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Mortality awareness and water decisions: a social psychological analysis of supply-management, demand-management and soft-path paradigms

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ABSTRACT

The beliefs underlying the water supply-management, demand-management, and soft-path paradigms are examined. Two questions are considered. First, can social psychology's insights on mortality salience help explain the desire to control water and the dominant water supply-management paradigm? Second, can those insights also help explain the limited progress of demand management and water soft paths? We propose that mortality salience helps explain why individuals and societies seek to control water supply and, by extension, deny their connection to nature and limit consciousness of physical vulnerability. We briefly consider the implications of this perspective for water research, advocacy and policy.

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Introduction

Most water issues are complex and multi-faceted, so they transcend conventional disciplinary boundaries and cannot be addressed by any one actor or perspective. Political, social and environmental uncertainties can also make water problems 'wicked', which means that even the most innovative technical responses can generate unexpected, unintended or undesirable outcomes. Political decrees meant to address water problems can likewise fail if made without technical expertise and social support. These approaches share an intent to reduce uncertainty through the gathering and use of additional information (Sarewitz, 2004).

Our research challenges 'insufficient information' as the conventional explanation for why and how people and societies make bad water decisions. We propose that something else is going on – something deeper, messier and more fundamental to the human condition. Cognitive science researchers have shown that emotions powerfully guide human thought, albeit often unconsciously. Social psychology has added, through terror management theory (TMT), insights about how mortality awareness influences everyday behaviours and preferences.

There is no reason to think that our water choices are any less susceptible to these influences. We propose that mortality salience,¹ arising from exposure to conscious and unconscious death reminders, helps explain why individuals and societies want to control water. By extension, mortality salience helps explain people's loyalty to the dominant water paradigm of supply management. Some evidence indicates that conscious and unconscious death thoughts motivate humans to control nature and to extract resources and services from it. This expression of dominance then allows people to deny their connection to nature and to limit awareness of their own physical vulnerability (Goldenberg et al., 2001). Starting from these foundations, two questions were asked:

- (1) Can social psychology's insights on mortality salience help explain the human desire to control water and, by extension, the dominant water supply-management approach?
- (2) Can the influence of mortality salience similarly explain the limited progress made by alternatives to supply management, notably by water demand management and water soft paths?

After a brief review of the theoretical framework underpinning the approach, this framework is applied to environmental and natural resource issues where the defences triggered by mortality salience are of particular interest. Next, the water supply- and demand-management as well as water soft-path paradigms are summarized, in particular their successes and failures in water management today. Then mortality awareness is applied to explore the two questions. The article concludes with initial ideas as to what insights mortality awareness might offer for future water research and policy.

This article is conceptual and theoretical. It draws together findings from fields beyond the conventional boundaries of water research that we argue have enormous implications for our field. The few published articles linking cognitive science and water management, reviewed below, are tangential. We aim to encourage the water community – researchers, policy makers and practitioners – to go beyond what we propose here and identify opportunities to initiate empirical research that broadly includes mortality salience as a key variable in individual and group water decision-making processes.

Theoretical framework

Thought processes and decision making

Prevailing theories of human thought in the last half of the twentieth century generally held that individuals are able to consciously choose to control their emotions so that their 'rational thought' is not contaminated or undermined (Salovey, Detweiler-Bedell, Detweiler-Bedell, & Mayer, 2010). From this perspective, we can make the best decisions if we have sufficient, correct and timely information from which to assess the costs and benefits of given alternatives. This perspective remains pervasive among water-policy analysts, and negative connotations are still often associated with 'emotional decisions' regarding water (World Bank, 2015).

But research now indicates that this pervasive understanding of decision processes is wrong. Our thoughts are deeply influenced by non-rational factors, including emotions and mental processes that serve to regulate emotions. For example, researchers know that people rely on automatic heuristic processing that is subconscious and non-rational.² Kahneman and Tversky's (1979) prospect theory has emerged to challenge utility theory as the normative model of rational choice. Kahneman's (2011) Nobel award-winning efforts included the distinction between our two thought systems:

- *System 1*: fast, automatic, frequent, emotional, stereotypic, subconscious decision processes; and
- *System 2*: slow, effortful, infrequent, logical, calculating, conscious decision processes.

