UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

EXAMINING THE EFFECTS OF NUDGING AND EDUCATION ON TRUST: AN EXPERIMENTAL COMPARISON OF POTABLE RECYCLED WATER INTERVENTIONS

A THESIS

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

MASTER OF SCIENCE

By

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Norman, Oklahoma

2023

EXAMINING THE EFFECTS OF NUDGING AND EDUCATION ON TRUST: AN EXPERIMENTAL COMPARISON OF POTABLE RECYCLED WATER INTERVENTIONS

A THESIS APPROVED FOR THE

DEPARTMENT OF PSYCHOLOGY

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Acknowledgments

First, I would like to express my deepest gratitude to Dr. Adam Feltz. Thank you for being an amazing mentor and a wonderful source of support. Your guidance, encouragement, and continual involvement throughout this process makes a tremendous difference. I would also like to thank my committee, Dr. Edward Cokely, Dr. Scott Gronlund, and Dr. Shane Connelly. To Dr. Edward Cokely, thank you for your continual support and encouragement throughout this journey. To Dr. Scott Gronlund and Dr. Shane Connelly, thank you for your encouragement and the constructive feedback you have provided that makes this project possible. Finally, a special thanks to my mother who continues to support me during my time here, my brother who always believes in me, as well as my friends in the Ethical Interactions lab for all your unconditional encouragement and compassion.

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Abstract

With increasing interest in applications and insights from decision sciences, it has become important to define ethical grounds governing ways to interact with those receiving behavioral interventions. Here, I seek to evaluate two interventions, libertarian paternalistic default nudges and educational decision aids, on their impact on *trust* (a core element of American Psychological Association's Integrity principle) when making decisions regarding recycled water. In 3 studies, I show that while both educational interventions and default nudges could be used to influence individuals' decision to use recycled water, education managed to maintain trust while some default nudges decreased it. Specifically, calculating difference scores for domain specific trust (pre and post experimental conditions) revealed that the education condition did not significantly impact participants' trust (M = .02, p = .82; M = -.05, p = .58, M = .06, p = .49). The default-in condition, on the other hand, led to either a significant or near significant reductions in trust (M = -.28, p < .001; M = -.22, p < .001, M = -.11, p = .08). These results can have some potential practical implications, as they can provide water reuse professionals and policymakers with recommendations as to which intervention is more likely to maintain public trust. They can also have important ethical implications. By demonstrating that default nudges can decrease individuals' trust, these results provide some of the first evidence that the implementation of default nudges might contradict what is recommended in the APA's code of conduct (professionals have an obligation to maintain trust). This research is an important steppingstone toward the goal of being able to empirically quantify and evaluate ethical costs associated with different kinds of behavioral interventions.

Keywords: libertarian paternalism, education, trust, water reuse, ethical interactions

Introduction

Trust is a foundational component in many interpersonal interactions. In most professional ethics codes, trust is somehow represented as an ethical standard that needs to be respected or promoted. Consequently, many think it is important to ensure that trust is maintained or increased when creating interventions to help people make better decisions. Often, the kind of trust in question is between the agency implementing the interventions (e.g., policymakers) and the target of the interventions (e.g., the public). One way to evaluate trust while implementing interventions is to compare which interventions create or maintain trust better than other interventions. For this thesis, I offer a direct comparison of two different choice architecture interventions and their impact on trust. Specifically, I want to see whether libertarian paternalistic default nudges and educational interventions might affect people's trust differently, which I contextualize using decisions to accept recycled water. The first step of this project involved developing and validating a domain specific trust scale that measures trust in recycled water. Study 1 (*N*'s=417, 144) developed a standardized trust in water reuse scale. Study 2 (*N*=76) utilized the developed water trust scale to examine the impact of education and default nudges on trust using a 2x2 factorial design. Study 3 (*N*=311) addressed the limitations from Study 2 and compared the impact of these interventions on trust using a four-group design. Results showed that a relevant educational intervention did a better job of maintaining trust compared to default nudges. Practically, this research could offer helpful guidance to professionals in water reuse looking to promote recycled water acceptance while still maintaining public trust. Additionally, this research moves us one step closer toward forming an integrated Ethical Interaction Theory that has the potential to offer comprehensive ethical evaluations of behavioral interventions.

Trust: A Criteria for Ethical Interactions

Various decision tools capable of effectively influencing and shaping decisions are established within different domains of behavioral science, marketing studies, and policy research (Munscher et al., 2015; Halpern & Sanders, 2016). Even though such technology is often geared toward helping decision-makers make better, more beneficial decisions for themselves (Thaler & Sunstein, 2008), it remains unclear whether these technologies are ethically defensible on other ethically relevant dimensions. Tools capable of manipulating public decisions without their awareness bear with them the risk of violating some ethical boundaries. The potential threat is evolving with increasing research, data, and data analytic techniques. These developments make evaluating those interventions on a number of ethical criteria more pressing.

Such a goal is broad, difficult, and likely multi-faceted, with the first question being *what ethical rules should govern these interactions*? There are many theoretical discussions surrounding this question (Sunstein, 2015; Thaler & Sunstein, 2008). These theoretical discussions have coalesced around a consensus that there *might* be *some* ethically problematic elements of some types of choice architecture (Sunstein, 2015; Blumental-Barby & Burroughs, 2012). However, there is a relative lack of consensus about what the ethically relevant dimensions for evaluations are. One major ethical ground that has been repeatedly discussed are individual welfare (Sunstein, 2015; Thaler & Sunstein, 2008; Felsen et al., 2013; Hagman et al., 2015; Yan & Yates, 2019). Interventions striving to improve individuals' welfare are ones that influence their behaviors in a way that makes their lives "longer, healthier, and better" (Thaler & Sunstein, 2008, p.5). While this criterion is important, welfare is likely insufficient to be a standalone criterion to guide ethical interactions. Freedom of choice within interventions is

another ethical criterion mentioned repeatedly by behavioral economists, where interventions formally leave open options and allow people to choose among different alternatives. While theorists emphasize the importance of liberty-preserving quality in interventions, some people have argued that their definition of "freedom of choice" oftentimes does not fully embody true freedom of choice (e.g., Feltz & Cokely, 2019). For example, if a person was given two options to choose from but the decision environment was intentionally made to make one more attractive than the other, many would think that some ethical boundaries were broken (even though choices are "not blocked or fenced off", hence technically is still liberty-preserving (Thaler & Sunstein, 2008)).

Rather than look to a definitive account of what the correct set of fundamental values are (if such an account is even possible, see Feltz & Cokely (2012; 2016)), I looked elsewhere. In particular, I looked to what some professional ethics codes identify as core elements in professional interactions. One of these is the American Psychological Association Ethics Code, which consists of five general principles (i.e., Beneficence, Fidelity, Integrity, Justice, and Respect for People) (American Psychological Association, 2017). While there is no consensus that these are the single correct set of values to evaluate interactions, they find fairly wide support in other professional ethics codes and are represented in many systematic empirical evaluations of what people on average tend to value (Holt, 2023; Lee et al., 2011; Schwartz, 2012).

My research is specifically built upon the *Integrity* principle, which emphasizes the preservation or promotion of *trust*. Trust is a complicated concept that has been extensively discussed both theoretically and empirically. There exists a vast theoretical landscape on the conceptualization of trust, as well as a wide variety of empirical measures of trust. Theoretically,

it is generally accepted that trust is a dyadic relationship between a trustor (individual doing the trusting) and a trustee (target of the trusting), in which the trustor is vulnerable to the trustee, has favorable attitudes about the trustee's honesty and intention, and believes that the trustee is competent and reliable (Hawley, 2012; McLeod, 2015). Conceptually, one major difference among different conceptions of trust is the distinction between *domain general* and *domain specific* trust. While the precise definitions of these different types of trust can be contested, one way to mark the distinction is that domain general trust refers to tendencies to be trusting in general (Delhey et al., 2011; Freitag & Bauer, 2013; Johnson-George & Swap, 1982; Larzelere & Huston, 1980; Sturgis & Smit, 2010), and domain specific trust refers to trust in a concrete trustee (i.e., trust in 'x'). Some examples of domain specific trust are trust in science and scientists (Nadelson et al., 2014) and trust in government (Grimmelikhuijsen & Knies, 2017).

Trust has been argued to carry both *intrinsic* and *instrumental* values (Hall, 2005). Intrinsically, trust is thought by many to be desirable for its own sake. Trust is characteristic of a relationship with stability and substance. In such a relationship, there is typically no need to question one's conduct, individuals' moral dignities are respected, and parties have the freedom to be vulnerable to one another (Thomas, 1979). Trust is simply valuable by itself. Instrumentally, trust helps us not live our lives in "paralyzing fear and chaos" (Luhmann, 1971). Trust is a device on which one relies to reduce the inevitable complexity present in one's social life. The alternative to trust, although available, is extremely resource intensive. The alternative to trust might require extensive knowledge and taking into consideration all possible future scenarios and circumstances (including potential disruptive and unexpected events), to produce good predictions (Carter, 1989; Lewis & Weigert, 1985). Without trust, one might have to constantly collect and analyze information to calculate probabilities for all contingent futures.

Such calculation and planning require a tremendous amount of time, energy, and resources (Lewis & Weigert, 1985). Trust allows social, interpersonal, and institutional interactions to operate on a basis of simplicity and confidence (Lewis & Weigert, 1985). Hence, many theorists hold that trust has substantial instrumental value.

My motivation for looking at trust is the APA's ethics codes. But it is worth noting how extensively trust is reflected in other professional ethic codes (American Public Health Association, 2010; Institute of Medicine, 2001; Committee on Science, Engineering and Public Policy, 2009). This gives substantial support that trust has *professional* value. From medical ethics to law to public policy, trust is recognized as one of the essential elements that exist in any ethical interaction between professionals and non-professionals (e.g., the public) (Brenkert, 1998; Mason & Smith, 1987; Hall, 2005). It is commonly held that the relationship between non-professionals and professionals is an unequal one, in which there often exist discrepancies in expertise, knowledge, and power (Dawson, 1994; Brien, 1998; Kelly, 2018). Such mismatch in expertise between the two groups means that non-professionals can be vulnerable to professionals' decisions and actions (Brien, 1998). In most professional relationships, it is fair to say that non-professionals take on the role as a trustor and the professionals are the trustee. Most professional ethics codes codify an obligation to create, ensure, or maintain trust among individuals (Rogers, 1994; Rhodes & Strain, 2000; O'Neil, 2002). Overall, trust has been theoretically argued to have intrinsic, extrinsic, and professional values.

Given such theoretical landscape, it is not surprising that trust has also been empirically found to have important implications in various different domains. In healthcare, trust highly correlates with improved patient outcomes (see LoCurto & Berg (2016) for a review). Patients who have higher trust in their physicians are more likely to utilize their services more often and

more consistently (Andersen & Newman, 1973; Russell 2005), more likely to adhere to physicians' advice of preventive services (Matthews et al., 2002; Kao et al., 1998; Thom et al., 2002), and experience more overall personal satisfaction and less anxiety (Keating et al, 2002; Thom & Campbell, 1997). In education, trust is an important predictor of improved academic performance for students (Adams & Christenson, 1998), a promoter of teachers' buy-in for improvement programs, and an overall indicator of improved educational outcomes (Bryk & Schneider, 2003; Forsyth et al., 2006). In marriages, high trust is negatively correlated with couple burnout (Pamuk & Durmus, 2015), negatively correlated with frequency of intrusive behaviors (e.g., checking partners' devices without permission) (Vinkers et al., 2011), positively correlated with spousal support (i.e., emotional support, instrumental support, appraisal support, and social companionship), and an overall indicator of a long and happy marriage. If trust has theoretical, practical, or professional value, then a comparison of different decision aids on their impact on trust is likely to have some valuable implications.

Given this background, I offer a direct comparison of two choice architecture interventions, educational decision aid and libertarian paternalistic default nudge, on their impact on individuals' *trust* within the domain of water reuse. With water shortage becoming an increasingly urgent issue in our contemporary world, recycling municipal wastewater has become a commonly mentioned alternative with thousands of water reclamation projects being proposed worldwide (Bixio et al., 2005). This promising solution involves treating and subsequently reusing recycled wastewater for potable uses. Even though recycled water has been repeatedly demonstrated to be as safe as traditional water sources (Seah et al., 2003; Lee & Tan, 2016; Sanchez-Flores et al., 2016), public objection has been among the leading challenges that prevent water reuse schemes from being executed (Nancarrow et al., 2009; Ross et al., 2014;

Hurlimann & Dolnicar, 2010; Uhlmann & Head, 2011). Past literature suggests that *trust* is one commonly identified psychological factor that has been associated with recycled water acceptance (see Smith et al., 2018 for a review). For example, Fielding et al. (2019) showed that both trust in scientific information and trust in government information significantly predicted intention to use recycled water. Similarly, Ross et al. (2014) found that trust in authority significantly predicted acceptance. With trust being an important predictor of public acceptance toward using reclaimed water for drinking purpose, water reuse serves as a useful domain on which decision interventions can be evaluated in terms of trust.

Interventions and Hypotheses

In this project, I aim to compare two kinds of interventions, *libertarian paternalistic nudge* and *educational intervention*, on their impact on *trust* within the water reuse domain. Educational interventions are one common form of choice architecture. Educational interventions typically involve providing some relevant domain specific information so that people can make a more informed decision for themselves. Even though cultural, social, and political factors are all found to be important factors influencing attitudes toward technologies (Priest, 2001), objective knowledge has been found to play an influential role in forming decisions involving scientific innovations and controversial topics (Cho et al., 2023). Past studies found that knowledge was often positively associated with more positive attitudes and more accurate beliefs regarding controversial scientific topics (Nisbet & Goidel, 2007; Cho et al., 2023). In the same vein, public doubt toward scientific innovations could be partially attributed to a lack of knowledge in these domains (see Allum et al., 2008). Past research suggests that transparent decision tools (e.g., training programs, educational or informational tools) can help increase people's representative understanding through providing relevant knowledge (e.g.,

Tanner & Feltz, 2022), which in turns can improve their decision-making quality (Garcia-Retamero & Galesic, 2010; Cokely et al., 2018; Cho et al., 2023).

