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# Running Out of Water! Developing a Message Typology and Evaluating Message Effects on Attitude Toward Water Conservation

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## ABSTRACT

In three phases, this study identifies and evaluates the major messages being used in communication campaigns focused on the ongoing drought in California. A literature review in Phase 1 resulted in a typology of 12 message strategies. Following this typology, trained coders in Phase 2 evaluated water conservation messages ( $N=100$ ) to determine whether each message utilized one or multiple strategies. The results revealed various frequencies of strategy application; and a correlational analysis rendered a pattern of strategy use in combinations. Phase 3 focused on a controlled message experiment applying the three most relevant strategies: conservation tips, loss aversion, and evidence of drought. Analysing data sampled from California residents ( $N=180$ ), conservation messages, regardless of the strategy, led to attitude change in a negative direction. Additional analyses revealed interesting patterns of combinatorial strategy effects. The results call for a re-examination of message strategies as they may lead to several unfavourable outcomes.

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Environmental communication researchers have long been interested in studying the effect of persuasive messages on environmental attitudes and behaviours (e.g. Pelletier & Sharp, 2008). Research on conservation messages reveals that different message strategies lead to discrepant effects on receivers. For example, Davis (1995) found that young, well-educated individuals responded favourably to messages emphasizing negative consequences if conservation actions (e.g. recycling) were not taken. Cialdini (2003) noted that pro-environmental messages can produce positive behavioural effects when both inductive and deductive norms are incorporated. Lu (2015) observed that sadness appeals are most effective when paired with a gain frame, whereas hope appeals are most effective with a loss frame. Collectively, these studies maintain that conservation message strategies can lead to positive effects on environmental attitudes.

Based on the literature above, this research examines message strategies and their application both individually and in various combinations. Specifically, the research focuses on current message campaigns aimed to reduce residential water use in California. This issue is critical and urgent as California's water supply currently faces several broad, dire challenges. These include ecological problems in the Delta, water delivery systems, climate change, dry conditions, and population growth (Association of Water California Agencies, 2015; Environmental Protection Agency [EPA], 2010).

Moreover, California is historically susceptible to drought (EPA, 2010). If left unaddressed, consequences stemming from California's current four-year drought include: a decline of stream and

river flows, visibly dry vegetation, a decline of water levels in reservoirs and lakes, an increase in the depth of wells, a decline in groundwater levels, land subsidence, seawater intrusion, and damage to ecosystems (United States Geological Survey, 2014). If carbon emissions continue to increase, NASA projects a dramatic increase in the likelihood of a mega-drought in the Southwest and Central Plains within the next 35 years (Northon, 2015). Therefore, the need to develop effective message campaigns for water conservation is more crucial than ever.

## Water conservation campaigns

In response to the drought, substantial financial resources have supported message campaigns to reduce water use. The State of California spent over a million dollars on the *Save Our Water* (SOW) campaign in 2014 alone (State of California, 2014). These messages have been disseminated through numerous channels, including billboards, social media, television, radio, websites, and targeted advertisements. Still, data show that multifaceted water conservation efforts—including water-saving technology (e.g. more efficient appliances), economic incentives (e.g. offering financial gains or mandating fines for waste), and communications (e.g. sending messages on mass media and social media)—fail to meet California's mandated goals of 25% reduction (California Water Resource Control Board, 2014).

Research outside of California have examined water conservation campaigns and factors related to attitude and water use. In Spain, March, Saurí, and Olcina (2014) suggested that demographic characteristics affect perceptions towards climate change and water supply. Researchers in Queensland, Australia (Fielding, Russell, Spinks, & Mankad, 2012) and in United Kingdom (Browne, Medd, & Anderson, 2013) also connected demographic characteristics to water use. In Gold Coast, Australia, Willis, Stewart, Panuwatwanich, Williams, and Hollingsworth (2011) found a relationship between the environmental and water conservation attitudes and the amount of water that they used. Although these findings illuminate on the effect of water conservation attitude on behaviour, they often employed survey methods that were unable to disentangle the causal effects generated by the messages people might have received.

This research focuses on addressing these concerns by employing a comprehensive set of research approaches. To start, in light of the well-documented connection between attitude and behaviour (Glasman & Albarracin, 2006), this research focuses on water conservation attitude as a proximal outcome to conservation messages. This research analyses existing campaigns and systematically evaluate the effects of the messages on conservation attitude. This work also responds to conclusions raised in a comprehensive review by Syme, Nancarrow, and Seligman (2000), which points to the need to identify causal mechanisms for messages that affect persuasiveness using a controlled design. Therefore, this research experimented on the effect of conservation messages on attitude.

Phase 1 develops a typology of 12 message strategies through a review of literature and ongoing water conservation messages in California. Based on the developed typology, Phase 2 describes current water conservation message strategies ( $N = 100$ ) in terms of their frequency and combinatorial application (i.e. how strategies are used together). Based on message frequencies and strategy use, three message strategies (i.e. conservation tips (CT), loss aversion (LA), and evidence of drought (ED)) were selected in Phase 3 for an experimental evaluation to test their effects on conservation attitude. Specifically, a factorial experiment evaluated when the strategies are used individually and in combinations with a sample of Californians ( $N = 180$ ). The results provide evidence on the effect of message strategies on conservation attitude and offer directions for future conservation message research.

## Phase 1: a typology of message strategies for water conservation in California

In the first phase, we advance a typology of 12 message strategies (see Table 1) based on existing environmental communication literature and the application of those strategies in ongoing water

conservation campaigns. This typology and review is broad, but by no means exhaustive or comprehensive. We briefly describe each strategy with a conceptual definition in *italics*, illustrating it with examples from existing water conservation campaigns and discussing the relevant literature. Some example messages involve a combination of strategies.