Epstein (1994) and Ariely (2008) propose that dual process systems – analytical-rational and intuitive-experiential systems that reduce the mental load of information processing – are actually necessary for us to function in complex environments. We are usually not conscious of how these different thought systems affect our 'rational' decision making (Kahneman, 2011). But these systems intrinsically and substantively shape virtually all human choices – a reality that is slowly but increasingly recognized by influential international organizations (e.g. World Bank, 2015). There is no reason to think that our water choices at any scale should be exempt from these cognitive systems (Sarewitz, 2004; Russell and Fielding, 2010; Sivakumar, 2011; Aggestam, 2014).

Nevertheless, dominant scholarly analyses of water – its management and consumption – are underpinned by the assumption that water suppliers, consumers, researchers and policy makers are System 2-thinking actors who generate calculated, rational water decisions. By this view, expert assessments of, and decisions about, issues of water supply and use are best made with data but without recourse to emotion. It follows then that efforts designed to modify actors' behaviour should be framed as ways to improve their System 2 thinking, including efforts to change individuals' consumption choices, municipal efficiency programmes, provincial water-quality policies, national water institutions, and international water decisions that are influenced by global debates about water rights and transboundary sharing. This is the conventional explanation in play: if water actors are better informed, i.e. have more information, surely they will use that information to make better water decisions. In contrast, we propose that much more than inadequate information is involved: mortality awareness plays a role in water decisions at multiple scales (household, national), from different perspectives (consumer, expert) and under variable environmental conditions (drought, flood).

Mortality awareness and human behaviour

Drawing on social anthropology and psychology, Ernest Becker explored how humans' self-awareness of their place in the universe generates feelings of impotence and insignificance. In his Pulitzer-winning book, Becker (1973) proposed that the human brain has a unique cognitive capacity that allows it to generate both language and culture. Language and culture in turn give us an awareness of time, an understanding of 'self' in relation to others, and an ability to plan or defer gratification. But these

cognitive abilities have a significant psychological cost: remembering the past and thinking of the future creates pervasive and unavoidable mortality awareness.

Becker considered – but did not empirically test – how mortality awareness influences human behaviour. He wrote that “the idea of death, the fear of it, haunts the human animal like nothing else; it is a mainspring of human activity – activity designed largely to avoid the fatality of death, to overcome it by denying in some way that it is the final destiny for man” (1973, p. ix). From this perspective one’s conscious and unconscious death anxiety is a central driver of behaviour, which expands our understanding of why we make choices and act as we do. For Becker, hero projects – symbolic and literal³ – enable individuals to generate self-esteem by participating in actions that a society values. Through hero projects, individuals seek to be part of something bigger and longer-lasting than their biological, time-limited selves: a shared cultural worldview. Any threat to that worldview can cause physical and psychological distress, which in turn can produce ideological entrenchment as one seeks to reduce the distress and remove the threat.

Becker’s conceptual ideas have been expanded and codified through social psychology and TMT’s empirical research on cultural-worldview preservation and self-esteem pursuit (Greenberg, Pyszczynski, & Solomon, 1986). The key insight from TMT is that “one of the most important functions of cultural worldviews is to manage the terror associated with this awareness of death. This is accomplished primarily through the cultural mechanism of self-esteem, which consists of the belief that one is a valuable contributor to a meaningful universe” (Solomon, Greenberg, & Pyszczynski, 1991, p. 94).

The TMT premise has now been tested and supported by over two decades of empirical studies examining how we maintain psychological equilibrium when constantly exposed to reminders of our physical vulnerability and inescapable mortality (Greenberg, Solomon, & Pyszczynski, 1997; Pyszczynski, Greenberg, Solomon, & Maxfield, 2006; Pyszczynski, Solomon, & Greenberg, 2015). A meta-analysis found that 83% of all of the published and empirical TMT studies were designed to test mortality-salience influence on participants. This meta-analysis of over 300 studies showed that mortality-salience effects are both robust and replicable (Burke, Marens, & Faucher, 2010). Mortality-salience testing is legitimate within the community and viable as an empirical mechanism, and shows significant results: *reminders of death conclusively intensify peoples’ cultural-worldview defence and self-esteem striving*.