In the context of recycled water, past research suggests that educational decision aids could be effective at increasing public recycled water acceptance (Price et al., 2015; Dolnicar et al., 2010), even though the magnitude of these effects tended to range from insignificant to modest (see Smith et al., 2018 for a review). A possible explanation for such patterns lies in educational methods used in these studies (e.g., 47-page informational booklet about water reuse, Simpson & Stratton, 2011). Encouragingly, Tanner (2021) found that an effective informing method (i.e., a 5-minute education video that provides representative understanding of water recycling) significantly increased people's knowledge of water reuse, which directly affected acceptance. In addition to finding a positive impact of effective education on increasing first order acceptance of recycled water (i.e., participants' binary enrollment choices for either a provider that supplies traditional water or a provider that supplies recycled water), past research also suggests that transparent decision intervention could positively impact a variety of other factors such as affect (lower worry about recycled water), satisfaction with policy makers, and reported behavioral intentions regarding water reuse (lower intentions to move and considerations of protesting) (Tanner & Feltz, 2022).

An alternative to educational interventions could be libertarian paternalistic default nudges. Unlike educational interventions which promote informed decision making, libertarian paternalistic nudges are a form of behavioral intervention strategy that seeks to influence decisions through exploiting automatic decision processes such as mental shortcuts or heuristics (Thaler & Sunstein, 2008). Past research suggests that even the most skilled decision makers tend to rely on heuristics along with their own knowledge and understanding when evaluating

risky prospects (Cokely & Kelley, 2009). Libertarian paternalistic nudges aim to drive decision makers toward a specific choice without formally closing off any other choices, therefore technically still giving decision makers freedom of choice (Sunstein, 2015). While libertarian paternalistic interventions are argued to be liberty preserving as they formally leave some options open (Thaler & Sunstein, 2008), they still might violate certain ethical boundaries due to their nature of withholding access to transparent information (Tanner, 2021). An example of libertarian paternalistic intervention is default nudges, which are designed to steer decisions toward the target option through setting default policies (i.e., participants will receive the target option unless they actively take actions to switch to alternative options; see Thaler & Sunstein, 2008). One potential explanation for why default nudges work is because of decision inertia (i.e., people rather doing nothing and staying with the default option than taking actions to switch options). Research suggests that when being defaulted into an option, people usually stay with that default option even though they have the choice to freely switch to another option (Ghesla et al., 2019; Madrian & Shea, 2001). To illustrate default nudges in a real world example, Thaler and Benartzi (2004) explored the impact of Save More Tomorrow (SMarT) program on participants' saving rates. They implemented the program at three different companies (i.e., manufacturing company, steel company, and an electronics company), and their samples consisted entirely of employees from these three companies. The employees were informed about the plan, which was to increase their contributions to their retirement savings after each pay raise and the contribution rate would only stop when it reached a predetermined maximum amount. It was made clear that employees were free to opt out of the program at any point of time, but if no actions were taken, employees would be automatically enrolled in the program. Results showed that only 20% of employees chose to opt out of the program. Similar default

effects have been found across various decision domains (e.g., retirement plan contributions, organ donor agreements, health plan decisions, end of life decisions) (Johnson & Goldstein, 2003; Johnson & Goldstein, 2013; Jachimowicz et al., 2019).

In the context of recycled water, default nudges have also been shown to influence decisions regarding water reuse (Tanner & Feltz, 2022). However, past studies suggested that while educational interventions provided transparent information which positively impacted second order acceptance indicators (e.g., worry about risks, intentions to move or protest if water reuse programs are implemented, etc.) default nudges likely did not promote any representative understanding about water reuse, and therefore did not impact any other factors outside of *first order acceptance* (Tanner, 2021). First order acceptance of recycled water is defined as participants' binary enrollment choices for their company's water provider (either a provider that supplies traditional water or a provider that supplies recycled water). Taking everything into consideration, I hypothesize that educational interventions are better at promoting participants' trust than default nudges.

I tested my hypothesis in a series of three studies. In Studies 1a and 1b, I developed and validated a standardized domain specific trust scale in water reuse. In Study 2, I conducted an experiment using a 2x2 factorial design (education/no education & default-in/default-out) to examine the impact of educational intervention and default nudge on participants' trust in water reuse. I found a significant main effect for education, suggesting that educational intervention maintained trust better than defaults. In Study 3, I addressed Study 2's limitations and also found that relevant educational intervention maintained trust better than default-in.

Study 1a

Domain specific trust has been the dominant way that trust has been measured with respect to water recycling (see Smith et al., 2018). This might be due to the fact that while

domain general trust tends to be relatively stable and not subject to change across times and situations (Rotter, 1980), domain specific trust has been shown to be capable of change in a short period of time (Mickucka et al., 2017). But there are a host of different measures that have attempted to capture domain specific trust in the context of recycled water. A review of empirical literature suggests that there have been several different groups that were the targets of trust, including municipal authorities (Bratanova et al., 2013), water authority (Hurlimann et al., 2008; Ross et al., 2014; Wu et al., 2013; Nancarrow et al., 2009), aquifer managers (Leviston et al., 2013), state government water provider (Mankad et al., 2015), and communities (Porter et al., 2005). However, the entities trusted are at least conceptually different from another (e.g., trust in municipal authorities is different from trust in aquifer managers). The existence of different instruments measuring domain specific trust in water reuse makes comparison among studies rather difficult. Without further study, it is difficult to know which scale is appropriate to use and why. Study 1 sought to compare the currently existing domain specific trust in recycled water measures. A secondary goal was to engage in data reduction techniques to potentially create an improved, brief, robust, and broadly suitable measure of domain specific trust in recycled water.

Study 1a aimed to examine relations among some commonly used domain specific trust scales in water reuse. Consistent with the conceptual diversity in how trust has been measured in this field, it was hypothesized that not all trust scales in water reuse would strongly correlate with one another. I first investigated the correlations among commonly used measures of trust in recycled water. Depending on the patterns of correlations (i.e., some correlations would be relatively weak), an initial exploratory factor analysis on all items in reported measures was performed to identify latent components of trust in water reuse. Subsequently, I then selected a smaller set of items to measure those factors, which was then further validated in Study 1b.

Method

Participants. Four hundred and seventeen undergraduates from the University of Oklahoma participated for partial course credits. All demographic information for all studies is presented in Table 1.

Procedure. A literature review conducted in June 2021 identified eight commonly used measures of trust in water recycling (see Table 2). The items in the measures were randomly presented to all participants. Some of the items taken from these measures were specific to jurisdictions. For example, Hurlimann et al. (2008) used the following item "I trust the Water Authority to manage any risk that may be associated with recycled water use at Mawson Lakes". Mawson Lakes refers to a specific location in Australia. Since the goal was to examine relations among existing scales that were not tied to any specific locations, some of the trust items were modified to omit any references to specific locations. All items are presented in Table 2. Participants responded to each item on a six-point scale from 1=Strongly disagree to 6=Strongly agree.

Results and Discussion

The first step in the analyses was to estimate correlations among the domain specific trust scales. The correlations are reported in Table 3. While all correlations were statistically significant, some correlations were significantly weaker than others, indicating that some of the instruments might measure different, but related, latent variables (minimum $r = .52$, maximum r = .81, mean $r = .67$). For example, Trust in Water Authority-1 was a significantly stronger predictor of Trust in Municipal Authorities ($r = .75$) than Trust toward Managed Aquifer Recharge ($r = .52$, Steiger's $z = 7.5$, $p < .01$, Cohen's $q = .4$). These results suggested the possibility that some of the items measured different latent variables.

To identify potential latent variables, an exploratory factor analysis on all 28 items was conducted. The exploratory factor analysis used parallel analysis with principal axis factoring and oblimin rotation (Costello & Osborne, 2005). Four factors were identified using this process (See table 4 for the full factor loadings; See figure 1 for scree plot). An inspection of those factors suggested 3 interpretable latent variables: (1) Trust in authority to provide safe water, (2) Trust in authority to manage risk, and (3) Trust in government. These three factors accounted for 54% of the total variance. Factor 4 only had one item that did not neatly lend itself to interpretation (Leviston item #3 in Table 2). Because of problems with 1-item measures of factors and no clear conceptual or theoretical reason to retain that factor, that item was excluded from subsequent analysis.

I then began a process of item reduction based on the factor analysis. The rationale was that with many items per factor, some items were likely to be less good predictors of the underlying latent trait. I set a threshold for retaining indicator items at a factor loading of 0.6 or greater (Comrey & Lee, 1992). This resulted in Trust in authority to manage risk and Trust in government having three indicator items, and Trust in authority to provide safe water with 8 indicator items. Reducing factors to less than 3 indicator items generally risks stability issues (Costello & Osborne, 2005). No more refinements of Trust in authority to manage risk and Trust in government were done.

However, Trust in authority to provide safe factor water had 8 items suggesting that some items could be trimmed without significant loss of the ability to measure that factor. To trim items measuring this trust factor, I performed a discrimination analysis to identify the 3 items with the strongest discrimination. The rationale for the analysis was that strongly discriminating items should show the greatest difference between those strong and weak on the underlying trait.

The analysis involved taking an average of all 8 items identified in the factor analyses as belonging to Trust in authority to provide safe water. Then, factor scores were divided into upper and lower quartiles. I used those upper and lower quartiles as an independent variable in an ANOVA and then each of the indicator items as the dependent variables. Theoretically, the most discriminating indicator items should show the largest differences with respect to the upper and lower quartiles. Given this justification, I performed the ANOVA and selected the 3 items that displayed the largest differences (see Table 5)[1]. The final set of items retained for Study 1b are in Table 6.

Study 1b

Given the exploratory nature of Study 1a, Study 1b was designed to: (1) confirm the factor structure identified in Study 1a and (2) provide some evidence for the new trust instrument's construct validity (e.g., convergent, discriminant, and predictive validity) (Cronbach & Meehl, 1955; Messick, 1995).

Method

Participants. One hundred and forty-four undergraduates from the University of Oklahoma participated for research credits (see results section for a discussion of power and reliability of the sample). Due to a programming error, demographic information was not collected. However, the characteristics of this sample are likely to be similar to those in Study 1a.

[1] Results from Item Response Theory analysis for graded responses produced generally the same pattern of results, with one minor exception of Ross-1 (and not Wu-2) being one of the three most discriminating items. IRT's results suggested Ross-1, Ross-3, and Ross-4 being the 3 most discriminating items. My discrimination analysis results suggested Ross-3, Ross-4, and Wu-2 being the 3 most discriminating items. All 4 items (Ross-1, Ross-3, Ross-4, and Wu-2) have very good discrimination parameters (> 3) according to IRT results. Given both analyses, I selected Wu-2 instead of Ross-1.

Procedure. Participants received the following materials in the order presented below.

Trust in Recycled Water Scale. Participants were first presented with the 9 items concerning trust in recycled water that were identified in Study 1a (see Table 6). Participants responded on a 6-point Likert scale 1=Strongly disagree and 6=Strongly Agree.

Generalized Trust Scale. Participants completed a 14-item, 4-factor generalized trust scale (Hoang et al., submitted). The 4 factors were: Confidence in others (e.g., "Most people answer public opinion polls honestly"), Belief in other's reliability (e.g., "Other people cannot be relied upon"), Belief in other's honesty (e.g., "It is safe to believe that in spite of what people say, most people are primarily interested in their own welfare"), and Belief in other's trustworthiness (e.g., "I believe that people are basically moral"). The full scale can be found on Open Science Framework (https://osf.io/gev8u/). The mean of each factor was used in analyses. I predicted that the factors in the domain specific trust scale would be positively correlated with the factors in the domain general trust scale, thereby helping establish convergent validity.

Acceptance of Potable Recycled Water. One of the major criterion variables was whether participants would be accepting of potable recycled water. To measure acceptance, I used 6 items that were designed to capture two different elements of acceptance. The first element was whether people would be accepting of consuming or using recycled water. I call these items the Use Recycled Water set. This element was measure with the following three items (see Tanner & Feltz, 2021; Rozin et al., 2015):

1. "How likely are you to drink recycled water" (11-point scale from 1=No chance/almost no chance (1 chance in 100) to 11=Certain/practically certain (99 chances in 100)).

2. Would you support or oppose using reclaimed water at your residence? (1=Strongly oppose, 7=Strongly support).
3. I do not want purified recycled water to be mixed with drinking water (reverse scored, 1=Strongly disagree, 7=Strongly agree).

The second set of items was designed to measure more indirect acceptance of potable recycled water. These items probed whether participants would be willing to be involved in recycled water related activities. I will call these items the Support Recycled Water set. These items were:

4. I would be willing to add my name to a mailing list to receive information about recycled water (1=Strongly disagree, 7=Strongly agree).
5. I would be willing to donate money to an organization advocating for the use of recycled water (1=Strongly disagree, 7=Strongly agree).
6. I would be willing to attend a town hall meeting discussing the possibility of using recycled water in my community (1=Strongly disagree, 7=Strongly agree).

I predicted that there would be a positive correlation between domain specific trust in recycled water and both sets of acceptance questions, indicating predictive validity.

Dissatisfaction with Government. I included 6 items to help measure potential dissatisfaction with one's government concerning potable recycled water. These items have been shown to be related to recycled water acceptance in previous research (Tanner & Feltz, 2022). Participants responded to the following items on a 7-point Likert scale (1=Strongly disagree, 7=Strongly agree).

