about potential risk events currently - useful to know what kinds of emotions it invokes or if it results in an apathy

Appendix C

UNIVERSITY OF CAPE TOWN
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13 July 2021

Aimée Tredoux
Department of Environmental and Geographical Science

The role of values, norms and affect in relation to water-scarcity risk perceptions and water conservation behaviours in the Western Cape

Dear Aimée Tredoux

I am pleased to inform you that the Faculty of Science Research Ethics Committee has approved the above-named application for research ethics clearance, subject to the conditions listed below.

- The applicant should ensure that the online surveys are updated to match the informed consent form in the application.
- Restrictions on involving human participants in research must be adhered to, given current concerns about the spread of Covid-19. Please ensure that you are aware of and comply with UCT policy on this, as communicated by management.
- Implement the measures described in your application to ensure that the process of your research is ethically sound; and
- Uphold ethical principles throughout all stages of the research, responding appropriately to unanticipated issues: please contact me if you need advice on ethical issues that arise.

Your approval code is: **FSREC 065 – 2021**

I wish you success in your research.

Yours sincerely

Dr Melissa Densmore
Acting Chair: Faculty of Science Research Ethics Committee

Appendix D

Unweighted sample

Location

	N	%
Atlantic Seaboard	1	0.9%
Bergvliet	1	0.9%
Blouberg	1	0.9%
Bo kaap	1	0.9%
CBD	2	1.8%
Claremont	5	4.5%
Clovelly	1	0.9%
Constantia	6	5.4%
Crawford	1	0.9%
Durbanville	4	3.6%
Eversdal	1	0.9%
Fish Hoek	2	1.8%
Franschoek	1	0.9%
Fresnaye	1	0.9%
Gardens	4	3.6%
Goodwood	2	1.8%
Gordon's Bay	1	0.9%
Green Point	3	2.7%
Hout Bay	36	32.1%
Hout Bay Heights	1	0.9%
Kenilworth	1	0.9%
Kenwyn	1	0.9%
Kuilsrivier	1	0.9%
Milnerton	2	1.8%
Mitchell's Plain	1	0.9%
Mowbray	1	0.9%
Muizenberg	2	1.8%
Newlands	4	3.6%
Noordhoek	2	1.8%
Observatory	3	2.7%
Oranjezicht	3	2.7%
Pinelands	2	1.8%
Rondebosch	4	3.6%
Sea Point	3	2.7%
Somerset West	1	0.9%
Southern Suburbs	1	0.9%
Three Anchor Bay	1	0.9%
University Estate	1	0.9%
Vredehoek	2	1.8%
Woodstock	1	0.9%

Weighted sample

Location

	N	%
Atlantic Seaboard	3	2.5%
Bergvliet	3	2.5%
Blouberg	3	2.5%
Bo kaap	3	2.5%
CBD	3	2.5%
Claremont	3	2.5%
Clovelly	3	2.5%
Constantia	3	2.5%
Crawford	3	2.5%
Durbanville	3	2.5%
Eversdal	3	2.5%
Fish Hoek	3	2.5%
Franschoek	3	2.5%
Fresnaye	3	2.5%
Gardens	3	2.5%
Goodwood	3	2.5%
Gordon's Bay	3	2.5%
Green Point	3	2.5%
Hout Bay	3	2.5%
Hout Bay Heights	3	2.5%
Kenilworth	3	2.5%
Kenwyn	3	2.5%
Kuilsrivier	3	2.5%
Milnerton	3	2.5%
Mitchell's Plain	3	2.5%
Mowbray	3	2.5%
Muizenberg	3	2.5%
Newlands	3	2.5%
Noordhoek	3	2.5%
Observatory	3	2.5%
Oranjezicht	3	2.5%
Pinelands	3	2.5%
Rondebosch	3	2.5%
Sea Point	3	2.5%
Somerset West	3	2.5%
Southern Suburbs	3	2.5%
Three Anchor Bay	3	2.5%
University Estate	3	2.5%
Vredehoek	3	2.5%
Woodstock	3	2.5%

Note. Table showing on the left, the proportion of respondents from neighbourhoods in Cape Town. Table on the right indicates results once equal weights are applied in order to address problems of over and underrepresentation. N = 112, % refers to the percentage proportion of responses from each neighbourhood.