As such, TMT provides a valuable conceptual framework – and viable methodological process – for understanding how mortality fears influence human attitudes and behaviour (Burke et al., 2010; Pyszczynski et al., 2015). We therefore focus our comments here on mortality salience and the specific psychological defences used to repress mortality awareness.

Psychological defences against mortality awareness

Humans use two types of psychological mechanisms to repress conscious and unconscious death thoughts (Pyszczynski, Greenberg, & Solomon, 1999); this is illustrated in Figure 1.

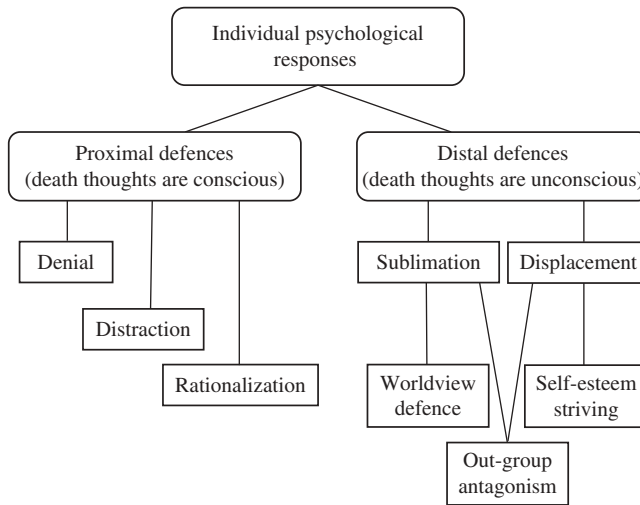


Figure 1. Individuals' responses to mortality salience.

Proximal defences minimize or marginalize death thoughts when they surface to consciousness. These defences include: denial that a problem exists or that it will continue; distraction from the problem, engaging in other cognitive tasks; and various kinds of rationalization that, for instance, minimize the problem's implications, the individual's contribution to the problem's origins, or the individual's role in its possible resolution. Denial, distraction and rationalization are different ways to distance oneself from the problem.

Distal defences use sublimation and displacement to keep death thoughts unconscious. They include increased antagonism towards other identity groups, buttressing individual and group worldviews and pursuing culturally sanctioned hero projects to maximize individual self-esteem.⁴ Through hero projects – e.g. named philanthropy, artistic expression, politics and Nobel prizes – an individual may 'live' beyond their biological existence within a society's historical and contemporary narrative. People who live successfully within the parameters set out by their cultures and identity groups feel that they are valued members of that continuing story, a feeling that mitigates their mortality awareness and anxiety.

Applications of mortality salience to environmental and resource decisions

We argue that the influence of System 1 thinking – fast, emotional, subconscious – in general, and mortality fears in particular, is a powerful lens for interpreting current environmental problems and water-management discourse. But resource managers, policy makers, and users, as well as the scholars who study the actors involved, generally do not acknowledge this influence (Carmi, Arnon, & Orion, 2015; Schmuck & Schultz, 2012).

The contemporary understanding of how environmental decisions should be made takes System 2 thinking as a starting point, where "[rational] science is a source of facts and theories about reality that can and should settle disputes and guide political action" (Sarewitz, 2004, p. 386). According to this understanding, resource policy makers and

managers will seek ever-more-accurate data and make ever-better resource decisions if they have access to sufficient high-quality information. Similarly, resource consumers will adjust their behaviour appropriately when they have additional or more appropriate information (Schmuck & Schultz, 2012, p. 9). Yet resource managers intuitively know – and researchers studying mortality salience have confirmed – that information by itself is not enough to produce good decisions, and that unstated or implicit fears can actually produce counter-intuitive individual choices.

Although more or ‘better’ information, regulation and economic incentives do influence behaviour, they are rarely enough to fundamentally shift belief systems, values and long-term behaviours, all of which are heavily laden with implicit emotions, including mortality fears (Arndt & Solomon 2003; Ariely, 2008; Mercer, 2010; Carmi, Arnon, & Orion 2015; Sarewitz, 2004). For example, recent research demonstrates that the psychological response to perceived threats to self or society can make individuals less receptive to information about urban flooding prevention (Mann & Wolfe, 2016). In her research on climate change and individuals’ rejection of behaviour modification, Dickinson (2009) wrote, “The behaviours people exhibit are not necessarily those that reduce risk of death, and in fact they may sometimes increase [risk of death] as long as [the behaviours] also bolster the individual’s symbolic self and the complex, immortality-striving hero system that defines it.”