1. I would be upset with my local government if they asked people to use recycled water for drinking.

2. I would trust my local government if they decided to ask people to use recycled water for drinking (reverse coded).
3. I would be worried about my health if my local government decided to ask people to use recycled water for drinking.
4. I would likely protest if my local government decided to ask people to use recycled water for drinking.
5. I would consider moving if my local government decided to ask people to use recycled water for drinking.
6. I would tell my friends and family not to move here if my local government decided to ask people to use recycled water for drinking.

I treated these responses as another set of criterion variables. I predicted that the domain specific trust factors would be negatively related to these response items thereby providing predictive validity.

Revised Disgust Scale (Olatunji et al., 2007). The revised disgust scale consists of 25 items measuring participants' state-level disgust sensitivity. The first part of the instrument (13 items) asked participants to rate items from 1=Strongly disagree to 5=Strongly agree (e.g., "I never let any part of my body touch the toilet seat in a public washroom"). The second part (12 items) asked all participants to rate items from 1=Not disgusting at all to 5=Extremely disgusting (e.g., "While you are walking through a tunnel under a railroad track, you smell urine"). I used the overall mean of responses in analyses. I predicted that there would not be strong correlations between the domain specific trust factors and disgust, thereby helping establish discriminant validity. However, disgust sensitivity should be related to Acceptance of potable recycled water (Use recycled water and Support recycled water).

Ten Item Personality Inventory (Gosling et al., 2003). All participants completed the Ten-item measure of the Big Five. The five dimensions measured are Extraversion (e.g., "I see myself as extraverted, enthusiastic"), Agreeableness (e.g., "I see myself as sympathetic, warm"), Conscientiousness (e.g., "I see myself as dependable, self-disciplined"), Emotional stability (e.g., "I see myself as calm, emotionally stable"), and Openness to experience (e.g., "I see myself as open to new experience, complex"). All items were answered from 1=Strongly disagree to 7=Strongly agree. The means for each of the Big Five Personality traits were used in analyses. It was predicted that there would not be strong correlations between the water trust factors and the Big Five except perhaps for agreeableness, openness to experience, and conscientiousness. Each of those three personality traits have been associated with greater tendencies to trust (Freitag & Bauer, 2016). The associations with agreeableness, openness to experience, and conscientiousness with the lack of association with extraversion and emotional stability would help establish convergent and discriminant validity, respectively.

Berlin Numeracy Test (Cokely et al., 2012). The Berlin Numeracy test assesses participants' statistical numeracy with 7 open-ended questions (e.g., "Out of 1000 people in a small town 500 are members of a choir. Out of these 500 members in the choir 100 are men. Out of the 500 inhabitants that are not in the choir 300 are men. What is the probability that a randomly drawn man is a member of the choir? Please indicate the probability in percent."). A total score of correctly answered items (coded as 1) were used in the analyses. I predicted that there would not be strong correlations between trust factors and numeracy, thereby helping to establish discriminant validity.

Results and Discussion

I performed a confirmatory factor analysis on the response to the items in the Trust in Recycled Water scale to help confirm the factor structure identified in Study 1a. The indicator items and factors were specified in accordance with the results of Study 1a. The confirmatory factor analysis suggested that the hypothesized model had acceptable fit to the data, $\chi 2(24) = 33.92$, $p = .09$, RMSEA = .05, 90% *CI* .00 - .09, *CFI* = 1.00, *TLI* = 1.00, *SRMR* = .04 (see Figure 2). Each of the subscales had excellent internal reliability: Trust in authority to provide safe water Cronbach's alpha = .92; Trust in authority to manage risk Cronbach's alpha = .85; Trust in government Cronbach's alpha = .9. The analyses revealed that the items' factor loadings were relatively strong (most of the factor loadings were greater than .8). Wolf et al. (2013) provided evidence from simulation studies that a confirmatory factor analysis is likely to yield reliable results given similar sample sizes and the item factor loadings observed in this study.

The Dissatisfaction with government items were all inter-correlated (*r*s = .42 - .70). An exploratory factor analysis indicated that all the items loaded onto one factor (factor loadings = .64 - .85), and the internal reliability were excellent (Cronbach's alpha = .89). Therefore, a mean score of all Satisfaction with government items was used in analyses. I also conducted an exploratory factor analysis on the Acceptance items (i.e., Use Recycled Water and Support Recycled Water). All acceptance items were z-scored so that they were on the same scale. The exploratory factor analysis indicated that there were 2 factors (Use Recycled Water and Support Recycled Water; factor loadings = .58 - .93). Both factors had good internal reliability: Use Recycled Water's Cronbach's alpha = .74; Support Recycle Water's Cronbach's alpha = .78. Consequently, means of each set of items were used in analyses.

I examined the correlations among the dependent variables to help establish elements of construct validity (see Table 7). As expected, there were significant correlations among the

domain specific trust factors in recycled water and some of the domain general trust factors. All three domain specific trust factors were correlated with Confidence and Trustworthiness. The subscales were also marginally related to Reliability subscale and not reliably related to the Good Intention factor of the domain general trust scale. These results provide some evidence for convergent validity. All three water reuse trust factors were found to significantly correlate with Use Recycled Water and Dissatisfaction with Government, providing evidence for the instruments' predictive validity. Trust in authority to provide safe water and Trust in authority to manage risk were correlated with Support Recycled Water, providing some additional evidence for predictive validity. Additionally, all three water reuse trust factors were found to correlate weakly or not at all with Agreeableness, Openness to experience, and not reliably correlate with Disgust, Numeracy, Extraversion, Conscientiousness, and Emotional stability, providing some evidence for the instrument's discriminant validity. It might be surprising to some that these 3 trust factors only correlated weakly or not at all with Agreeableness (*r*s = .17, .22, 0). However, it is worth noting that these are domain specific trust factors in water reuse and not domain general trust. Domain general trust and Agreeableness are both trait level variables and are more likely to correlate with one another (Hiraishi et al., 2008; Sneed, 2002). My results showed the same pattern between domain general trust and agreeableness (*r*s = .30, .35, .08, .19). Results also showed that Agreeableness weakly correlated with Trust in water reuse.

Study 2

Study 1 was designed to develop and validate an instrument measuring domain specific trust in recycled water. Study 2 tested the impact of different interventions, educational intervention and default nudge, on trust as measured by the scale I developed in Study 1.

Method

Participants. 76 undergraduates from the University of Oklahoma participated in the study for partial research credits. All demographics are reported in Table 1.

Procedure. I used a 2x2 factorial design (relevant education/irrelevant education & default-in/default-out), to see if there would potentially be an interaction between education and default nudge. A post-hoc power analysis suggested that this sample size could detect a moderately sized effect (*power* = .8, *alpha* = .05, *Cohen's f* = .32). First, all participants were asked to complete the trust in water reuse scale. Then, participants were randomly assigned into one of the four experiment groups (relevant education & default-in, relevant education & default-out, irrelevant education & default-in, irrelevant education & default-out) (see Table 8 for experimental conditions). In the relevant education condition, participants watched a 5-minute educational video on water reuse developed by Tanner (2021), explaining the process of recycling water, the need for recycled water, and its benefits (https://www.youtube.com/watch?v=eGcZjnwQy2w). In the irrelevant education condition, participants watched a 5-minute video on how the internet works (https://www.youtube.com/watch?v=7_LPdttKXPc). In the default-in condition, participants the following scenario:

> Imagine you work for a small business. As part of your job, you are in charge of ordering water for the office water dispenser. In the past, your business has ordered from Company A, which is listed as the business's default provider of water. One day, Company A announces it will officially supply only recycled water to customers. You notify your boss of this change, and they tell you that you can continue ordering from Company A, or you can choose to switch providers and instead start ordering water from Company B, which uses traditional purified water. Assuming Company A and Company

offers the same prices for their water, and you have no outside pressure to choose one option over the other, which company would you choose?

Participants then had the option to either stay with the default (recycled water) or switch to another water provider that supplied traditional water. In the default-out condition, participants read the following scenario:

> Imagine you work for a small business. As part of your job, you are in charge of ordering water for the office water dispenser. In the past, your business has ordered from Company A, which is listed as the business's default provider of water. One day, one of Company A's competitors, Company B, announces it will officially supply only recycled water to customers. You notify your boss of this change, and they tell you that you can continue ordering from Company A, which uses traditional purified water, or you can choose to switch providers and instead start ordering from Company B. Assuming Company A and Company B offer the same prices for their water, and you have no outside pressure to choose one option over the other, which company would you choose?

Participants in this condition then had the option to stay with their default provider (traditional water) or switch to the other provider that supplied recycled water. Afterwards, all participants filled out the domain specific trust measure in water reuse again.

Results and Discussion

To test my hypothesis (relevant education promotes trust in water agencies better than default nudge), I calculated trust difference scores by subtracting the pre-experiment trust score from the post-experiment trust score for all 3 trust factors. Previous research suggests that domain specific trust can change in a relatively short period of time (Mickucka et al., 2017). After calculating difference scores, I performed 3 separate two-way analyses of variance (for 3

domain specific trust factors), with Education and Default as the fixed factors and the trust score difference as the dependent variable (see Table 9 for descriptive statistics). I first examined the effect of Education and Default on participants' change in *Trust in authority to provide safe water*. There was a main effect of education on change in trust, $F(1,72) = 5.25$, $p = .03$, $\eta^2 = .07$, suggesting that participants who received relevant education demonstrated a significantly bigger increase in trust in authority to provide safe water, compared to participants who did not receive relevant education. There was no significant main effect for default setting on change in trust, $F(1,72) = .002$, $p = .97$ $\eta^2 < .001$. There was also no significant interaction of education and default on change in trust, $F(1,72) = .08$, $p = .78$, $\eta^2 = .001$. I then moved on to examine the effect of Education and Default on participants' change in *Trust in authority to manage risk*. There was no significant main effect for education, $F(1,72) = 2.42$, $p = .97$, $\eta^2 = .03$, default $F(1,72) = 1.82$, $p = .18$, $\eta^2 = .02$, or interaction, $F(1,72) = 1.38$, $p = .25$, $\eta^2 = .02$. Finally, I examined the effect of Education and Default on participants' change in *Trust in government*. There was also no significant main effect for education, $F(1,72) = 1.47$, $p = .23$, $\eta^2 = .02$, default $F(1,72) = .62$, $p = .43$, $\eta^2 = .01$, or interaction, $F(1,72) = .006$, $p = .94$, $\eta^2 = 0$. Full descriptive statistics are reported in Table 9.

It might be worth noting that in 5 out of 6 difference scores for defaults in the control conditions, defaults actually resulted in a negative difference score indicating an overall decrease in trust from pre-test to post-test (see Table 9). I compared each of the mean gain scores against a value of 0 to see if these differences were statistically different from 0 (see Table 10). Results showed that the Default-in in the Irrelevant education condition led to a significant decrease in Trust in authority to provide safe water, $t = -2.31$, $p = .03$, $d = .50$. Default-out in the Irrelevant education condition also led to a near significant decrease in Trust in authority to provide safe

water, t = -1.91, p = .07, d = .45. All the other Defaults in Irrelevant education groups led to a non-significant change in trust (see Table 10 for all results).

I also tested the effect of educational intervention and default nudge on participants' first order acceptance of recycled water. To reiterate, *first order acceptance* is defined as participants' binary enrollment choices for their company's water provider (either a provider that supplies *traditional* water or a provider that supplies *recycled* water) (Tanner, 2021). Results showed that receiving relevant education was not associated with significantly higher enrollment in recycled water program $X^2(1) = .04$, $p = .84$. Specifically, only 17 out of 37 (46%) participants in the relevant education condition chose to enroll in hypothetical recycled water program, and 17 out of 39 (44%) participants in the irrelevant education condition chose to enroll in the recycled water program. The default manipulation was also not statistically significant $X^2(1) = 2.69$, $p = .10$. Specifically, 21 out of 39 (54%) participants in the default-in condition chose to enroll in the recycled water program, and 13 out of 37 (35%) of participants in the default-out chose to enroll in the recycled water program. Results also indicated that there was no interaction between education and default, $W(1) < .001$, $p = .98$.

Study 2 provided some interesting insights. First, even though the study had low statistical power due to small sample size, the results trended in the hypothesized direction. Specifically, relevant education resulted in a significantly larger increase in trust in authority to provide safe water compared to the irrelevant education condition. For trust in authority to manage risk and trust in government, even though the main effects for education were statistically non-significant, I observed the hypothesized larger numerical increase in trust in the relevant education condition compared to irrelevant education condition (see Table 9 for descriptives). This led me to believe that with more statistical power, I might see significant

main effects for all 3 trust factors. Second, there were no main effects of defaults on levels of trust. If anything, being exposed to defaults led to lower levels of trust. Third, there was no significant interaction effect across all 3 ANOVA's. This might potentially be due to a lack of statistical power. However, past research suggested that there tended to be no reliable interactions between education and default for different variables such as satisfaction with policymakers, intention to move, or consideration of protesting (Tanner, 2021). There was no reason to believe that there would be a reliable interaction for trust. Excluding the interaction from the experiment might allow for the observation of the effect of education on trust in a cleaner manner (i.e., without complicating the results by crossing education with default).

Study 3

While Study 2 provided some evidence that an educational intervention could be effective at increasing trust in water reuse, there were some limitations to this study that warranted further addressing. Specifically, the sample size was relatively small, and no interaction effect was found. As such, Study 3 was designed to address these issues. Since no interaction effect was found, there was no theoretical or empirical reason to continue with a factorial design. Instead, Study 3 used a simple 4-group (Relevant education, Irrelevant education, Default-in, and Default-out) to examine how these conditions impacted participants' domain specific trust in water reuse.