### **Conservation tips**

Conservation tips refer to messages that *directly provide the receiver with any type of content, tips, and/or strategies to save water*. Examples include tip sheets or informational videos that teach individuals how to conserve water (Ferraro & Miranda, 2013). The SOW campaign tweets and publicizes posts such as,

WaterWise Tip: Put a layer of mulch around trees and plants to reduce evaporation and keep the soil cool. Organic mulch also improves the soil and prevents weeds. Save: 20–30 gallons each time you water 1000 sq. ft.! #EveryDropCounts#SaveOurWater #MulchItUp.

Another example comes from the Metropolitan Water District of Southern California, which tweeted “#CA Native plants use less water, creates a natural habitat for animals & is low maintenance. See what to plant: [http://www.bewaterwise.com/great\\_native.html](http://www.bewaterwise.com/great_native.html).” Although information regarding national habitat for animals can increase receivers’ knowledge, this knowledge does not necessarily correspond to conservation behaviour (Abrahamse, Steg, Vlek, & Rothengatter, 2005). Likewise, Schultz (2010) observed that knowledge does not create sufficient motivation for individuals to engage in actual conservation behaviours. Conservation tips may require a message strategy in combination to heighten individual motivation for behaviour change.

**Table 1.** Frequencies and conceptual definitions of 12 message strategies in the typology.

| Message strategy          | Conceptual definition   | Frequency out of 100 | Percentage |
|---------------------------|---|----------------------|------------|
| Conservation tips         | Conservation tips refer to messages that directly provide the receiver with any type of content, tips, and strategies to save water.  | 48                   | 48%        |
| Referrals and redirection | The referrals and redirections strategy refers to messages that aim to direct the receiver to another source of information which serves as a means for the audience to learn more about conservation.                                    | 33                   | 33%        |
| Policies                  | Policies are any rules, regulations, laws, mandatory restrictions, and monetary exchanges for some conservation actions.  | 30                   | 30%        |
| Goal-setting              | Goal-setting refers to providing the receiver a clear reference point in their conservation behaviour in an effort to achieve or surpass that point.  | 16                   | 16%        |
| Loss aversion             | Loss aversion occurs when a message conveys to the receiver that inadequate conservation efforts will result in a reduction in water supply and other related consequences.   | 15                   | 15%        |
| Evidence of drought       | Offers some concrete evidence, often in data or pictorial elements, to encourage conservation behaviour.  | 14                   | 14%        |
| Social identity           | Social identity is a message strategy that heightens the awareness of the receiver’s group membership and makes salient his/her group-level characteristics in favour of the desired outcome.   | 11                   | 11%        |
| Humour                    | Humour attempts to gain attention by inducing a receiver’s positive reaction or arousal.  | 10                   | 10%        |
| Direct request            | The direct request strategy refers to water conservation messages that instruct the audience to conserve without any support or justification.  | 10                   | 10%        |
| Commitment                | Commitment asks the receiver to demonstrate a willingness to conserve water, privately and/or publicly.   | 9                    | 9%         |
| Social norms              | Social norms refer to the subjective and generalized belief that individuals have about the referent others in their social environment.  | 2                    | 2%         |
| Social comparison         | Social comparison is a framing strategy that makes a direct evaluation of the receiver against a certain referent individual (or group) in the attempt to induce behavioural change in alignment with the referent individual (or group). | 1                    | 1%         |

### **Loss aversion**

Loss aversion occurs when a message *conveys to a receiver that inadequate conservation efforts will result in a reduction in water supply and other negative consequences*. An example includes a billboard message from the San Diego Water Authority declaring, “You never miss it until it’s gone. Water: Save it or lose it.” Moreover, the Water Coalition of Santa Cruz County utilized LA in its message, “Conservation is nice, and definitely needed, but we need to start planning for the possibility of something like this if we want to keep living here in California with the quality of environment and lifestyle we love.”

In the literature, Mankand and Tapsawan (2011) found that when people felt a high risk is involved, the community was more willing to accept and adopt alternative water systems. Additionally, Syme et al. (2000) concluded that loss messages are more successful than gain messages in promoting energy efficient products. The premise is that losses induce a stronger effect in behaviour than gains.

### **Evidence of drought**

Evidence of drought offers *some concrete evidence, often with data or pictorial elements, to encourage conservation behaviour*. Evidence aims to convince receivers of both the reality and the severity of the drought. The SOW campaign utilized messages such as, “In March 2015 snowpack was at 5% of average and January 2015 was one of the driest months on record here in California.” Another use of ED is to provide data and statistics that express the status and severity of the drought. In contrast, the University of California at Irvine’s Drought Reach applied pictorial evidence in their campaign by displaying powerful pre- and post-drought pictures of well-known California lakes, streams, and reservoirs that have been drastically depleted, accompanied by a message stating, “This is your state on drought.”

A review showed some application of evidence in promoting water conservation; parallel work in the health sector has met with success. In a 2009 health campaign, the World Health Organization (WHO) advocated the effectiveness of graphic, startling images as health warnings on cigarette boxes and packets—an approach also known as a “fear appeal.” The WHO also found this type of pictorial evidence to be effective when shown to both a young or an illiterate audience, with both audiences demonstrating an increased engagement with the message. Although some research suggests that individuals have a pre-existing belief about water availability (e.g. March et al., 2014) and they may utilize this belief to reject the evidence they receive (Hurlimann & Dolnicar, 2011), we suspect the efficacy of the WHO campaign may carry over in the water conservation contexts.