In line with Dickinson’s observations, TMT studies have identified multiple links between mortality salience, the defensive responses provoked, and environmentally harmful behaviours. These behaviours include increased material consumption (Kasser & Sheldon, 2000), stronger aesthetic preferences for cultivated and controlled outdoor landscapes (Koole & Van den Berg, 2005), accelerated use of resources (Sheldon & McGregor, 2000) and preference for authoritarian attitudes (Fritzsche, Cohrs, Kessler, & Bauer, 2012). Specific to water consumption, McCabe, Vail, Arndt, and Goldenberg (2014) demonstrated the difference between proximal (conscious) and distal (unconscious) defences against mortality salience. Participants with conscious mortality awareness rated bottled water more favourably and drank more if a medical professional endorsed it. When death is on our minds, we do what’s best for our health by listening to the medical expert. Participants whose mortality awareness had time to recede to unconsciousness – because of a delay task in the testing – were more likely to find celebrity endorsement of bottled water compelling. With their mortality awareness successfully shunted away, participants were more likely to try to emulate celebrity norms. But the story of mortality salience and the environment is not yet complete: other studies have shown that mortality salience or awareness can also produce stronger environmental compliance and identity (Fritzsche, Jonas, Kayser, & Koranyi, 2010; Vess & Arndt, 2008).

These studies illustrate how our responses to mortality salience can influence our attitudes and behaviours towards the natural environment and resource use (Dickinson, 2009). They can help explain why it is so difficult to get individuals to sustain behavioural changes – say, for household water efficiency or reducing bottled-water consumption. These findings also hint at the complexity inherent in shifting entire organizations, institutions or cultures populated by diverse, and possibly conflicting, immortality-striving hero projects. *We propose that to achieve significant or sustained change in environmental behaviour, it is essential to at least anticipate psychological defences that may hinder pro-environmental responses to resource constraints.* In

response, we survey the water paradigms' characteristics and – by incorporating mortality salience – consider the difficulties of transitioning from one management paradigm to another.

The evolution of water-management paradigms

The accumulation of small shifts in water-management practices – ongoing adjustments in the definition of problems, setting of priorities and identification of solutions – has been called “the changing water paradigm” (Gleick, 2000, p. 127). This evolution presents both publics and practitioners with a changing suite of water issues and has significant implications for water policy.⁵

Here we use what has been learned about the influence of mortality salience on human decision making in other situations to assess dominant concepts of water supply management and water demand management, as well as the potential transition to a ‘soft path’ management paradigm.

Supply- and demand-management paradigms

The traditional response to water scarcity has usually been to develop more supply. At least as early as Roman times, centrally managed agencies built dams and dikes or dug to find groundwater and then ran pipes and aqueducts to farms, factories and cities. Supply management has produced huge benefits throughout history, at least for industrial societies: potable water for almost everyone, whenever and wherever desired, and generally enough left over for public baths, swimming pools and gardens.

Unfortunately, supply management also has many adverse consequences. Rivers that used to run free are now contained, constrained and overused; water tables are sinking; natural habitats are disappearing. Almost everywhere, the cheapest sources of water have been tapped, and costs for additional supplies in coastal zones are rising towards a ceiling of about USD 1 per cubic metre, the cost at the plant for desalinated seawater (Gleick et al., 2006, p. 161).

In many places today, lower demand offers the best source of ‘new’ water; in effect, it makes the existing supply go further. Demand management is not different in concept from supply management, except that it takes water's nature as an economic good more seriously by incorporating the option of reducing demand (Table 1) and by shifting the focus of action from centralized engineering to decentralized consuming.

Advocates of demand management identify measures to cut water use and compare their cost to alternatives that would increase supply. Common measures include volume-based pricing, low-flow faucets and toilets, drip or sprinkler irrigation, and recycling and reuse of water.

Water-system operators have always invoked demand management, although usually only as a temporary option during episodes of serious scarcity until additional supplies are secured. However, demand management can no longer be viewed as a second-best policy. Today it integrates public education with a set of technical, regulatory and market strategies. Quantitative studies have shown that relatively simple, off-the-shelf measures can reduce water use by 30–50% in most locales at monetary costs below

Table 1. Contrasting the supply-side-management, demand-side-management and soft-path approaches.