Method

Participants. Three hundred and eleven participants who resided in the United States were recruited from Amazon Mechanical Turk for Study 3. In an attempt to address low sample size limitation from Study 2 and other limitations that come with recruiting samples from undergraduate student pools (e.g., age restriction, restricted SES, generally better educated), I

recruited participants from Amazon MTurk. Samples from Amazon Mechanical Turk have been shown to be more representative of overall U.S. population compared to university subject pool (Buhrmester et al., 2018). Participants filled out a survey in exchange for $0.75. All demographics are reported in Table 1.

Procedure. Instead of the 2x2 factorial design like in Study 2, I used a 4-group design in Study 3. Participants first filled out the trust in water reuse scale. Then, participants were randomly assigned to one of the four experimental groups (Irrelevant education, Relevant education, Default-in, Default-out). In the irrelevant education condition, participants watched a 5-minute video on how the internet works (https://www.youtube.com/watch?v=7_LPdttKXPc). Afterwards, they were asked to imagine that a part of their job involved ordering water for their office water dispenser, and to choose between a company that provided recycled water or a company that provided traditional water. In the relevant education condition, participants watched a 5-minute educational video on water reuse (https://www.youtube.com/watch?v=eGcZjnwQy2w) (Tanner et al., 2023). Afterwards, participants in this condition were also asked to imagine that a part of their job involved ordering water for their office water dispenser, and to choose between a company that provided recycled water or a company that provided traditional water. In the default-in condition, participants the following scenario:

> Imagine you work for a small business. As part of your job, you are in charge of ordering water for the office water dispenser. In the past, your business has ordered from Company A, which is listed as the business's default provider of water. One day, Company A announces it will officially supply only recycled water to customers. You notify your boss of this change, and they tell you that you can continue ordering from

> Company A, or you can choose to switch providers and instead start ordering water from Company B, which uses traditional purified water. Assuming Company A and Company B offer the same prices for their water, and you have no outside pressure to choose one option over the other, which company would you choose?

Participants then had the option to either stay with the default (recycled water) or switch to another water provider that supplied traditional water. In the default-out condition, participants read the following scenario:

> Imagine you work for a small business. As part of your job, you are in charge of ordering water for the office water dispenser. In the past, your business has ordered from Company A, which is listed as the business's default provider of water. One day, one of Company A's competitors, Company B, announces it will officially supply only recycled water to customers. You notify your boss of this change, and they tell you that you can continue ordering from Company A, which uses traditional purified water, or you can choose to switch providers and instead start ordering from Company B. Assuming Company A and Company B offer the same prices for their water, and you have no outside pressure to choose one option over the other, which company would you choose?

Participants in this condition then had the option to stay with their default provider (traditional water) or switch to the other provider that supplied recycled water. Afterwards, all participants filled out the domain specific trust measure in water reuse again.

After completing the post-experiment domain specific trust measure in water ruse, all participants filled out a measure of Acceptance of potable recycled water (which captured 2 elements: Use recycled water and Support recycled water) (Tanner & Feltz, 2021), a measure of

Dissatisfaction with the government (Tanner & Feltz, 2021), and a measure of Objective knowledge of potable recycled water (Mahmoud-Elhaj et al., 2020)

Results and Discussion

Prior to testing my hypothesis, I first ran a confirmatory factor analysis on the responses in the pre-test measure of domain specific trust in water reuse to confirm the factor structure identified in Study 1. The confirmatory factor analysis suggested that the hypothesized model had some modest model misfit, $\chi 2 = 70.59$, $p < .05$, df = 23 ($\chi 2/df = 3.07$), *RMSEA* = .08, 90% *CI* .06 - .10, *CFI* = .99, *TLI* = .98, *SRMR* = .01 (see Figure 3). Subsequent investigations revealed that the model misfit was largely due to correlated error variances in this sample and one cross loaded item (Ross-4 loading onto Trust in government). Given the modest misfit, I continue to use the 3 factors that were specified in previous analyses. Each of the subscales had great internal reliability: Trust in authority to provide safe water Cronbach's alpha = .95; Trust in authority to manage risk Cronbach's alpha = .94; Trust in government Cronbach's alpha = .96.

To test my hypothesis (relevant educations protect trust in water agencies better than default nudges), I calculated trust difference score by subtracting the pre-experiment trust score from post-experiment trust score for all 3 trust factors. Then I performed one-way analyses of variance for 3 domain specific trust factors with the experimental conditions as fixed factors and the trust score difference as dependent variable. I first examined the effect of these conditions on participants' change in *Trust in authority to provide safe water*. Results showed that there was a significant difference among four groups, $F(3, 307) = 3.55$, $p = .02$, $\eta^2 = .03$. Tukey's HSD test for multiple comparisons revealed that Relevant education did a significantly better job in preserving trust in authority to provide safe water, compared to Default-in. There was no significant difference among any other conditions (see Table 11 for all post-hoc tests, see Figure

4). I then examined the effect of these experimental conditions on participants' change in *Trust in authority to manage risk*. Results showed that there was no significant difference among four groups, $F(3, 307) = 1.26$, $p = .29$, $\eta^2 = .01$ (see Figure 5). Finally, I examined the effect of conditions on participants' change in *Trust in government*. Results showed that there was also no significant difference among four groups, $F(3, 307) = 1.11$, $p = .35$, $\eta^2 = .01$ (see Figure 6). All post hoc comparisons for all 3 domain specific trust factors are reported in Table 11. All descriptive statistics regarding changes in trust across 4 groups are reported in Table 12.

While results from the omnibus tests showed that a significant difference was only detected in Trust in authority to provide safe water (and not Trust in authority to manage risk or Trust in government), a closer look into the descriptive statistics revealed that Default-in condition led to a biggest decrease in trust in all 3 trust factors compared to all other conditions (see Table 12). On the other hand, relevant education either led to an increase in trust (in Trust in authority to provide safe water and Trust in government), or the smallest decrease in trust compared to all other conditions (in Trust in authority to manage risk). Therefore, in addition to looking at Tukey's HSD pairwise comparisons, I also performed an independent sample t-test comparing changes in trust between *Default-in* condition and *Relevant education* condition. Results revealed a significant difference in Trust in authority to provide safe water, $t(155) = 2.78$, $p = .01$, $d = .44$, suggesting that participants in the Default-in condition experienced a significantly bigger decrease in trust ($M = -.28$), compared to participants in the education condition ($M = .02$). There was no significant difference between Default-in and Relevant education for the other 2 trust factors (see all t-test results in Table 13).

It might be worth noting that as mentioned earlier, Default-in always resulted in the biggest *decrease* in trust in all 3 trust factors, compared to all other experimental conditions (see

Table 12). I ran these mean gains against a value of 0, to see if those decreases were reliable. Results showed that default-in led to a significant decrease in Trust in authority to provide safe water (t = -4.91, p < .001, d = .54), a significant decrease in Trust in authority to manage risk (t = -3.63, p < .001, d = .40), and a near significant decrease in Trust in government (t = -1.76, p = .08, d = .19) (see Table 14). I also detected a negative mean difference for Relevant education in Trust in authority to manage risk (see Table 12). However, running this mean difference against a value of 0 revealed that this decrease is non-significant, t = -.56, p = .58, d = -.07. As a matter of fact, none of the changes in trust for Relevant education is significantly different from 0 (see Table 14). All in all, while default-in led to significant decreases in trust, participants in the relevant education condition did not experience a reliable change in trust. In other words, even though relevant education did not significantly increase participants' trust level, it still might do a better job of *maintaining* trust, compared to default-in.

I also examined the impact of education and default nudge on first order acceptance of recycled water. Results showed that receiving relevant educational intervention was associated with significantly higher enrollment in recycled water program, $X^2(1) = 7.05$, p = .01. Specifically, only 24 out of 74 (32%) participants in the irrelevant education condition chose to enroll in hypothetical recycled water program, while 40 out of 74 (54%) participants in the relevant education condition chose to enroll in recycled water program. However, the default manipulation was not statistically significant, $X^2(1) = 1.65$, p = .20. Specifically, 19 out of 83 (23%) participants in the default-in condition chose to enroll in recycled water program, and 12 out of 80 (15%) participants in the default-out condition chose to enroll in recycled water program.

In addition to testing for the effect of education and default on trust and first order acceptance, I also examined other variables that I collected in this Study (i.e., Objective knowledge of potable recycled water, Intention to use recycled water, Intention to support recycled water, Dissatisfaction with government). Regarding *Objective knowledge of potable recycled water*, results revealed a significant difference among 4 groups, $F(3, 307) = 23.77$, $p < .001$, $\eta^2 = .19$ (see Figure 7). Post hoc tests revealed that participants in the Relevant education condition showed significantly higher knowledge about recycled water than participants in Default-in condition, Default-out condition, and Irrelevant education condition. See Table 15 for descriptive statistics and Table 16 for post-hoc results. Regarding *Intention to use recycled water*, results showed that there was a statistically significant difference among the 4 groups, $F(3, 307) = 9.60$, $p < .001$, $\eta^2 = .09$ (see Figure 8). Post-hoc tests revealed that participants in the Relevant education condition showed significantly higher intention to use recycled water compared to participants in the Default-in and Default-out conditions. Participants in the Irrelevant education condition also showed significantly higher intention to use recycled water than participants in Default-in and Default-out conditions (see Table 15 for all descriptive statistics; see Table 16 for post hoc results). Regarding *Intention to support recycled water*, results showed that there was no significant difference among the 4 groups, $F(3, 307) = 1.81$, $p = .15$, $\eta^2 = .02$ (see Figure 9). See Table 15 for descriptives. Finally, regarding *Dissatisfaction with the government*, results revealed a significant difference among 4 groups, $F(3, 307) = 9.53$, $p < .001$, $\eta^2 = .09$ (see Figure 10). Post-hoc tests revealed that participants in the Relevant education condition indicated significantly less dissatisfaction with the government than participants in both Default-in and Default-out condition. Participants in the Irrelevant education condition also indicated significantly less Dissatisfaction with government compared to participants in both

Default-in and Default-out condition. See Table 15 for descriptive statistics and Table 16 for post hoc results. These results provided evidence that effective education significantly impacted a host of variables in addition to minting trust. Specifically, effective education significantly increased Objective knowledge, increased Intention to use recycled water, and lowered Dissatisfaction with the government.

To see how changes in domain specific trust related to these variables (i.e., Intention to use recycled water, Intention to support recycled water, Dissatisfaction with government, Objective knowledge of recycled water), I looked at correlations. Correlation results revealed that positive changes in all 3 domain specific trust factors negatively correlated with Dissatisfaction with the government, positively correlated with Objective knowledge of potable recycled water, and positively correlated with both Intentions to Support and Use recycled water (see Table 17 for all correlations).

These results imply that participants' decisions to accept potable recycled water likely proceeded along a pathway consistent with what is proposed in the skilled decision theory framework (Cokely et al., 2018) (see Figure 11). Specifically, participants' objective knowledge of potable recycled water might have had a direct effect on their intentions to support and use recycled water, and an indirect effect through increasing trust. To test this, I first conducted a mediation analysis (with bias-corrected percentile bootstrap confidence intervals with 1000 replications) using Objective knowledge as the predictor, Change in trust in water authority to provide safe water as the mediator, and Intentions to use and support recycled water as the outcomes. The direct effects of Objective knowledge on Intention to use recycled water (b = .04, SE = .004, 95% CI [.03, .05], p < .001) and Intention to support recycled water (b = .03, SE = .01, 95% CI [.02, .05], p < .001) were both significant. The indirect effect was statistically

significant for Intention to use recycled water (b = .002, SE = .001, 95% CI [< .001, .01], p = .05), and marginally significant for Intention to support recycled water (b = .003, SE = .001, 95% CI [< .001, .01], p = .08). This suggests that the impact of participants' knowledge of recycled water on their intentions to use and support recycled water was partially mediated by their change in trust in water authority to provide safe water (see Figure 12).

Next, I conducted a mediation analysis (with bias-corrected percentile bootstrap confidence intervals with 1000 replications) with Objective knowledge as the predictor, Change in trust in water authority to manage risk as the mediator, and Intentions to use and support recycled water as the outcomes. The direct effects of Objective knowledge on Intention to use recycled water (b = .04, SE = .004, 95% CI [.03, .05], p < .001) and Intention to support recycled water (b = .03, SE = .01, 95% CI [.02, .05], p < .001) were both significant. The indirect effect was also significant for both Intention to use recycled water (b = .002, SE < .001, 95% CI [< .001, .004], p = .04) and Intention to support recycled water (b = .003, SE = .002, 95% CI [< .001, .01], p = .05). This suggests that the impact of participants' knowledge of water reuse on both their intentions to use and support recycled water was partially mediated by their change in trust in water authority to manage risks (see Figure 13).

Finally, I conducted a mediation analysis (with bias-corrected percentile bootstrap confidence intervals with 1000 replications) with Objective knowledge as the predictor, Change in trust in water government as the mediator, and Intentions to use and support recycled water as the outcomes. The direct effects of Objective knowledge on Intention to use recycled water (b = .04, SE = .004, 95% CI [.03, .05], p < .001) and Intention to support recycled water (b = .03, SE = .01, 95% CI [.02, .05], p < .001) were both significant. The indirect effect, however, was not significant for either Intention to use recycled water (b = .001, SE < .001, 95% CI [< 0, .002], p =

.12) or Intention to support recycled water (b = .002, SE = .001, 95% CI [< 0, .01], p = .10). There was no mediation effect for change in trust in water government. Overall, these results suggested that impact of knowledge on intentions to use and support recycled could be partially explained by changes in trust.