### **Social norms**

Social norms refer to *the subjective and generalized beliefs that individuals have about the referent others in their social environment*. For water conservation, social norms often relate to individuals’ own beliefs regarding how much water others in his/her neighbourhood use. Coachella Valley Water Counts advocated for conservation norms with messages such as, “Drought irrigation guide, find out how much you should be using to water. Be efficient.” The organization also provides customers with a guide on water usage, with the goal of changing customers’ perceived norms around water conservation. This strategy is especially beneficial in showing excessive water users that they are clearly non-normative.

Norm-based strategies have been shown to be effective in water (e.g. Beal, Stewart, & Fielding, 2013; Fielding et al., 2013) and energy conservation (e.g. Murtagh, Gatersleben, & Uzzell, 2014). Beal and colleagues observed the importance of feedback in enhancing the norm effects. They also noted that certain demographic groups may over- or under-estimate their water use, cautioning the validity of self-reported water conservation in norm-based approaches. Moreover, research

suggests that social norms can be paired with social comparison, such as competition (Allcott, 2011)—the next strategy discussed.

### **Social comparison**

Social comparison is a strategy that *makes a direct evaluation of receivers against a certain referent individual (or group) in the attempt to induce behavioural change in alignment with the referent individual (or group)*. Social comparison differs from social norms in that social norms focus on the normative beliefs of others, while social comparison involves others as a benchmark for improvement. For example, the East Bay Municipal Utility District distributed report cards to indicate how residents compared with their neighbours in terms of water conservation.

The literature shows that this strategy effectively decreases water and energy consumption. For example, social comparison can incorporate the comparison of one's own consumption to one's peer group consumption (Ferraro & Miranda, 2013). Information about referent individuals (or group) serves to prompt people to compare their household consumption to that of their neighbours, the county's average consumption, or both (Schultz, 2010). However, social comparison must rely on available data about the referent others, often held by utility companies.

### **Social identity**

Social identity *heightens the awareness of a receiver's group membership and makes salient his/her group-level characteristics in favour of the desired outcome*. This strategy increases the salience of the receiver's group membership, prompting him/her to act in accordance with a social category by highlighting the group's alignment with the proposed attitude or behaviour. An example came from SOW: "The Official 2014 four-letter word LEAK. Find and fix leaks because Californians don't waste." The City of San Diego also employed this strategy by stating, "San Diegans waste no water. All ways. Always."

Some researchers have defined social identity as an expansion of the self-concept involving a shift from individual self-concept to the collective self, often based on perceived membership in a social category (Goldstein, Cialdini, & Griskevicius, 2008; Lea, Spears, & de Groot, 2001). This strategy is effective when it stimulates competition relevant to pro-social behaviour (Hitt, Gidley, Smith, & Liang, 2014). Additionally, the public visibility of pro-social behaviours featured by an individual's "in-group" on social media such as Facebook may elicit public commitment to an identity (Walther et al., 2011) and competition among in-groups and out-groups if a specific goal is set.

### **Referrals and redirections**

Referrals and redirections refers to messages that *aim to direct a receiver to another source of information about conservation*. These sources may include workshops, videos, and websites. This strategy does not affect conservation directly; it leads receivers to additional resources. An example is the Metropolitan Water District's commercials, "Go to waterwise.com for tips and rebates and don't waste another minute wasting water."

In the literature, Dettmann-Easler and Pearse (1999) examined the effectiveness of six residential environmental education programmes in fostering positive attitudes toward wildlife in the upper Midwest. Results showed that in-class programme students resulted in more positive attitude toward both wildlife and wild places. This study suggests that more information exposure may promote more favourable attitudes—particularly when that information is comprehensive. However, Syme et al. (2000) discuss that individuals were willing to receive information and education programmes, only when they were coupled by personal contacts (e.g. group discussion or neighbour-based activities).

## Policies

Policies, in this context, are *any rules, regulations, laws, mandatory restrictions, and/or monetary exchanges for conservation actions*. Monetary exchanges may include positive incentives in terms of financial gains (e.g. “if you save 10% on your water usage you will receive a \$10 bonus on your next bill”) or even negative punishments due to an excess use of water (e.g. “if you have lawn runoff, you can incur a \$500 fine”). The policies strategy follows current legislation (Aisbett & Steinhauser, 2013), with specific examples of policies including rebates, fines, and governmental restrictions (e.g. no car washing without a hose attachment). The enforcing entity may include local, municipal, or county governments. In 2015, the Water Conservation Coalition of Santa Cruz publicized a new law to report neighbourhood water waste: “Have you noticed water waste? Report Water Waste.”

The effect of the policy strategy, or messages communicating policies, appear to be inconclusive and possibly ineffective. A field experiment in California tested the efficacy of fines in influencing citizens’ water usage in Palo Alto, Mountain View, and Hayward; the effects were too small to have any practical significance (Agras, Jacob, & Lebedeck, 1980). Furthermore, Abrahamse and colleagues (2005) examined the use of rewards—such as incentives and rebates—to convince individuals to lower their water consumption. However, within the first year, they found that rewards had a fleeting effect on water conservation. These policies failed to affect the underlying attitude required for long-term outcomes.

## Goal-setting

Goal-setting provides the receiver a clear reference point of conservation behaviour in an effort to achieve or surpass that point. Usually, goal setting involves a concrete behavioural target that a receiver may use to measure success. Los Angeles Waterkeeper tweeted, “Go Dirty for the drought #Dirtycarpledge. Sign the pledge below to not wash your car for 60 days. It saves water and money. (And the car sticker we give you saves your image, too).”