Policy	Dominant discipline	Policy orientation	Fundamental question	Planning process	Outcome
Supply management	Engineering	Policies based on presumed need for new infrastructure	How can we meet projected water needs given current trends in water use and population growth?	Planners extrapolate from current consumption patterns to determine future 'requirements' and then locate and develop new sources of supply to meet this projected demand.	Construction of dams, pipelines, canals, wells, desalination systems and interbasin transfer infrastructure
Demand management	Neo-classical Economics	Policies based on cost-benefit calculations	How can we reduce needs for water, to conserve the resource, save money and reduce environmental impacts?	Planners use pricing, technology, and information programmes to improve water-use efficiency and optimize use of existing infrastructure. Increasing capacity is only one option among others in a least-cost approach.	Efficiency gains through pricing, technical fixes and consumer education
Soft path	Environmental and ecological economics and systems engineering, with recognition of bio-physical limits	Policies centrally involve stakeholder consultation and political review	How can we deliver services currently provided by water in ways that recognize the need for economic, social and ecological sustainability?	Planners model a sustainable future state for water use with attention to long-term economic and social prosperity. They then 'backcast' to devise a feasible and desirable path to reach that state. Ecological sustainability is fundamental to all economic, political and socio-cultural choices.	Options to reduce water use through innovation, conservation, water reallocation and changing patterns of use and reuse; more water left <i>in situ</i>

those of absolute new supplies and with far fewer adverse environmental effects (Brooks, Brandes, & Gurman, 2009).

Even so, demand management's success has varied greatly. Failure is often attributed to lack of a crisis sufficiently acute to generate the public awareness and political will necessary to shift management and consumer practices. Water pricing is generally a function of local or regional government, and no political body likes to go to voters with a proposal to substantially increase water rates. Even in those regions most acutely short of water, many centralized water-supply agencies have become embedded in state bureaucracy, and neither their senior management nor their operating staff are prepared to surrender part of their power to new demand-management requirements (Straith, Adamowski, & Reilly, 2014).

Even if governments recognize the need for water conservation, they commonly continue to expect public water utilities to cover costs or even make a profit. Such expectations give municipal or state utilities conflicting objectives: they are obliged simultaneously to sell enough water to meet financial objectives and to promote water conservation, which reduces water sales.

However, achieving sustainable water security is not just a matter of striking a better balance between supply and demand management. In a world of worsening climate, demographic stresses and increasingly common absolute water scarcity that affects billions of people (Mekonnen & Hoekstra, 2016), supply management, even when modified by demand management will often not produce sustainable water outcomes. Sustainability is simply not part of the mandate of these conventional approaches. The real contrast to supply management is not demand management as it is interpreted in different economic and environmental contexts, but the more radical alternative of a soft-path paradigm.

The soft-path paradigm

The analytics of a 'soft path' were developed first for energy in the 1970s (Lovins, 1977), and a couple of decades later for water (Brooks et al., 2009; Gleick, 2003). The differences between supply management, demand management, and soft path are shown in Table 1.

Water soft paths – there is no one 'best' or 'optimal' soft path – are developed by a logic that is the reverse of the logic used in conventional forecasting, which merely extrapolates past trends. The approach begins by choosing some point in the future, imagining it in sufficient detail to determine how that future's likely larger human population and economy could have equitable access to sustainable water sources, and then working backwards ('backcasting') to identify policies and actions that can connect the future to the present.

In severely water-short areas, the strategy may challenge official plans for population or economic growth. The outcomes proposed – achieved through pricing, regulation, rationing, or most likely some combination of all three – are not intended to be value-free. By explicit design, they are intended to be sustainable and equitable.

This approach has been tested in Canada at the watershed level in Nova Scotia, at provincial scale in Ontario, and in mid-size cities in Manitoba, British Columbia and Ontario (Brooks, Maas, Brandes, & Brandes, 2015). In all cases, it was found possible

not just to cut water use but also to bring it well within sustainable limits, including ecological flows, at costs close to those for existing supply sources and below those for additional sources. The difference in cost is typically quite large: if investments for existing water supplies have already been fully amortized, additional supply need only meet pumping costs; in contrast, new water supplies must show a return on investment, not just operations.