General Discussion

These studies sought to examine the extent to which educational interventions and libertarian paternalistic nudges impact individuals' *trust* when making decisions regarding water reuse. Studies 1a and 1b focused on developing and validating a standardized scale to measure domain specific trust in the water recycling domain. Study 2 and Study 3 sought to evaluate educational interventions and default nudges on their impact on individuals' trust. For Study 2, I used a 2x2 factorial design (education/no education & default-in/default-out) and performed 3 two-way ANOVA's (for 3 domain specific trust factors) with Education and Default as fixed factors and changes in trust as the dependent variables. Results revealed that there was a significant main effect of education on participants' change in Trust in authority to provide safe water, suggesting that relevant education resulted in a significantly bigger increase in trust compared to non-education conditions. Examining the impact of these conditions on first order acceptance revealed that there was no significant effect for either education or default nudge on participants' first order acceptance of recycled water. For Study 3, I used a 4-group design (irrelevant education, relevant education, default-in, and default-out) and performed 3 one-way ANOVA's (for 3 domain specific trust factors) comparing these 4 experimental conditions on their impact on participants' trust. Results revealed a significant difference for Trust in authority to provide safe water. Post-hoc tests suggested that participants in the relevant education condition demonstrated significantly smaller decreases in trust compared to participants in

default-in. Additionally, results showed that default-in consistently led to significant reductions in trust in all 3 trust factors, whereas relevant education consistently maintained participants' trust levels. Regarding first order acceptance, Study 3's results revealed that there was a significant effect of education on participants' first order acceptance of recycled water, but there was no effect for default nudge on first order acceptance.

Theoretically, this research provides evidence that trust might be an important evaluative criterion for determining the ethics of some interventions. Specifically, my results suggested that an ethical cost could be associated with implementing libertarian paternalistic default nudges. While educational interventions managed to maintain individuals' trust (i.e., participants' trust did not change after being exposed to the intervention), default nudges consistently led to significant decreases in trust. These results revealed important differences between different choice architecture interventions and provide one way to compare and evaluate differences in decision interventions using trust. It is also worth noting that this research, to my knowledge, is the first to provide evidence that implementing default nudges could come at the direct cost of the trust of those we seek to help.

Examining correlations in Study 3, I also found that positive changes in all 3 trust factors significantly correlated with a host of important outcomes, such as participants' objective knowledge of potable recycled water, intention to use recycled water, intention to support recycled water, and dissatisfaction with government. Mediation analyses results revealed that participants' changes in Trust in authority to provide safe water and Trust in authority to manage risks partially mediated the impact of knowledge on their intentions to support and use recycled water.

These results provided some evidence that trust carries intrinsic, instrumental, and professional values. Intrinsically, trust might be simply desirable by itself. If trust is intrinsically valuable, then, everything else being equal, default nudges would lead to an overall worse world since some fundamental values would be decreased. My work suggests that there are alternatives that do not reduce trust, hence those alternative techniques would be better everything else being equal. Instrumentally, positive changes in trust significantly predicted a host of important outcomes involving water reuse decisions (i.e., intentions to use and support water reuse, dissatisfaction with the government) and also partially explained the relationship between knowledge and acceptance of recycled water. In other words, having a representative understanding of water reuse promoted people's trust, which in turns resulted in acceptance of recycled water and a host of other positively regarded states (e.g., dissatisfaction with government). The finding that default nudges might lead to reduction in trust is also problematic because losses tend to loom larger than gains (Kahneman & Tversky, 1979). Negativity bias remains among one of important principles in human psychology (Rozin & Royzman, 2001). Negative occurrences are more heavily weighed (Skowronski & Carlston, 1989; Vaish et al., 2008; Kappenman et al., 2015; Huang & Luo, 2006), harder to detach or move on from (Salemink et al., 2007), and disproportionately fixated on (Baumeister et al., 2001; Neumann & Bockenholt, 2014; Brown et al., 2020) compared to either neutral or positive occurrences. Losses can create a more heightened cognitive impact on judgments and decisions compared to equivalent gains or neutral events (see Neumann & Bockenholt, 2014 for a review). In the context of decision policies, these results imply that libertarian paternalistic default nudges can exert a stronger emotional impact on the public via losing their trust compared to just maintaining trust via educational intervention.

Trust also seems to also carry professional values. I previously argued that it is commonly held that the relationship between professionals (who typically take on the role as a trustee) and non-professionals (who typically take on the role as a trustor) is an unequal one due to discrepancies in expertise and knowledge (Dawson, 1994; Brien, 1998; Kelly, 2018). The current results provided empirical evidence that on the one hand, increasing participants' knowledge (narrowing down the discrepancies in knowledge between experts and non-experts) might lead to positive changes in trust among these non-professionals, which resulted in their acceptance of recycled water. It is especially valuable in this context involving water reclamation as water recycling has been shown to be a polarizing issue (see Smith et al., 2018). On the other hand, using default-in techniques resulted in a decrease in trust. These results reaffirm the importance of trust in decisions involving water reuse and provide empirical support for the claim that trust has intrinsic, instrumental, and professional values.

To illustrate, my results suggest that utilizing default nudges might contradict the APA's ethical principles emphasizing professionals' obligations to increase or maintain trust. Previous research has advocated for the use of default nudges on the basis that it is liberty preserving and that it does not directly harm people (see Thaler & Sunstein, 2008). However, no previous research has empirically found that default nudge could detrimentally affect people's trust. Results from my thesis provide some evidence, for the first time, that default nudges might contribute to a potential psychological harm (decreasing trust). My studies suggest that this could potentially be critically important for the deployment of default nudges. Recall that one of the proposed mechanisms for why defaults work is decision inertia. In the current context, the libertarian paternalistic nudge that would encourage that choice is the default-in condition. But that is exactly the condition that fairs worst when it comes to maintaining trust. Indeed, my data

suggests that this nudge can lead to a significant *decrease* in trust. These observations may suggest that it is critical that choice architects keep this in mind - that implementing default nudges might yield the results that they want (nudging the public toward desired direction) at the cost of their trust.

Practically, this thesis contributes to the ongoing research about trust in recycled water acceptance and can offer helpful recommendations to professionals within the domain of water recycling. Study 1's results reinforced the importance of trust as a predictor of reuse acceptance, as well as offered a brief measure of trust in recycled water entities. Trust has been consistently shown to be related to various kinds of recycled water acceptance (see Smith et al., 2018 for a review). But there is a host of different scales that have attempted to measure domain specific trust in water reuse. Review of empirical literature suggests that there are several different concrete individuals who were the targets of trust (e.g., municipal authorities, aquifer managers, state government water providers) that might be at least conceptually different from one another. Without further study, we do not know which trust measure is better and why. This research is the first to offer a comparison of popular ways to measure trust in water reuse agencies, and a more unified way to measure trust in recycled water entities. Furthermore, this research also has helpful implications for policymakers within this field who are looking to reliably increase public acceptance of recycled water. Public objection has been among the biggest obstacles preventing water reuse schemes from being executed (Ross et al., 2014; Hurlimann & Dolnicar, 2010; Uhlmann & Head, 2011). As such, policymakers have been finding ways to reliably increase public acceptance. This research suggests that while both educational interventions and libertarian paternalistic nudges can be effective at increasing first order acceptance of water reuse, educational intervention seems to be better at maintaining trust. More importantly, our

results suggest that positive changes in participants' trust in water reuse can partially explain the impact of knowledge on their intentions to use and accept recycled water. In other words, higher objective knowledge can increase public's trust, which in turns can increase their intentions toward using and accepting water reuse.

To demonstrate these results in an example, imagine a government official, in an effort to formulate an effective policy that could reliably influence public decisions toward an intended direction, reads *Nudge* by Thaler and Sunstein (2008). The book starts out by detailing human biases in judgements and decision making, followed by in-depth explanations and demonstrations of how nudges work via targeting these biases (and how effective they are). Thaler and Sunstein (2008) adamantly claim that nudges benefit "unsophisticated choosers" (p.241) by effectively guiding them toward choices that are better for their own health, wealth, and happiness. Reading this, said government official might think that defaulting people into proposed policy would be the optimal strategy. However, current results provide some evidence that doing so might not be a good idea. First, the efficacy of nudges is questionable. Specifically, results from both Study 2 and Study 3 showed that there was no significant effect for default manipulation. Previous research has also examined the effect of default nudges on first order acceptance of recycled water and found the effect to be rather inconsistent. For example, Tanner (2021) found a significant effect for default nudges in three studies but found a non-significant effect in the fourth study. Second, compared to default nudges, the efficacy of education was more consistent for first order acceptance. While results from Study 2 suggest that there was no effect of education, results from Study 3 suggest a significant impact of education on participants' first order acceptance. Tanner (2021) also found that relevant education successfully influenced participants' enrollment choices. Third, educational intervention

consistently maintained participants' trust (in both Study 2 and 3), while default nudges consistently decreased participants' trust. If one of the major justifications for nudging is that nudges consistently effectively help people make better decisions that benefit themselves, then these three points put pressure on that justification. Not only were nudges inconsistent with influencing first order acceptance (the very thing that Thaler and Sunstein argued nudges were good for), they also consistently reduced trust. Education, on the other hand, showed a more consistent impact on participants' first order acceptance, while not negatively impacting trust. In other words, all else being equal, default nudges seemed to be a measurably less optimal strategy than education.

Based on the criteria above (e.g., first order acceptance and trust), these results suggest that default nudges are measurably the less optimal candidate for public policy strategy. But it is even more so the case with *trust*. Public trust has been repeatedly shown to be an important predictor of compliance of governmental policies (Pak et al, 2021; Pagliaro et al., 2021; Bargain & Aminjonov, 2020; Devin et al., 2021; Cook & Gronke, 2005; Scholz & Lubell, 1998). With current data suggesting that implementing default nudges might lead to a trust reduction among public, default nudges as a policy strategy might not only be nonoptimal but also problematic. Sarracino et al. (2022), using a time-varying measure of compliance, found that public compliance could change over time. Changes (increase or decrease) in participants' trust significantly predicted changes (increase or decrease) in participants' compliance. Such findings suggest that compliance can fluctuate and should not be taken for granted (i.e., compliance now does not mean compliance later), and also reaffirms the importance of nurturing and cultivating public trust when implementing policies. Taking all of these into consideration, education seems to be a more fitting policy strategy for said government official.

Two things worth mentioning regarding the current results are (1) for both Study 2 and Study 3, I only observed a significant effect for education in Trust in authority to provide safe water (and not the other 2 trust factors), and (2) educational intervention did not increase domain specific trust as initially hypothesized, but education did comparably better at maintaining trust compared to default nudges. There might be some plausible theoretical explanations for these effects. For (1), the educational intervention that I used only focused on demonstrating the process of providing safe recycled drinking water and the scenarios were only about water providers. The educational video did not include any information regarding risk managements in water reuse or governments. Therefore, it makes sense that I would only observe a statistically significant effect for Trust in authority to provide safe water, and not the other two trust factors. For (2), if we think that trust is being characterized by being vulnerable to others (one of the necessary conditions of trust), then educating participants might make them less vulnerable and therefore make them less in need of trust. As a result, we observed a maintenance of trust and not an increase. If this line of reasoning is close to being right, then it also makes sense that default nudges decreased trust. Specifically, to opt into a program without further information or a representative understanding of what the program is about, participants would require more trust (compared to educational intervention). But because default nudges do not provide relevant information, participants might feel more vulnerable, which might result in a reduction in trust. While the answer regarding why education did not increase domain specific trust is unclear, this could be a potential explanation that warrants further exploration.

Of course, this research has limitations. Specifically, the nature of experimental scenarios used in Study 2 and Study 3 is somewhat unrealistic. Even though hypothetical scenarios can provide some information about construct validity (Webb & Sheeran, 2006), the hypothetical

scenario used in the studies along with the binary choices (i.e., choosing either a supplier providing traditional water or a supplier providing recycled water for one's company) might not directly reflect an actual water reuse decision that one would normally make in real life. People typically do not have to choose whether or not their household would receive recycled water. Future research should replicate these findings with more realistic behavioral outcomes.

To summarize, this research provides evidence that while different interventions can effectively influence individuals' decisions, there are ethical costs associated with different interventions that must be taken into account. This research documents *trust* as one such potential cost. While educational interventions manage to maintain individuals' trust, default nudges may often diminish it. This finding is essential to the goal of choosing ethically defensible interventions when targeting public acceptance of water reuse. More importantly, this is an important steppingstone toward forming a larger Ethical Interactions theory of defining the most appropriate ways of interacting with those that we aim to help.

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Table 1

Demographic Information for Study 1a (N = 417), Study 2 (N = 349), and Study 3 (N = 311).

Variable		Study 1	Study 2	Study 3
Age		*M* = 18.68 *SD* = 1.45	*M* = 18.75 *SD* = 1.21	*M* = 41.88 *SD* = 12.27
Male		19%	22%	38%
Education	Vocational/Technical school	1%	1%	5%
	High school or equivalent	27%	28%	12%
	Some college	70%	71%	25%
	Bachelor's degree	1%	0%	36%
	Grammar school	0%	0%	0%
	Master's degree	0%	0%	19%
	Professional degree (MD, etc.)	0%	0%	2%
	Doctoral degree	0%	0%	1%
Ethnicity	Asian/Pacific Islander	8%	9%	5%
	Black	6%	9%	9%
	Caucasian/White	63%	59%	73%
	Hispanic	10%	10%	6%
	Indigenous or Aboriginal	3%	4%	0%
	Latino	2%	3%	1%
	Multiracial	6%	4%	3%

Political orientation	Strongly liberal	6%	3%	15%
	Liberal	15%	13%	17%
	Slightly liberal	13%	17%	13%
	Middle	32%	31%	29%
	Slightly conservative	18%	24%	13%
	Conservative	12%	7%	6%
	Strongly conservative	5%	5%	6%
Religion	Agnostic	10%	10%	19%
	Atheist	7%	3%	11%
	Buddhism	1%	1%	2%
	Catholic	16%	18%	15%
	Mormon	0%	0%	2%
	Muslim	1%	2%	2%
	Protestant/other Christian	55%	55%	32%

Table 2

Original domain specific trust scales in water reuse and their items in Study 1a.