Unlike social comparison, which highlights a rivalry (typically one’s self versus others), goal setting is more objective and direct. Experimental work examining goal setting shows that when it is combined with feedback regarding progress, households conserve more water than a “goal only” group (Abrahamse et al., 2005). This suggests that goal setting is an effective strategy when coupled with other strategies. In another example, the San Diego Water Authority displayed on billboards, “[Picture of a sprinkler] No more than 3 days a week. Water: Save it or lose it. [www.20gallonchallenge.com](http://www.20gallonchallenge.com).” This message differs from the Los Angeles Water Keeper’s example in that it also embedded a commitment strategy.

## Commitment

Commitment asks a receiver to demonstrate a willingness to conserve water, privately or publicly. Private commitment requires a person to uphold a standard to conserve water on a personal level. Public commitment, on the other hand, requires a person to demonstrate a collaborative agreement between the self and others (Dickerson, Thibodeau, Aronson, & Miller, 1992; McKenzie-Mohr, 2000; Schultz, 2010). The Los Angeles Water Keeper used commitment in its *Dirty Car Pledge* campaign that encouraged receivers to not wash their cars for 60 days while displaying a public commitment to the pledge through a bumper sticker. The EPA also utilized this strategy on its Water Sense website that asked,

Are you for water? Take the Pledge! Step 1: Join us on Facebook and Twitter; Step 2: Update your Facebook and Twitter status; Step 3: Send an email to spread the word about saving water; Step 4: Post the widget on your website; Step 5: Share these videos with your friends.

Social media enable public commitment without a physical presence or displays. For example, Facebook users may commit to conserve water by declaring through a status update. Walther and colleagues (2011) reported that online commitment produces effects similar to an in-person commitment. Furthermore, McKenzie-Mohr and Schultz (2014) found that individuals who received information (e.g. CT), a personal visit, and were asked to sign a conservation pledge, decreased their water consumption by 54%, while individuals who received information only increased their water consumption by 15%. This example again shows the need to experimentally distil the exact strategy or the combination of strategies that led to successful outcomes.

### **Humour**

Humour attempts to *gain attention by inducing a receiver's positive reaction or arousal*. San Francisco Utilities Commission's campaign deployed humour by coupling sexual innuendo with CT that appear across commercials and billboards, such as, "Replace your toilet and get paid for Doing It." The Southern California Water Committee (SCWC) also uses humour through its mascot's twitter account (@Lawn\_Dude). An example is from its biography on Twitter: "Recovering wateraholic. SWEAT by Day & DRINK by Night, is my motto. I'm SCWC's official mascot telling you wasting H2O is BAD! C'mon CA, up your conservation."

Humour has been widely researched, especially in advertising (see Weinberger & Gulas, 1992). Humour increases a receiver's attention to information. However, humour alone does not lead to increased persuasive effects. Applied to water conservation campaigns, message senders often couple humour with other message strategies to elicit a favourable response from receivers (Diedring, 2008).

### **Direct requests**

Direct requests refer to water conservation messages that instruct the audience to conserve without any support or justification. The California Department of Transportation implemented this strategy via freeway signs stating, "SERIOUS DROUGHT. HELP SAVE WATER." The County of San Diego also employed direct requests by stating, "Rethink how you use water."

Direct requests typically involve reminder messages. In persuasion research, direct requests often serve as the control group to compare the effect of alternative message strategies. In this research, a direct request occurs when the message does not involve any of the aforementioned strategies.

## **Phase 2: frequency and combinations of water conservation messages**

### **Method**

The second phase applied the typology created in the first phase to categorize and describe ongoing water conservation campaigns in California. Messages were randomly sampled from campaigns in late 2014 to early 2015. To do this, an initial list of message sources (e.g. SOW) was developed, and their channels identified, which included social media accounts, billboards, television commercials, and print advertisements. Each source may include multiple messages from various venues. To balance among these sources, up to five random messages were collected from each randomly sampled source. The dataset reflected a sample of 23 conservation organizations, with a total of 100 conservation messages.

Consistent with established content analytic approaches (Liang, DeAngelis, Claire, Dorros, & Levine, 2014; Liang & Kee, 2016; Krippendorff, 2013), two trained coders evaluated and coded each message according to conceptual definitions (Table 1). These definitions were revised through a pilot test with a small sample of offset messages ( $N = 10$ ). Upon consensus between the two coders and the researchers regarding the typology's face validity, the coders received additional training to apply the definitions for all 100 messages in the dataset. Initial coding (first set of 50 messages) produced 99.2% agreement between the two coders. Then, coders discussed the disagreements and

resolved them, reaching a 100% agreement. The second set of 50 messages produced 96.7 agreement between the two coders, followed by a discussion that led to a 100% agreement. Each message was evaluated based on whether it demonstrated any one or more of the 11 strategies, or it was coded as a direct request (the 12th strategy). The strategies are not mutually exclusive in an actual message; therefore, a message can theoretically contain the first 11 strategies in the typology. In the dataset, however, the average number of strategies per message is 1.99 ( $SD = 1.06$ ).

## Results

The initial analysis describes the frequency of strategy usage (for descriptive statistics and percentages of messages, see [Table 1](#)). The most common strategies are CT (48%) and referrals and redirection (33%). With an exception of policies (30%), there is a large gap between the two most frequently used message strategies and the next five most frequently (or second most frequently) applied strategies, including goal setting (16%), LA (15%), ED (14%), and social identity (11%). The least frequently utilized strategies are humour (10%), direct request (10%), commitment (9%), social norms (2%), and social comparison (1%).