Water soft paths have not yet made a great impact on policy choices. Only in communities faced with a major capital investment, such as York Region, north of Toronto, have soft paths been viewed as an alternative. In most cases, even in such otherwise environmentally conscious areas as British Columbia's Salt Spring Island, water soft paths have not received serious consideration. To now, water soft paths are only beginning to be explored outside North America, and not at all in countries with absolute water shortages where all available sources are already exploited.

Emotions, mortality salience and water policy

Water and emotion research

Social science-driven, water-related studies have examined water phobias (Poulton, Menzies, Craske, Langley, & Silva, 1999), gender and distress related to water insecurity (Wutich, 2009), and individual risk perceptions of flooding, drought, or contamination (Overdevest & Christiansen, 2013; Terpstra, 2011). Specific to cognition and mortality fears, Terpstra (2011) concluded that public-agency communications relating to flood risk must accommodate both cognitive and emotional mechanisms. Some effects were complex: higher trust in flood protection lessened people's dread of flood risk and indirectly hampered preparedness. Previous flood experiences instilled both negative emotions of fear and powerlessness and positive ones of solidarity and belonging. Other research finds that stakeholders' value orientations are a factor in water management and planning (Sivakumar, 2011; Vugteveen et al., 2010; Wolfe, 2012). These studies address individuals' risk perceptions and both positive and negative emotional associations with water experiences, but they do not address the influence of different thought systems or mortality salience on decision making. Our research addresses that gap by examining whether mortality-salience responses – proximal and distal defences – could influence water management.

Mortality salience and water paradigms

Although the current literature has no explicit application of TMT to water management, one can hypothesize how mortality salience might influence attitudes towards water and, in turn, water decisions within each of the three water-management paradigms. In Table 2 we provide the results of our preliminary thought experiment. This thought-experiment design allowed us to explore questions that would be empirically problematic: the potential data are widely dispersed over time and place, and include a huge number of possible participants from the professional water community and society. We addressed our research questions by applying indicators from the theoretical framework to our case studies. Using an extended and animated process of

thinking–debating–re-analyzing, we considered whether the theoretical framework fit and what our assessment told us about individual and societal reactions to the three water-paradigm cases. We also considered opportunities for new empirical research.

Specifically, we used water scarcity as a ‘water-specific’ mortality-salience trigger – an observed change in water resources’ tangible properties that could generate implicit or explicit mortality awareness. For example, water scarcity that leads to severe restrictions on household water consumption or boil-water advisories could make people directly aware of their mortality. We included water-scarcity conditions, with all of their typical outcomes, as well as the subsequent media coverage of these outcomes: urban water restrictions, crop failures, visual changes to the environment, increased wildfire frequency and intensity, loss of fish spawning because of low stream levels, and the like. We found that water scarcity could elicit individuals’ and societies’ prototypical responses – the affirmed beliefs or normative judgments indicated by quotation marks in [Table 2](#) – within each paradigm. These responses were then categorized as proximal and distal defences within particular water-management paradigms.

Proximal defences of denial, distraction, and rationalization minimize conscious death thoughts that water issues provoke, but they may also frustrate policy responses to scarcity. For example, efforts to educate consumers about efficient water use by highlighting scarcity, and to discourage consumption by raising water’s price, may trigger proximate defences through denial that the water problem is serious.

Distal defences serve to sublimate unconscious death thoughts; they manifest themselves through self-esteem-building ‘hero’ projects, solidification of one’s worldview, and reinforced out-group antagonism. Water infrastructure is obviously built for practical purposes – providing urban supply, hydropower, or irrigation, or limiting flow extremes. But constructing this infrastructure can also serve as a distal defence through a culturally defined hero project. Imposing structures like the Hoover Dam (USA) or the W. A. C. Bennett Dam (Canada) can elicit feelings of national pride, power, and confidence in national sufficiency, particularly among the people who design and build the infrastructure and first use the water it controls (Ross & Wolfe, 2016). Sometimes, powerful individuals can identify themselves with large-scale water projects in an extreme form of self-aggrandizement; Nasser’s High Aswan Dam and Mulholland’s water diversions are examples. At the societal level, the employment these projects generate and the subsequent energy provision and public services development can boost feelings of community well-being.