Origin	Item
Bratanova et al. (2013) *Trust in Municipal Authorities*	1. The water plant uses first class, modern techniques, for the purification of the water.
	2. The people working at the waterworks have the consumers' interests at heart.
	3. The politicians in the municipality have enough knowledge about the water distribution issue to make good decisions on the subject.
	4. I felt that the authorities had the situation under control and knew what they were doing.
	5. I trust that the authorities in the future will provide me with good information about possible problems with the drinking water.
Hurlimann et al. (2008) *Trust in Water Authority-1*	1. I trust the water authority to manage any risk that may be associated with recycled water use.
	2. I trust the water authority to ensure water safety and quality.
	3. The water authority provides information that can be entrusted.
Leviston et al. (2013) *Trust toward Managed Aquifer Recharge*	1. I would be reassured that the water was safe if there was a panel of independent experts who could guarantee its safety.
	2. I feel I can trust the media for information

	and messages about recycled water.
	3. I trust scientists to tell me whether the water is safe or not.
	4. Government bodies would be more accountable than privatized companies for a recycled water scheme.
	5. Recycled water wouldn't go ahead unless the authorities were satisfied it was safe.
Mankad et al. (2015) *Trust in State Government Water Provider*	1. I trust my water provider to safely deliver recycled water for drinking/nondrinking purpose.
	2. I trust my water provider to reliably deliver recycled water for drinking/nondrinking purpose.
Ross et al. (2014) *Trust in Water Authority-2*	1. I have confidence that the water authority will deliver a good water supply.
	2. I think that the water authority has good intentions in managing recycled water supply.
	3. I can depend on the water authority to provide a good quality water supply.
	4. I have complete trust in the water authority to provide me with good quality water supply.
Wu et al. (2013) *Trust in Water Authority-3*	1. I trust the information about the safety of water treated through recycling process given to me by water authorities.

	2. I trust water authorities to ensure the water treated through recycling process to which I have access is healthy and safe.
Nancarrow et al. (2009) *Trust in Water Authority-4*	1. I have complete trust in the government authorities to ensure I have healthy and safe water.
	2. I have complete trust in any information about the safety of our water given to me by the various government authorities.
	3. I have complete trust in private companies to ensure I have healthy and safe water.
	4. I have complete trust in government authorities to manage our water supply responsibly.
Porter et al. (2005) *Community Trust*	1. I have complete trust in the authorities to provide me with good quality water.
	2. I would trust information about the safety of our water given to me by the water authorities.
	3. I have complete trust in the authorities to manage our water responsibly.

Table 3

Correlations among all original trust measures in Study 1a.

	1	2	3	4	5	6	7	8
1. Trust in municipal Authorities								
2. Trust in Water Authority-1	.75**							
3. Trust toward Managed Aquifer Recharge	.52**	.61**						
4. Trust in State Government Water Provider	.58**	.68**	.53**					
5. Trust in Water Authority-2	.67**	.71**	.59**	.78**				
6. Trust in Water Authority-3	.61**	.71**	.62**	.70**	.81**			
7. Trust in Water Authority-4	.66**	.62**	.59**	.57**	.69**	.68**		
8. Community Trust	.68**	.71**	.59**	.67**	.80**	.75**	.80**	
Mean	3.49	3.88	3.87	4.1	4.12	4.02	3.5	3.88
SD	0.82	0.92	0.71	0.97	0.89	0.93	1.02	0.97

Note: ** $p < .01$.

Table 4

Initial exploratory factor analysis results on all original water trust items using parallel analysis with principal axis factoring and oblimin rotation in Study 1a.

Item	Trust in authority to provide safe water *Eigenvalue* = 13.64, 47% of total variance	Trust in authority to manage risk *Eigenvalue* = 1.64, 4% of total variance	Trust in government *Eigenvalue* = 1.42 3% of total variance	Factor 4 *Eigenvalue* = 1.17 3% of total variance
Ross-1	**.85**	-.07	.04	.02
Mankad-1	**.79**	.11	-.12	.07
Mankad-2	**.78**	.07	-.07	.01
Ross-3	**.77**	.06	.05	0
Ross-4	**.76**	0	.14	-.15
Wu-2	**.68**	.10	.09	.10
Ross-2	**.67**	.07	.06	.08
Wu-1	**.62**	.02	.21	.12
Porter-3	**.54**	.13	.27	-.14
Porter-2	**.51**	.11	.27	-.02
Bratanova-5	-.10	**.80**	.12	.02
Hurlimann-1	.15	**.73**	-.05	.02
Hurlimann-2	.33	**.61**	-.10	.11
Bratanova-3	-.11	**.56**	.20	-.21
Bratanova-4	.19	**.55**	-.02	-.25
Hurlimann-3	.09	**.54**	.20	.21
Nancarrow-2	.08	.01	**.82**	.04
Nancarrow-4	.14	.03	**.76**	-.10
Nancarrow-1	.06	.10	**.75**	.03
Leviston-3	.22	-.03	.18	**.52**
Bratanova-1	.18	.40	.03	-.02
Bratanova-2	.11	.42	.14	-.06

Leviston-1	.38	.21	-.14	.34
Leviston-2	-.16	.17	.49	.09
Leviston-4	-.06	.08	.49	.33
Leviston-5	.11	.32	.33	.13
Nancarrow-3	.38	.17	.21	-.28
Porter-1	.39	.12	.43	-.12

Table 5

ANOVA results for all 8 items in Trust in Authority to Provide Safe Water, and effect sizes from Study 1a. Note: *3 items with strongest discrimination are in bold.*

Item	Lower Mean, SD	Upper Mean, SD	F	*p*	*η2*
Ross-1	*M* = 3.07, *SD* = .66	*M* = 5.22, *SD* = .71	427.50	< .001	.71
Mankad-1	*M* = 2.92, *SD* = .73	*M* = 5.34, *SD* = .63	544.64	< .001	.76
Mankad-2	*M* = 2.94, *SD* = .72	*M* = 5.24, *SD* = .77	413.19	< .001	.71
Ross-3	***M* = 2.81, *SD* = .66**	***M* = 5.27, *SD* = .57**	**695.90**	**< .001**	**.80**
Ross-4	***M* = 2.75, *SD* = .65**	***M* = 5.32, *SD* = .60**	**728.36**	**< .001**	**.81**
Wu-2	***M* = 2.85, *SD* = .69**	***M* = 5.29, *SD* = .55**	**660.68**	**< .001**	**.79**
Ross-2	*M* = 3.14, *SD* = .75	*M* = 5.33, *SD* = .68	408.07	< .001	.71
Wu-1	*M* = 2.93, *SD* = .72	*M* = 5.14, *SD* = .76	384.36	< .001	.69

Table 6

Finalized trust measure in water recycling domain for Study 1a.

Origin	Item
	Factor 1: Trust in authority to provide safe water
Ross et al. (2014)	1. I can depend on the water authority to provide a good quality water supply.
Ross et al. (2014)	2. I have complete trust in the water authority to provide me with good quality water supply.
Wu et al. (2013)	3. I trust water authorities to ensure the water treated through recycling process to which I have access is healthy and safe.
	Factor 2: Trust in authority to manage risk
Bratanova et al. (2013)	4. I trust that the authorities in the future will provide me with good information about possible problems with the drinking water.
Hurlimann et al. (2008)	5. I trust the water authority to manage any risk that may be associated with recycled water use.
Hurlimann et al. (2008)	6. I trust the water authority to ensure water safety and quality.
	Factor 3: Trust in government
Nancarrow et al. (2009)	7. I have complete trust in any information about the safety of our water given to me by the various government authorities.
Nancarrow et al. (2009)	8. I have complete trust in government authorities to manage our water supply responsibly.

Nancarrow et al. (2009)	9. I have complete trust in the government authorities to ensure I have healthy and safe water.

Table 7

Correlations among all trust factors, intention to use recycled water, disgust, personality, and numeracy from Study 1b.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.Trust safe water	1																
2.Trust manage risk	.75**	1															
3.Trust govern	.63**	.57**	1														
4.Confidence	.35**	.28**	.28**	1													
5.Reliability	.11	.15	.12	.02	1												
6.Good intention	0	.03	.11	-.22**	.54**	1											
7.Trustworthiness	.23**	.18*	.25**	.36**	.20*	.14	1										
8.Disgust	-.04	-.04	-.02	.21*	-.13	-.26**	.01	1									
9.Numeracy	.04	.02	.04	.05	.18*	.08	.09	-.11	1								
10.Extraversion	-.02	-.08	.05	.09	.15	.09	.08	.01	-.11	1							
11.Agreeable	.17*	.22**	0	.30**	.35**	.08	.19*	.08	.25**	-.02	1						
12.Conscientious	.17*	.13	.02	.21*	.16	.09	.24**	.13	.17*	.30**	.26**	1					
13.Emotional	.16	.13	.27**	.23**	.33**	.15	.36**	-.10	.08	.22**	.23**	.31**	1				
14.Openness	.17*	.23**	.07	.26**	.11	-.03	.18*	-.03	.09	.30**	.33**	.34**	.11	1			
15.Satisfaction	-.40**	-.38**	-.27**	-.17*	-.27**	-.12	-.03	.29**	-.19*	.03	-.20*	.01	-.08	-.03	1		
16.Use Water	.35**	.33**	.25**	.03	.14	.10	.07	-.34**	.11	-.09	.07	-.09	.07	.02	-.71**	1	
17.Support Water	.18*	.19*	0	-.03	0	.15	.09	-.08	.08	-.06	.15	.13	-.02	.08	-.12	.22*	1
Mean	3.79	3.53	3.26	4.12	3.76	2.96	3.62	84.75	2.67	8	9.4	10.34	7.98	9.76	3.22	4.98	3.60
SD	1.11	1.08	1.51	0.88	0.93	1.09	0.93	14.58	1.4	3.18	2.25	2.45	2.68	2.16	1.07	1.52	1.32

* $p < .05$, ** $p < .01$

Table 8

Experimental conditions for Study 2.

	Default-in	Default-out
Relevant education	Group 1	Group 2
Irrelevant education	Group 3	Group 4

Table 9

Descriptive statistics of difference in Trust in Authority to Provide Safe Water, Trust in Authority to Manage Risk, and Trust in Government for Study 2.

		Mean gain scores	SD
Change in Trust in Authority to Provide Safe Water			
Control video	Default-in	-.25	.50
	Default-out	-.32	.70
Education video	Default-in	.13	.78
	Default-out	.18	1.20
Change in Trust in Authority to Manage Risk			
Control video	Default-in	.14	.51
	Default-out	-.26	.72
Education video	Default-in	.20	.57
	Default-out	.18	.91
Change in Trust in Government			
Control video	Default-in	-.05	.63
	Default-out	-.19	.54
Education video	Default-in	.20	.79
	Default-out	.04	.26

Table 10

Comparisons of changes in trust by Defaults in Control groups against 0 for Study 2.

	t	*p*	Cohen's d
Default-in condition			
Change in trust in authority to provide safe water	-2.31	.03	-.50
Change in trust in authority to manage risk	1.28	.22	.23
Change in trust in government	-.35	.73	-.08
Default-out condition			
Change in trust in authority to provide safe water	-1.91	.07	-.45
Change in trust in authority to manage risk	-1.53	.14	-.36
Change in trust in government	-1.46	.16	-.34

Table 11

Post hoc comparisons for changes in 3 domain specific trust factors in water reuse for Study 3.

	Conditions		*t*	*p*	*Cohen's d*
Trust in authority	Default-in	Default-out	-2.21	.12	.35
to provide safe		Irrelevant ed	-1.06	.71	.17
water		Relevant ed	-3.06	.01	.49
	Default-out	Irrelevant ed	1.09	.70	.18
		Relevant ed	-.89	.81	.14
	Irrelevant ed	Relevant ed	-1.94	.21	.32
Trust in authority	Default-in	Default-out	-1.08	.70	.17
to manage risk		Irrelevant ed	-.23	.99	.04
		Relevant ed	-1.75	.30	.28
	Default-out	Irrelevant ed	.82	.84	.13
		Relevant ed	-.68	.91	.11
	Irrelevant ed	Relevant ed	-1.47	.46	.24
Trust in govt.	Default-in	Default-out	-1.05	.72	.17
		Irrelevant ed	-.93	.79	.15
		Relevant ed	-1.81	.27	.29
	Default-out	Irrelevant ed	.10	1	.02
		Relevant ed	-.77	.87	.13
	Irrelevant ed	Relevant ed	-.86	.83	.14

Table 12

Descriptive statistics for changes in domain specific trust for all 4 conditions in Study 3.

	Condition	*N*	Mean gain scores	*SD*
Change in trust in authority to provide safe water	Default-in	83	-.28	.52
	Default-out	80	-.07	.52
	Irrelevant education	74	-.18	.57
	Relevant education	74	.02	.83
Change in trust in authority to manage risk	Default-in	83	-.22	.55
	Default-out	80	-.12	.57
	Irrelevant education	74	-.20	.55
	Relevant education	74	-.05	.77
Change in trust in govt.	Default-in	83	-.11	.58
	Default-out	80	-.01	.51
	Irrelevant education	74	-.02	.51
	Relevant education	74	.06	.79

Table 13

Independent sample t-test results between Default-in and Relevant education for 3 trust factors for Study 3.

	t	df	*p*	*Cohen's d*
Trust in authority to provide safe water	2.78	155	.01	.44
Trust in authority to manage risk	1.62	155	.11	.26
Trust in water government	1.60	155	.11	.26

Table 14

Comparisons of changes in trust by Default-in and Relevant education against 0 for Study 3.