To understand combinatorial strategies (i.e. strategies more likely utilized in tandem) and non-combinatorial strategies (i.e. strategies less likely utilized in tandem), a Spearman's rho nonparametric test assessed the strength of association in their frequency of use ([Table 2](#)). This analysis involved coding the presence of a message strategy as 1 and its absence as 0. These results are interpreted such that positive relationships indicate that two strategies are more likely to be used in combinations in a single message. Humour was most associated with CT,  $\rho = .28$ ,  $p < .01$ . Goal-setting messages positively associated with policies,  $\rho = .31$ ,  $p < .01$ , and commitment,  $\rho = .44$ ,  $p = .01$ . Loss aversion positively associated with ED,  $\rho = .40$ ,  $p < .01$ . Referrals and redirection positively associated with policies,  $\rho = .24$ ,  $p < .05$ . Last, social comparison positively associated with social norms,  $\rho = .70$ ,  $p < .01$ .

Negative relationships indicate that two strategies are less likely to be used in combinations. Conservation tips negatively associated with ED,  $\rho = -.22$ ,  $p < .05$ . Furthermore, LA was negatively associated with CT,  $\rho = -.29$ ,  $p < .01$ .

## Discussion

The results point to some patterns in the frequency of strategy use in combinations, which led to the selection of strategies for testing in Phase 3. First, the data showed that CT, as well as referrals and redirection, are more frequently utilized (average 40.5%) when compared to other strategies (average 11.8%). Conservation tips utilize an information-oriented approach by providing a receiver some actual, usable information to conserve water. These strategies often include novel approaches to save water; however, they are predicated on the assumption that the receiver is willing to act pro-environmentally and has favourable attitudes, behavioural intentions, or both toward conservation. Based on this assumption, information-based strategies likely fail or achieve only mixed results as reflected in the previous review.

Unlike CT, referrals and redirection strategies involve directing the receivers to information that provides them with more learning materials on water conservation, making this strategy lack applicability or less conducive to implement for campaign practitioners. A number of other message strategies also lack applicability for campaign practitioner use. Policies, for example, require legislative action through the development of laws and regulations that require time, deliberation, and funds to pass in courts and/or within local or state government. Social norms, social comparison, and goal-setting strategies typically require practitioners to have access to data held by municipal utility companies. Strategies including humour and commitment rely on psychological activation (i.e. arousal) and behaviour (i.e. public commitment), suggesting the need for unique research designs to test their individual effects.

**Table 2.** Correlation matrix among message strategies.

|                              | 1      | 2       | 3      | 4       | 5     | 6     | 7      | 8     | 9     | 10    | 11     | 12 |
|------------------------------|--------|---------|--------|---------|-------|-------|--------|-------|-------|-------|--------|----|
| 1 Policies                   |        |         |        |         |       |       |        |       |       |       |        |    |
| 2 Tips and strategies        | -.149  |         |        |         |       |       |        |       |       |       |        |    |
| 3 Evidence of drought        | .05    | -.215*  |        |         |       |       |        |       |       |       |        |    |
| 4 Social norms               | -.094  | .006    | -.058  |         |       |       |        |       |       |       |        |    |
| 5 Social comparison          | -.066  | -.097   | -.041  | -.704** |       |       |        |       |       |       |        |    |
| 6 Social identity            | -.091  | .110    | -.142  | -.050   | -.035 |       |        |       |       |       |        |    |
| 7 Goal-setting               | .310** | .017    | .138   | -.062   | -.044 | .021  |        |       |       |       |        |    |
| 8 Humour                     | -.145  | .280**  | -.134  | -.048   | -.034 | .096  | -.145  |       |       |       |        |    |
| 9 Commitment                 | .023   | -.092   | .075   | -.045   | -.032 | -.111 | .435** | -.105 |       |       |        |    |
| 10 Loss aversion             | -.153  | -.291** | .395** | -.060   | -.042 | -.058 | .046   | -.140 | -.132 |       |        |    |
| 11 Referrals and redirection | .237*  | .135    | .146   | .052    | -.071 | .161  | -.016  | -.163 | -.146 | -.057 |        |    |
| 12 Direct request            | -.218* | -.320** | -.134  | -.048   | -.034 | -.117 | -.145  | -.111 | -.105 | -.140 | -.234* |    |

\* $p < .05$ .\*\* $p < .01$ .

Loss aversion (15%) is less likely to occur in conjunction with CT ( $p = -.29$ ). However, health communication research suggests that loss-framed messages aid in targeting behaviours related to disease detection (e.g. Rothman, Bartels, Wlaschin, & Salovey, 2006). Although outcomes differ, water conservation may explore applying LA messaging in conjunction with other messages.

Interestingly, ED is negatively related with CT. However, the content of these message strategies has the potential to jointly affect receivers. Conservation tips may enable receivers with practical behaviours. Then concurrently, ED focuses on showing that water shortage is indeed happening, possibly aiming to change water availability beliefs (March et al., 2014), conservation attitude, and/or behaviour. Given the frequency of message strategies use and the applicability for practitioners, the results suggest that CT, LA, and ED are the most appropriate for further testing.

### **Phase 3: experimental testing of water conservation message strategies method**

The last phase is to test the effect of messages in a controlled design. It involves experimentally isolating and identifying the effect of individual and combinatorial message strategies. A fully crossed design allows statistical analysis of interaction to assess their effects on water conservation attitude.