In the supply-management paradigm, proximal and distal defences against mortality salience largely involve efforts to dominate and control water. In contrast, in the demand-management paradigm, these defences involve balancing and adapting. Both paradigms, however, share an underlying worldview that accepts large-scale interventions in nature, massive infrastructure construction, and engineered, primarily anthropocentric management of water. Dams and watershed diversions may have fallen out of favour for capturing new supply, but meeting consumers’ water demand is still the fundamental priority – albeit fine-tuned with pricing signals and high-efficiency technology. Though less popular now than they once were among the public, dams are typically rejected, even in developing countries, only when they impose dramatic and adverse environmental effects, or when they require the displacement of many thousands of people.

Table 2. Possible cognitive and behavioural responses to water-scarcity-induced mortality salience, by water paradigm.

Responses to mortality salience		Supply management	Demand management	Soft path
Proximal defences				
Denial	"Water scarcity isn't a problem: it can be eliminated by controlling the natural environment to find, for instance, new sources of water."	"Water scarcity isn't a problem: it can be eliminated by getting the price of water right and thereby ensuring that appropriate technologies are in place." "Water scarcity isn't a problem: current infrastructure and allocation systems are fine but can be improved with better public participation and more effective policies and price incentives."	"Water scarcity isn't a problem: it can be eliminated by getting the price of water right and thereby ensuring that appropriate technologies are in place." "Water scarcity isn't a problem: current infrastructure and allocation systems are fine but can be improved with better public participation and more effective policies and price incentives."	"Water scarcity isn't a problem: it can be managed or even eliminated with an ecologically informed, community-based, technologically sophisticated long-term plan of water provision."
Distraction	Focus relentlessly on controlling existing water resources and finding more supply.		Keep repeating that water scarcity will go away if economic signals and incentives are correct. Focus conversation on the cost difference between demand-management options within the current system and options that would be available in a reformed system. "Economic and technological changes will allow adaptation to all water conditions." "Everyone should pay full cost for water use, regardless of system impacts or social equity."	Emphasize public involvement in water decision making; focus on developing mechanisms for community and citizen engagement.
Rationalization	"Humanity is a unique species entitled to dominate the natural landscape and shape it to its needs." "Natural services provided by water may be important, but they are secondary to human needs."			"The natural environment should be returned to conditions prior to imposition of the colonial production ethic." "Conservation should take precedence over cost-effectiveness."
Distal defences				
Sublimation (worldview defence)	"Control over ever-larger environments for water access is a good thing." "It is my right to use as much water as I need and desire."		"Humans have a right to control and extract water to meet demand, but provision must be efficient." "Everyone can play a role in conservation and efficiency efforts." "Not conserving water during scarcity conditions is socially deviant."	"Efficiency is never adequate, and conservation is costly in time and very difficult to enforce." "Small-scale efforts are essential; unnecessary water consumption by self or others is morally wrong."
Displacement (self-esteem striving)	Pursuit of hero projects, especially in the form of commitment to / participation in large water-supply infrastructure construction		Pursuit of hero projects, manifest as leading-edge efficiency innovation (e.g. Israel's irrigation projects) and low water footprints; identification of conforming individuals, for example people with xeriscaped property, rain barrels and low-flush toilets	Pursuit of hero projects: individual consumers adopt low-water-use self-identities, while water experts seek a redefinition (revolution) of water management paradigms and practices
Out-group antagonism	Incitement of conflict over access to and allocation of scarce water resources based on region, community, sector, nationality, tribe, etc.		Identification of deviant individuals, for example people with irrigated lawns, swimming pools and fountains, encouragement of public contempt for, or shaming of, communities that are engaged in unpaid, wasteful, or subsidized water use because of e.g. practices like unmetered water consumption or flat water tariffs	Encouragement of public contempt for, or shaming of, identifiable groups of consumers with wasteful water-consumption practices; stated mistrust of previous-paradigm advocates, especially their lack of recognition of significant inequity and environmental problems

Mortality salience and a shift to water soft paths

Not only does the prevailing water paradigm affect the types of proximal and distal defences used, but those defences in turn probably reinforce current water-consumption behaviour and existing strategies that water managers identify, prioritize and pursue. These same defences may also subtly impede water soft-path efforts. Given societies' limited experience with water soft-path policies – or even proposals – to this point, we can only speculate as to what further research along these lines might indicate.