	Mean gain scores	t	*p*	*Cohen's d*
Default-in condition				
Change in trust in authority to provide safe water	-.28	-4.91	< .001	.54
Change in trust in authority to manage risk	-.22	-3.63	< .001	.40
Change in trust in government	-.11	-1.76	.08	.19
Relevant education condition				
Change in trust in authority to provide safe water	.02	.23	.82	.03
Change in trust in authority to manage risk	-.05	-.56	.58	.07
Change in trust in government	.06	.69	.49	.08

Table 15

Descriptive statistics for Intention to use recycled water, Intention to support recycled water, Dissatisfaction with government, and Objective knowledge of potable recycled water for 4 conditions in Study 3.

Outcome variable	Condition	*Mean*	*SD*
Use recycled water	Default-in	-.28	.83
	Default-out	-.19	.84
	Irrelevant education	.20	.87
	Relevant education	.26	.92
Support recycled water	Default-in	3.41	1.46
	Default-out	3.48	1.37
	Irrelevant education	3.38	1.43
	Relevant education	3.86	1.49
Dissatisfaction with govt.	Default-in	4.11	1.43
	Default-out	4.10	1.53
	Irrelevant education	3.37	1.23
	Relevant education	3.19	1.28
Objective knowledge	Default-in	17.40	9.89
	Default-out	14.11	10.51
	Irrelevant education	17.58	10.87
	Relevant education	27.16	8.78

Table 16

Post hoc comparisons for ANOVA tests for Intention to use recycled water, Dissatisfaction with government, and Objective knowledge of recycled water for 4 conditions in Study 3.

Variable	Conditions		*t*	*p*	*Cohen's d*
Use recycled water	Default-in	Default-out	-.63	.92	.10
		Irrelevant ed	-3.43	.004	.55
		Relevant ed	-4.57	< .001	.73
	Default-out	Irrelevant ed	-2.80	.03	.45
		Relevant ed	-3.93	< .001	.63
	Irrelevant ed	Relevant ed	-1.11	.68	.18
Dissatisfaction govt.	Default-in	Default-out	.02	1	.003
		Irrelevant ed	3.33	.005	.53
		Relevant ed	4.19	< .001	.67
	Default-out	Irrelevant ed	3.28	.006	.53
		Relevant ed	4.13	< .001	.67
	Irrelevant ed	Relevant ed	.83	.84	.14
Objective knowledge	Default-in	Default-out	2.09	.16	.33
		Irrelevant ed	-.11	.99	.02
		Relevant ed	6.08	< .001	.97
	Default-out	Irrelevant ed	2.14	.14	.35
		Relevant ed	-8.05	< .001	1.30
	Irrelevant ed	Relevant ed	-5.80	< .001	.95

Table 17

Correlations among Changes in 3 trust in water reuse factors, Objective knowledge of recycled water, Dissatisfaction with the government, Intention to support recycled water, and Intention to use recycled water in Study 3.

	1	2	3	4	5	6
1. Change trust provide safe water	1					
2. Change trust manage risks	.61**	1				
3. Change trust in govt.	.43**	.47**	1			
4. Dissatisfaction with govt.	-.22**	-.23**	-.14*	1		
5. Knowledge of recycled water	.12*	.14*	.13*	-.45**	1	
6. Intention to support water	.20**	.22**	.17**	-.37**	.28**	1
7. Intention to use water	.28**	.25**	.17**	-.84**	.50**	.45**

* $p < .05$, ** $p < .01$

Figure 1

Scree plot for EFA using parallel analysis in Study 1a.

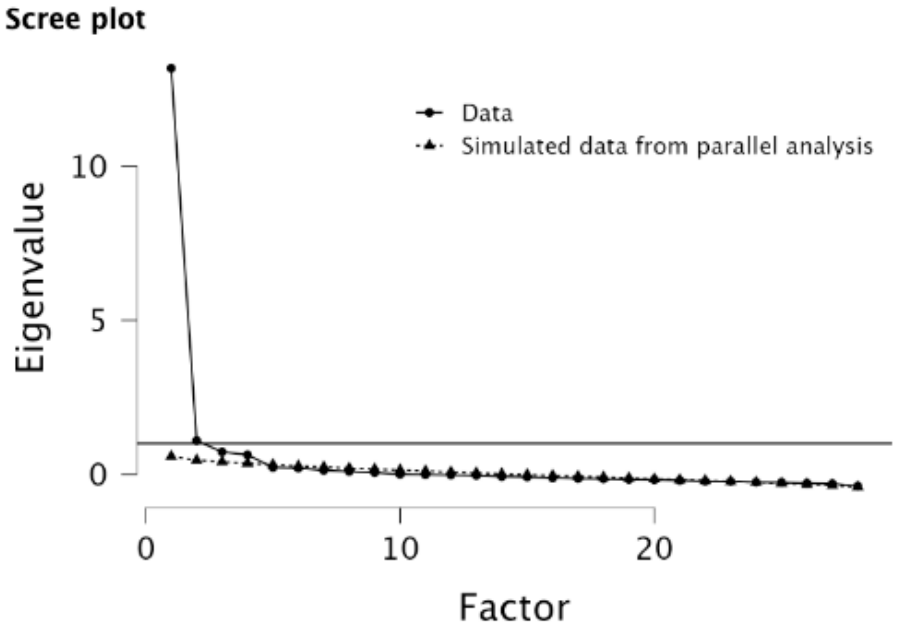


Figure 2

Confirmatory factor analysis model with standardized parameter estimates and error terms for Study 1b.

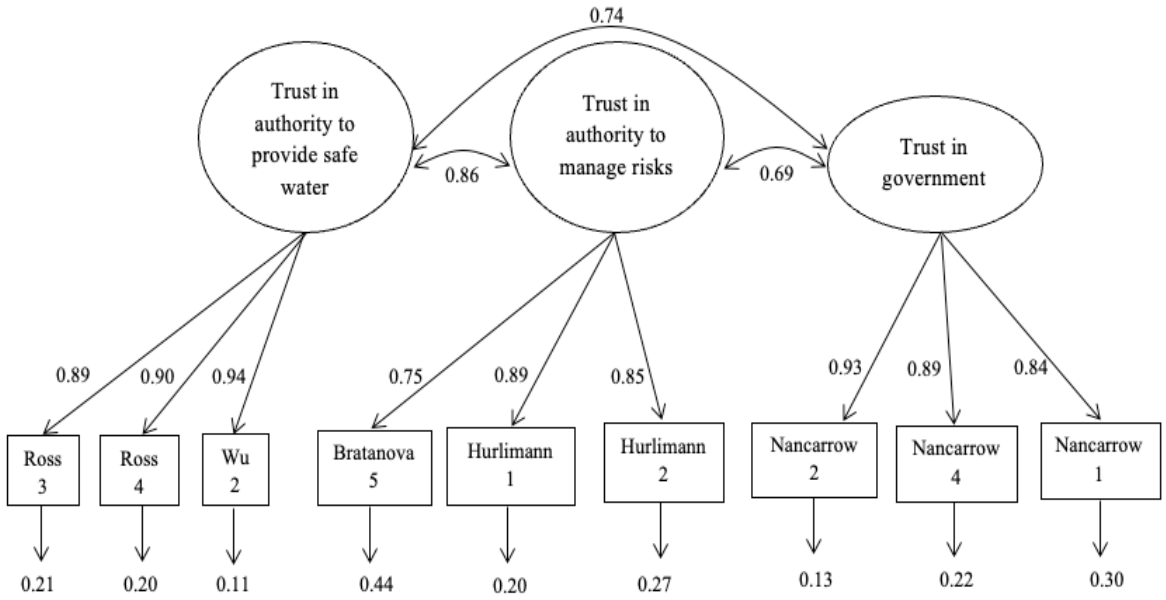


Figure 3

Confirmatory factor analysis model with standardized parameter estimates and error terms for Study 3.

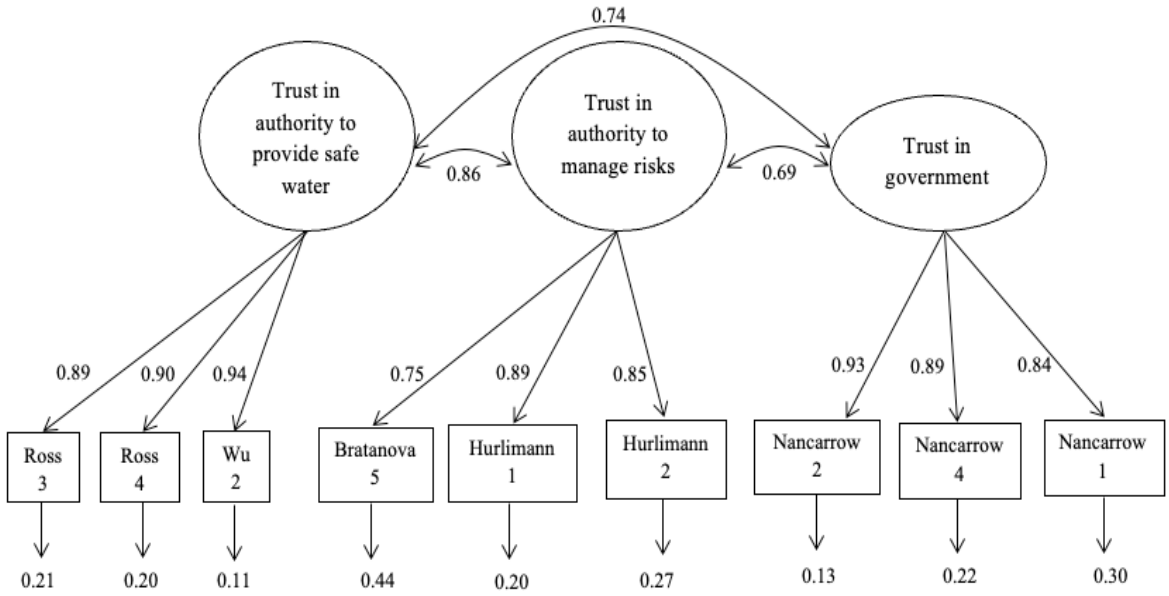
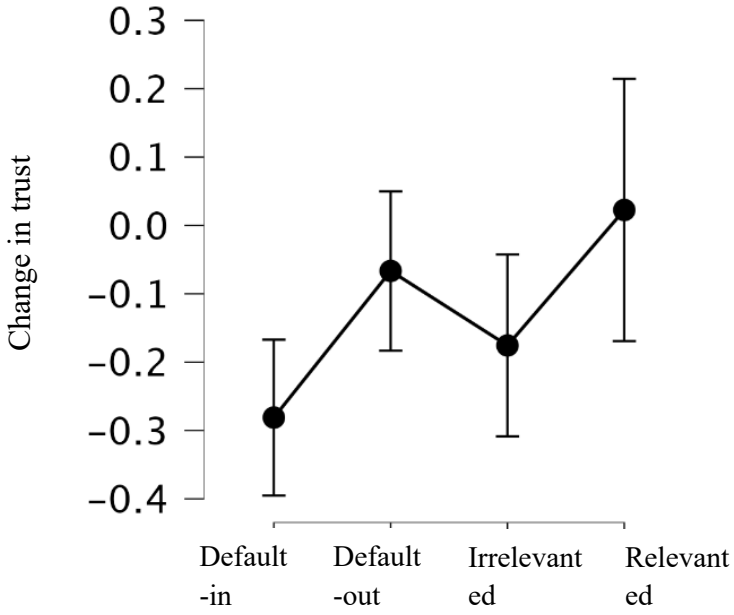


Figure 4

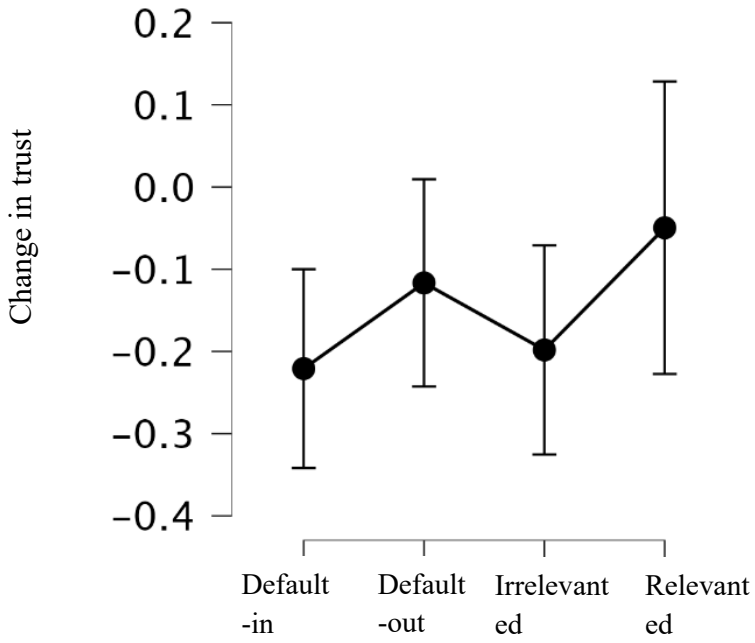
Descriptive plot for change in Trust in Authority to Provide Safe Water in Study 3.



Note. Error bars represent 95% confidence intervals.