#### ***Message pre-testing***

A pre-test collected data regarding perceptions of the messages to represent CT, LA, and ED. The goal is to use this data to select the message stimuli in the main experiment. First, an initial review of relevant data from each strategy in Phase 2 provided 10 messages for each of the three selected strategies. Second, all 30 messages received empirical testing with participants ( $N = 127$ ) from a departmental subjects' pool at a private university in California. Every participant rated each message using single-item, 7-point Likert-type measures ranging from strongly agree (7) to strongly disagree (1). The measures asked participants to rate the extent to which each message (a) provided a tip for water conservation; (b) created a feeling of loss if nothing is done; and (c) offered evidence of the drought. Third, to empirically determine the best representative strategy that minimally induced the other two strategies, the messages were ranked according to (a) the magnitude of rating according to its own strategy category, and (b) the magnitude of discrepancy from the other two strategies.

The selected messages are described here given their empirical properties according to the two criteria described above. The selected CT message originated from California's SOW campaign, "If you accidentally drop ice cubes, don't throw them in the sink. Drop them in a house plant instead." On average, this message scored a 6.17 in CT, a 2.99 in LA, and a 2.96 in ED. The LA message came from EPA's WaterSense, "Say goodbye to clean and safe water soon. As reservoir water levels get lower, water supplies, human health, and the environment are put at serious risk. For example, lower water levels mean higher concentrations of natural and human pollutants." This message received a 5.94 in LA, a 5.32 for in ED, and a 2.6 in CT. The ED message was selected from the SOW campaign: "In March 2015, snowpack was at 5% of average and January 2015 was one of the driest months on record here in California." This message received a 5.63 for ED, a 4.58 for LA, and a 2.41 for CT.

#### ***Participants***

The experiment utilized an online panel to sample California residents ( $N = 180$ ). Participant received payment (\$.50) for involvement in the study. The average age was 49.24 years old ( $SD = 11.34$ ), with exactly half of the participants female. More participants reported an annual household income at or above \$75,000 (32.2%), below \$30,000 (23.9%), between \$30,000 and \$49,999 (22.8%), followed by between \$50,000 and \$74,999 (21.1%). Most participants had a four-year college education (46.7%), followed by some college (33.3%), a post-graduate degree (10%), and high school or less (10%).

After providing informed consent, participants were asked to report their attitude toward a variety of issues including social media, robots, and water conservation (as a pre-test measure). This range of issues reduced the likelihood of participants learning the purpose of the study. Then, participants were randomly assigned to view the eight experimental messages (see experimental induction section). Participants completed induction check measures, followed by a second measure of their attitude toward water conservation (post-test) and other measures not reported in the current paper. Finally, the subjects provided basic demographic information and were debriefed and thanked for their participation.

### **Experimental induction**

A factorial experiment (Agresti & Finlay, 2009; Baxter & Babbie, 2003) aimed to identify the messages effects and their interaction (i.e. how messages work in conjunction with each other). The experiment reflected a 2 (Loss Aversion: Present/Absent)  $\times$  2 (Evidence of Drought: Present/Absent)  $\times$  2 (Conservation Tips: Present/Absent) pre-test–post-test mixed design. When multiple message strategies were present (e.g. LA and ED), the messages were combined into one block of text and presented to participants as a single message. To provide an adequate control condition (i.e. when all three experimental conditions were assigned absent), all messages included a baseline message of “Please Save Water.”

### **Induction check**

A series of independent sample *t*-tests ensured that the messages successfully induced the respective strategy by asking participants to respond to single-item seven-point Likert-type measures gauging whether the message: (a) provides a conservation tip; (b) creates a feeling of loss if nothing is done; or (c) offers evidence of the drought. The CT present condition produced higher ratings for CT ( $M = 6.00$ ;  $SD = .99$ ) compared to the absent condition ( $M = 3.39$ ;  $SD = 1.85$ ),  $t(178) = 11.89$ ,  $p < .001$ ,  $r_{\text{effect}} = .67$ . The LA present condition also led to higher ratings of loss ( $M = 5.54$ ;  $SD = 1.42$ ) compared to the LA absent condition ( $M = 4.58$ ;  $SD = 1.88$ ),  $t(178) = 3.85$ ,  $p < .001$ ,  $r_{\text{effect}} = .28$ . Finally, the ED present condition received higher ratings of evidence ( $M = 5.68$ ;  $SD = 1.37$ ) than the ED absent condition ( $M = 4.02$ ;  $SD = 2.15$ ),  $t(178) = 6.19$ ,  $p < .001$ ,  $r_{\text{effect}} = .42$ .

### **Attitude toward water conservation**

Participants' attitude toward water conservation was measured twice using a 4-item, 7-point semantic differential scale in a pre-test attitude (before message exposure) and post-test attitude (after message exposure). Participants responded to, “Water conservation is ...” with items bad/good, unfavourable/favourable, unnecessary/necessary, and negative/positive ( $\alpha = .94$ ). The data were averaged such that 1 reflected the most negative attitude and 7 reflected the most positive attitude.

### **Results**

Phase 3 assessed the effect of the three strategies (CT, LA, and ED) on attitude toward water conservation. A mixed ANOVA model included the three strategies as the “between factor” and the pre-test–post-test as the “within factor.” (Tables 3 and 4). The average overall pre-test attitude ( $M = 6.47$ ;  $SD = 1.10$ ) shifted toward a negative direction in the average overall post-test attitude ( $M = 6.29$ ;  $SD = 1.24$ ),  $F(1, 172) = 5.59$ ,  $p = .019$ ,  $\eta^2_{\text{partial}} = .031$ . In terms of the individual strategies, no main effect model between pre-test and post-test attitude emerged for CT,  $F(1, 172) = .81$ ,  $p = .37$ ,  $\eta^2_{\text{partial}} = .005$ , LA,  $F(1, 172) = 1.32$ ,  $p = .25$ ,  $\eta^2_{\text{partial}} = .008$ , or ED,  $F(1, 172) = .48$ ,  $p = .49$ ,  $\eta^2_{\text{partial}} = .003$ . A three-way interaction also did not achieve significance.