Table 2 shows that our proposed prototypical mortality-salience defences within the water soft-path paradigm are distinctly different from – and probably even incommensurable with – those likely within the supply- and demand-management paradigms. Soft-path proximal and distal defences are characterized by mistrust of the existing system, disgust with inequitable water security and environmental allocations, and adoption of worldviews that would produce – if fully implemented – nothing short of a revolution in the dominant water-management paradigm.

As climate change effects on water become more frequent, widespread and severe, possibly triggering fear of environmental collapse, our environmentally derived mortality salience will become more acute. At the same time, evidence in favour of a water soft path – with the paradigm's emphasis on ecological and social equity – is likely to become more abundant and stronger. Eventually, this 'revolutionary' paradigm could become the dominant one – in which case soft-path adherents will probably develop new proximal and distal defences, including symbolic hero projects that justify, and make sense within, the soft-path paradigm.

Conclusion: possible insights for future water research and policy

We do not argue against a general notion of rationality: human cognition is an intimate dance of both System 1 and System 2 thinking. We simply argue for recognition that socio-psychological emotional triggers and responses play a central role in economic, political and environmental decision making. Accounts of decision processes that do not integrate this reality cannot fully explain how people and groups make decisions about complex problems, such as natural resource scarcities. We argue further that negative emotions – particularly the fear, anxiety and foreboding associated with mortality awareness – strongly influence actors' worldviews, consumption patterns and antagonisms towards out-groups.

What might be the conceptual and practical implications of these insights for water researchers, policy makers, non-governmental advocates and citizens? Admittedly, our ability to answer this question is limited compared with our ability to answer the first two questions, but that is one of the reasons for posing it. We propose that to address current water challenges effectively, researchers, water managers, and policy makers must first recognize and understand emotions' central causal role in water negotiations, governance processes and policy decision making and programme implementation. TMT, which explains how people defend against mortality salience, can aid this understanding. Researchers can also use TMT to evaluate the connection between out-group antagonism and water governance. How people defend themselves against mortality

salience may be an important factor in entrenched disputes over scarce water, a possibility not fully articulated in the current literature on water conflicts (Wolf, 2009). This factor could also help explain hostile reactions to 'the other' in water-resource decisions (Greenberg et al., 1990; Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989).

Researchers might also investigate historical and contemporary water texts to identify, extract and analyze embedded emotions and mortality-salience triggers. Such an analysis should provide insight into the complex emotions that water problems evoke in individuals and groups over time and in different contexts. Researchers can also investigate the social and psychological dimensions of historical water-infrastructure projects as hero projects. Finally, scholars might study the role of distal and proximal defences to water in the development of identity, especially as connected to religion, spirituality, concepts of 'sacred places', religious practice and the formation of attitudes of responsibility towards water.

But the conceptual and theoretical approach we have elaborated here also has great potential utility beyond scholarship. It could identify new ways to encourage individuals and groups to make better choices regarding water; it could help policy makers better influence people's risk perceptions relating to water; it could aid the development of marketing for 'water smart' appliance purchases; and it could strengthen the effectiveness of campaigns against bottled water and for water education. In sum, TMT could contribute enormously to better water decisions.

Notes

1. 'Mortality salience' is the technical term for mortality awareness; 'salience' and 'awareness' are used interchangeably throughout the article.
2. Space limitations preclude extensive citing of literature. However, a supplementary list of references has been prepared. It can be sent to anyone who requests it from the lead author.
3. Examples of symbolic hero projects include nation building and fostering nationalism, supporting sports teams, building monumental architecture, engaging in philanthropy, and participating in social movements. Literal projects include adopting a religious belief in heaven or in reincarnation.
4. We rely on a definition of culture derived from social psychology and the TMT literature: culture provides socially sanctioned roles, behaviour models and symbolic immortality projects (Pyszczynski et al., 2015). In this definition, culture is a general template that varies across time and space but is also independent of the natural environment. The disconnect from the environment, and the resources that a culture is dependent upon, differs from the better-recognized definitions of culture in the water literature; see for example Linton (2010) or Strang (2015).
5. For ease of explanation, our discussion of water paradigms focuses on the household sector, but similar conclusions apply to commercial, industrial, institutional and agricultural uses of water.

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