Figure 5

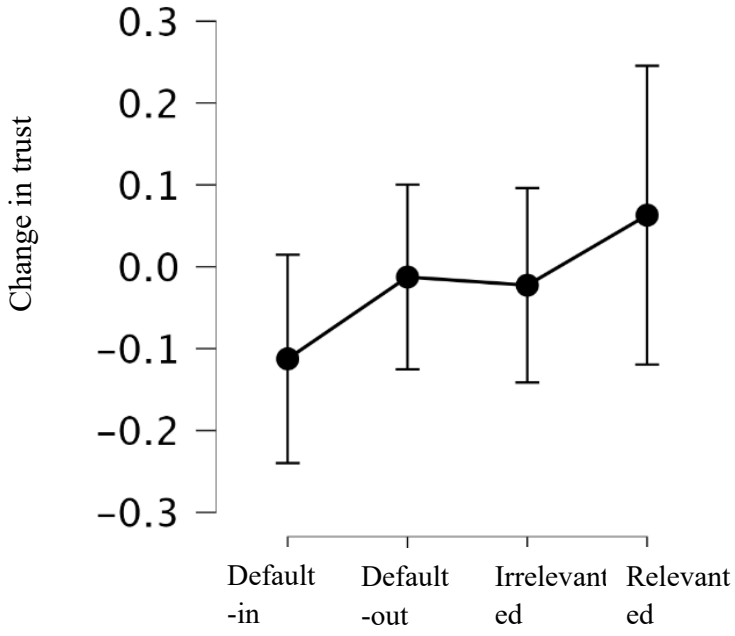
Descriptive plot for change in Trust in Authority to Manage Risk in Study 3.



Note. Error bars represent 95% confidence intervals.

Figure 6

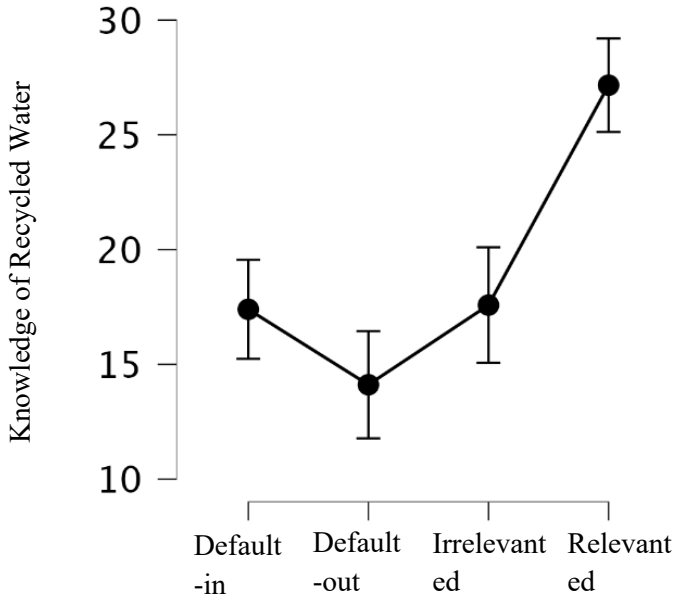
Descriptive plot for change in Trust in Government in Study 3.



Note. Error bars represent 95% confidence intervals.

Figure 7

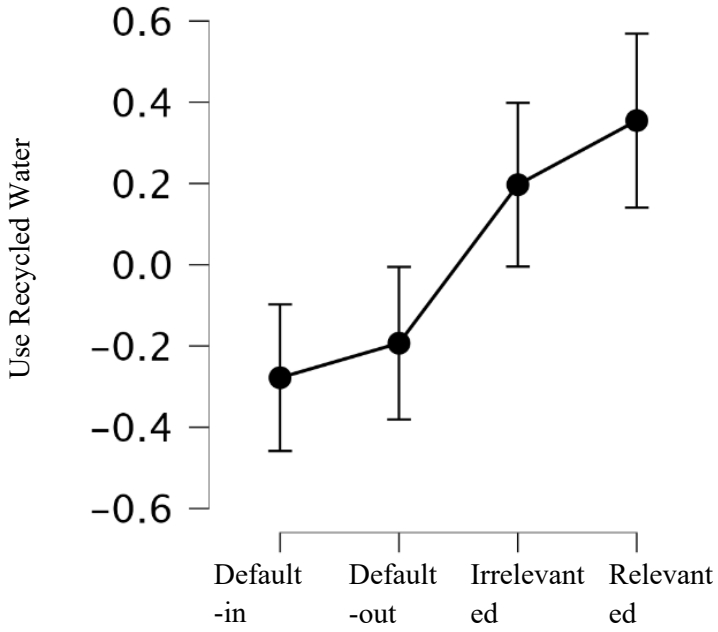
Descriptive plot for Objective Knowledge of Potable Recycled Water in Study 3.



Note. Error bars represent 95% confidence intervals.

Figure 8

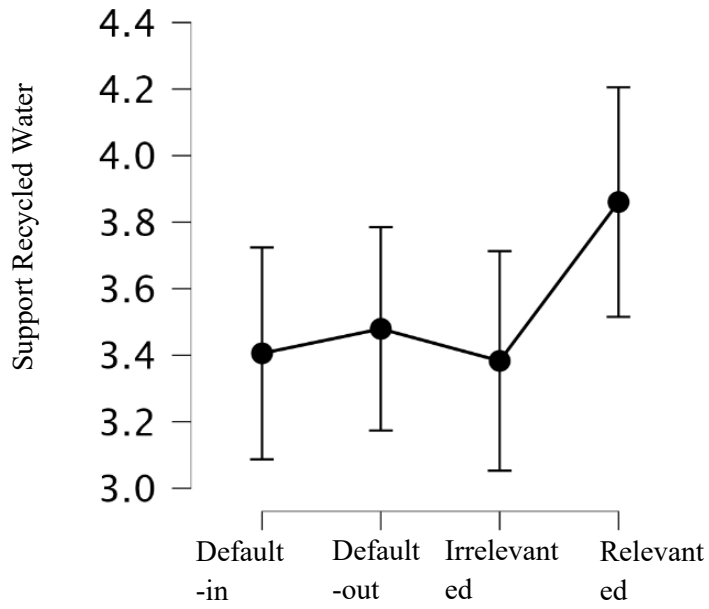
Descriptive plot for Intention to Use Recycled Water in Study 3.



Note. Error bars represent 95% confidence intervals.

Figure 9

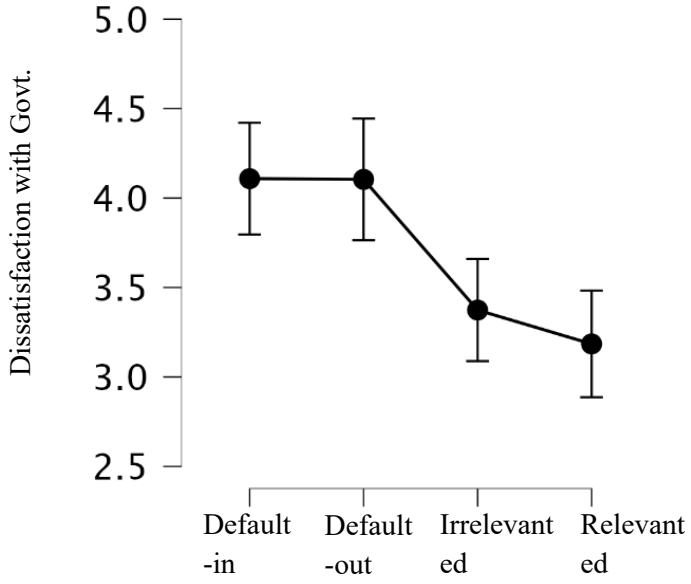
Descriptive plot for Intention to Support Recycled Water in Study 3.



Note. Error bars represent 95% confidence intervals.

Figure 10

Descriptive plot for Dissatisfaction with the Government in Study 3.



Note. Error bars represent 95% confidence intervals.

Figure 11

Structural process model from the Skilled Decision Theory.

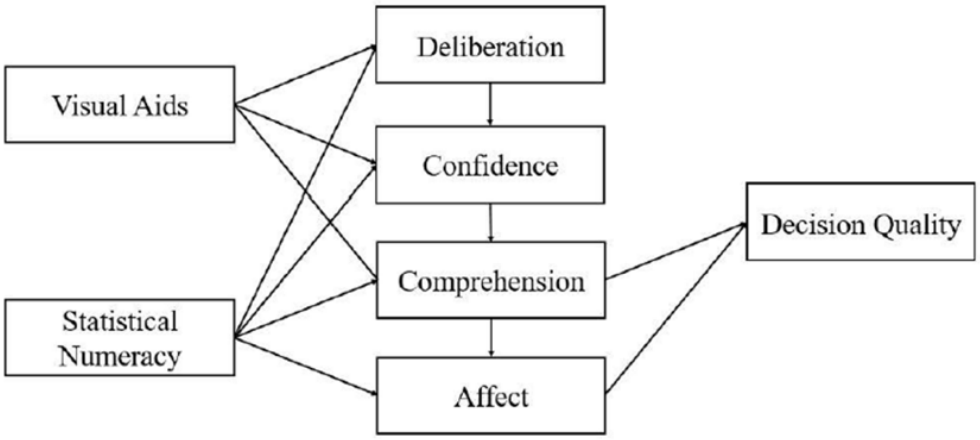
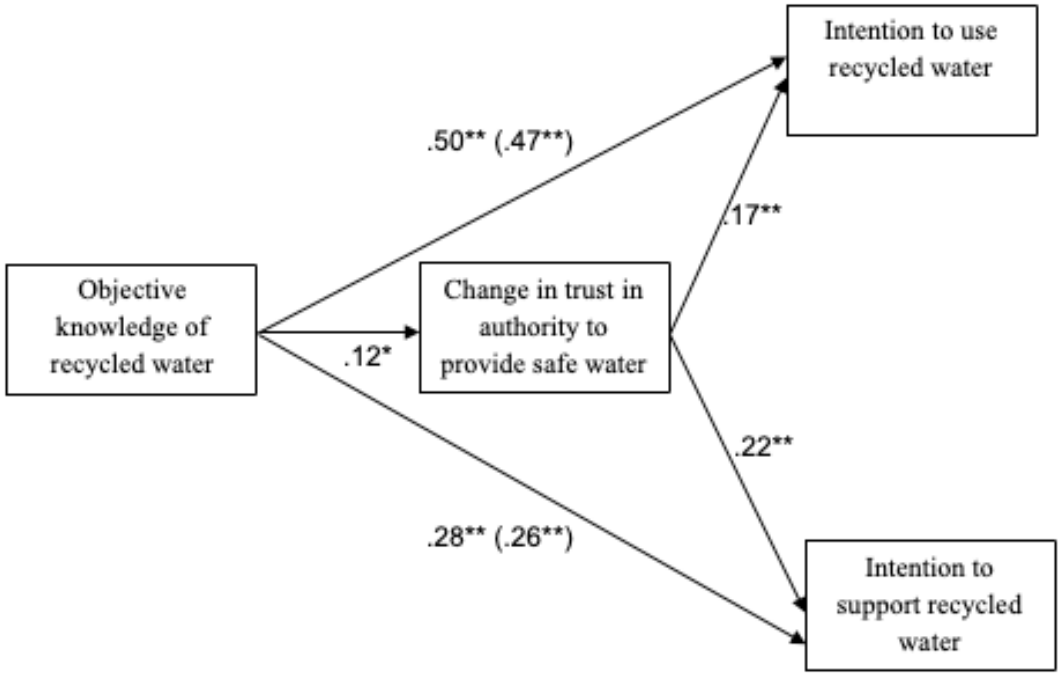


Figure 12

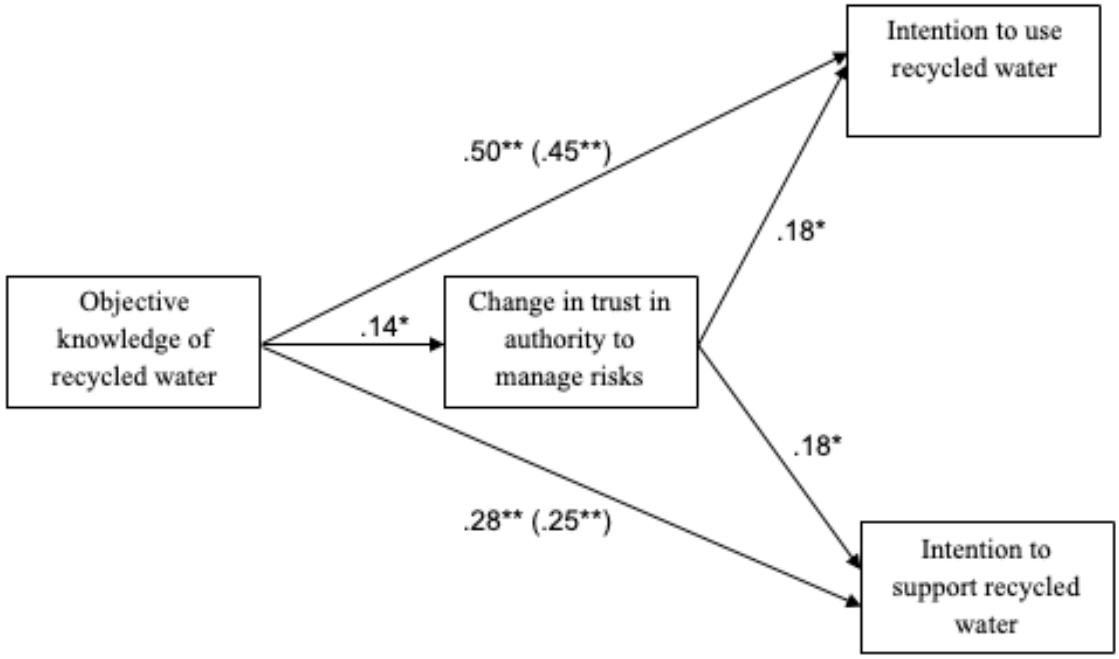
Mediation Path Analysis between Objective Knowledge, Change in trust in authority to provide safe water, and Intention to use recycled water in Study 3.



Note. Path values are standardized regression coefficients, * $p < .05$, ** $p < .01$.

Figure 13

Mediation Path Analysis between Objective Knowledge, Change in trust in authority to manage risks, and Intentions to use and support recycled water in Study 3.



Note. Path values are standardized regression coefficients, * $p < .05$, ** $p < .01$.