**Table 3.** Means and standard deviations for messages conditions, pre-test attitude, and post-test attitude.

|                      |                   | Evidence             |                   |                      |                   | No evidence          |                   |                      |  |
|----------------------|-------------------|----------------------|-------------------|----------------------|-------------------|----------------------|-------------------|----------------------|--|
|                      |                   | Loss aversion        |                   | No loss aversion     |                   | Loss aversion        |                   | No loss aversion     |  |
|                      | Conservation tips | No conservation tips |  |
| <b>Pre-attitude</b>  |                   |                      |                   |                      |                   |                      |                   |                      |  |
| <i>M</i>             | 6.33              | 6.03                 | 6.58              | 6.63                 | 6.55              | 6.48                 | 6.78              | 6.46                 |  |
| <i>SD</i>            | 1.22              | 1.45                 | 1.22              | .62                  | .80               | 1.41                 | .67               | 1.04                 |  |
| <b>Post-attitude</b> |                   |                      |                   |                      |                   |                      |                   |                      |  |
| <i>M</i>             | 6.55              | 6.03                 | 6.55              | 5.88                 | 5.94              | 6.45                 | 6.7               | 6.15                 |  |
| <i>SD</i>            | .94               | 1.23                 | 1.22              | 1.39                 | 1.43              | 1.41                 | .7                | 1.33                 |  |

**Table 4.** Mixed analysis of variance results for message conditions, pre-test attitude, and post-test attitude.

| Source  | df  | SS     | MS   | F    | p    | $\eta^2$ |
|---|-----|--------|------|------|------|----------|
| Within subjects   |     |        |      |      |      |          |
| Pre- and post-attitude  | 1   | 3.39   | 3.39 | 5.59 | .019 | .031     |
| Between subjects  |     |        |      |      |      |          |
| Pre- and post-attitude $\times$ Evidence of drought   | 1   | .29    | .29  | .48  | .49  | .003     |
| Pre- and post-attitude $\times$ Loss aversion   | 1   | .81    | .81  | 1.33 | .25  | .008     |
| Pre- and post-attitude $\times$ Conservation tips   | 1   | .49    | .49  | .81  | .37  | .005     |
| Pre- and post-attitude $\times$ Evidence of drought $\times$ Loss aversion                            | 1   | 2.15   | 2.15 | 3.54 | .06  | .02      |
| Pre- and post-attitude $\times$ Evidence of drought $\times$ Conservation tips                        | 1   | 2.36   | 2.36 | 3.89 | .05  | .022     |
| Pre- and post-attitude $\times$ Loss aversion $\times$ Conservation tips                              | 1   | 2.36   | 2.36 | 3.89 | .05  | .022     |
| Pre- and post-attitude $\times$ Evidence of drought $\times$ Loss aversion $\times$ Conservation tips | 1   | .13    | .13  | .22  | .64  | .001     |
| Error pre- and post-attitude  | 172 | 104.45 | .607 |      |      |          |

A set of interesting patterns emerged with respect to the two-way interactions among the messages. First, a CT  $\times$  ED effect occurred,  $F(1, 172) = 3.89, p = .05, \eta^2_{\text{partial}} = .022$ . Regardless of LA, when both CT and ED were present, pre-test attitude 6.48 ( $SD = 1.10$ ) actually increased slightly favourably in the post-test 6.55 ( $SD = 1.10$ ). However, when ED was presented without CT, attitude shifted negatively from 6.31 ( $SD = 1.17$ ) to 5.96 ( $SD = 1.29$ ). The decrease in attitude also occurred when CT was present and ED was absent from 6.66 ( $SD = .74$ ) to 6.32 ( $SD = 1.18$ ). Minor shifts in attitude arose when both ED and CT were not present in a message, causing participant's attitude to change from 6.47 ( $SD = 1.2$ ) to 6.30 ( $SD = 1.36$ ).

Second, a LA  $\times$  CT interaction effect occurred,  $F(1, 172) = 3.89, p = .05, \eta^2_{\text{partial}} = .022$ . When both LA and CT were present, a pre-attitude of 6.44 ( $SD = 1.13$ ) shifted to a post-attitude average of 6.23 ( $SD = 1.43$ ). CT messages shown without LA resulted in almost no attitude change from 6.67 ( $SD = 1.01$ ) to a 6.62 ( $SD = 1.02$ ). When messages contained LA without CT, individuals also retained their attitude from 6.25 ( $SD = 1.43$ ) to 6.23 ( $SD = 1.32$ ). Contrarily, messages without both LA and CT affected attitude considerably from 6.53 ( $SD = 1.01$ ) to 6.02 ( $SD = 1.32$ ).

Lastly, an ED  $\times$  LA interaction effect approached conventional statistical significance,  $F(1, 172) = 3.54, p = .061, \eta^2_{\text{partial}} = .02$ . When both strategies were present, a pre-attitude of 6.17 ( $SD = 1.37$ ) shifted favourably to a post-attitude of 6.27 ( $SD = 1.12$ ). Specifically, when both strategies were absent, attitude decreased from 6.62 ( $SD = .88$ ) to 6.42 ( $SD = 1.10$ ). Likewise, when LA was absent and ED present, attitude dropped from 6.60 ( $SD = 1.01$ ) to 6.27 (1.33). When ED was absent and LA was present, attitude also lowered from 6.51 ( $SD = 1.13$ ) to 6.20 ( $SD = 1.43$ ).

### Integrated discussion

Surprisingly, the data revealed that exposure to pro-conservation messages actually *decreased* participants' attitude toward water conservation. One possibility for this effect is that the high, pre-attitude mean ( $M = 6.47$ ) naturally regressed toward a normal distribution, an occurrence known as statistical regression to the mean (Bland & Altman, 1994). However, the message effects observed across different patterns of message use in combinations lessened the likelihood of statistical regression as an explanation. Instead, these data point to the message strategies as the culprit for producing the negative effects on attitude.

The results showed that each individual strategy failed to directly affect attitude. This is an important finding as it highlights the relevance of combinatorial strategies. Past work in persuasion and environmental communication typically tested theories on the effect of a strategy in isolation (e.g. Goldstein et al., 2008). However, the results in this research point to the necessity of examining strategy combinations, especially for water conservation. Our study did not examine the underlying causal mechanisms guiding these effects; thus we speculate on a series of possible explanations for various findings presented below.

Some effects revealed that the inclusion of an additional strategy could shift the direction of the effects. For example, regardless of LA, ED presented without CT lowered attitude greatly. One possibility is that individuals faced with information that demonstrated the severity of the drought cannot cognitively dismiss the need to conserve water. However, they cannot conserve due to other reasons. The effect of such a reaction may result from lowered self-efficacy (Bandura, 1997) or even a psychological reaction that negatively shifted attitude. Another possibility is that ED prompted participants to consider the source's credibility. In fact, the elaboration-likelihood model of persuasion suggests that certain levels of information credibility actually affect the type of cues and information considered during cognitive processing (Cacioppo, Petty, Kao, & Rodriguez, 1986). Some messages may even produce feelings of counter-argument or cognitive dissonance, especially if participants have high levels of social vigilanism (Saucier & Webster, 2010), referring to those who believe their knowledge is superior to that of others.

When CT is presented without LA in a message, it appeared to have prevented the attitude decrease, from 6.67 to 6.62. However, the average post-attitude for all three of the other conditions is 6.16, showing that one condition generated the interaction effect. The negative interaction occurred when LA is presented with CT may be related to who receivers believe is responsible for conserving water during the drought. If the receivers believe that the government and/or other people are more responsible, then reading a message that stresses their individual call to action could promote counter-argument (i.e. looking for flaws within the message) or a psychological response (i.e. feelings of anger, threats to freedom, negative cognition, and attitude). Another possibility relates to self-efficacy (Bandura, 1997). If receivers do not believe that their individual conservation efforts could make a difference, then, after reading about the consequences, it could leave them feeling less efficacious and favourable toward conservation. Finally, an alternative explanation for the LA  $\times$  CT effect is that the impact presented in the LA message outweighed the impact that the participants believed CT would produce.

When LA and ED are both absent in a message, participants' attitude shifted positively from 6.17 to 6.27. However, when ED is absent and LA is present, participants' attitude shifted negatively from 6.51 to 6.20. This same pattern shift occurred when ED is present and LA is absent, with attitude dropping from 6.60 to 6.27. One might infer that if these two message strategies are used, then it would be best to use them together rather than individually. However, even when used together, the positive shift was not strong. One reason ED and LA produced negative results on their own is the typically negative connotation of the messages. For example, LA tries to highlight what the participant is going to lose and ED stresses the severity of the drought—without offering any advice on how to avoid these consequences.

Collectively, these results provide several implications for water conservation campaigns. First, this research documented a descriptive basis for the strategies that water conservation messages typically and frequently employ. Second, the data show the type of strategies that are more likely or less likely to be used in combinations. Third and more importantly, these results suggest that initial attitudes are generally highly favourable toward conservation but can be negatively affected after message exposure. This finding cautions the design and implementation of water campaigns. Fourth, the results showcased the effects of combinatorial messages in affecting attitude. Some messages, when used in conjunction with other messages, did not create the negative attitude shift—others amplified the effect.

The research's major limitation is that the mechanisms and theoretical explanations behind such effects remain unclear. The data document a clear need to develop and test conservation messages at a theoretical level to understand their effects. Moreover, the outcome in this research concerned only receiver's attitude. Traditionally, attitudes are viewed as a predictor of behaviours. Notably, however, the correlation between attitude and actual behaviour may differ for water conservation. The study could also be improved with more representative sampling, as opposed to an online panel, when assessing participant responses to message exposure.

Several other limitations should be noted. First, Although the online panel sampled Californians, the limited sample size and demographics (e.g. sex, income, age, education) were unlikely to represent the general California population, as demographics have been shown to affect responses to water conservation campaigns in past research (e.g. Browne et al., 2013). Second, the effects obtain achieved borderline statistical significance with small message effect sizes consistent with communication research. Third, the selected messages were not uniform in their ability to separate among the other strategies during initial testing. Although the induction check verified their individual effects, the lack of stronger message distinction may have possibly contributed to the resulted obtained.

In sum, future research should focus on identifying the causal mechanisms and testing the behavioural effects of the messages. These next steps will assist in developing more persuasive messages that assist in the reduction of water use, an important issue in California. Communication messages remain a golden opportunity to influence receivers' attitude and water use without incurring the high financial costs of legislating or retrofitting water systems in the midst of such an ongoing crisis.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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