Selected Presentation at the 2021 Agricultural and Applied Economics Association Annual Meeting, Austin, Texas, August 1-3

The influence of climate narratives on the preferences for long-term groundwater management

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Abstract

We elicited groundwater preferences using a choice experiment survey involving outcomes of the Mississippi River Valley Alluvial Aquifer (MRVA). We randomly assigned respondents to an individualistic cultural frame about climate change to test for framing effects predicted by culturally congruent and incongruent messaging. Results suggest that culturally incongruent messaging (i.e., to non-individualists) emboldens opposition and makes promoted groundwater policies less tractable. This is instructive to policy makers that identifying different stakeholders and communicating different congruent messages about climate change could improve the effectiveness of collaborative water governance.

Keywords: natural resource wealth, aquifer, hedonic

Introduction

Global climate change is likely to increase existing pressures on scarce groundwater reserves that serve as water sources for irrigated agriculture. Critical aquifer systems in places like the Lower Mississippi River Basin (LMRB), the High Plains, and California's Central Valley already face issues of immediate and long-term overdraft associated with expanding irrigated agriculture (USDA, 2014; Konikow, 2015; Schaible and Aillery, 2017). Climate change threatens to accelerate groundwater shortages because more frequent and intense droughts (Rosenberg et al., 1999; 2003; Logan et al., 2010) will diminish natural recharge and make users more reliant on groundwater (Whittemore et al., 2015; Meixner et al., 2016). Although the agricultural use values of groundwater are the dominant ecosystem services guiding management policy decisions, increasing groundwater scarcity makes it more important than ever for policy makers to consider the public's preferences for other ecosystem services, including those with passive-use or non-use value. Since climate change is linked to increased groundwater shortage, perceptions about climate change and prevalent climate change framing in the media could influence people's preferences for groundwater services and how to manage them.

This paper contributes to the literature seeking better understanding of the mechanisms underlying climate change framing effects. In their study focused on policies to reduce GHG emissions, Jones and Song (2014) exposed survey participants to different cultural frames about climate change and then measured the way individuals grouped relevant terms and phrases. They found that cultural cognition and motivated reasoning can explain systematic differences in framing effects related to climate change. Cultural cognition operationalizes Douglas and Wildavsky's (1982) Cultural Theory (CT) of risk perception and describes the hypothesized tendency that people have to perceive risks in relation to personal values (Kahan, 2008). Cultural cognition helps generally to explain public disagreement about the significance of empirical evidence (Kahan et al., 2006; Kahan et al., 2011). The motivated-reasoning model holds that individuals credit evidence in alignment with one's worldview while dismissing that which challenges held values (Kunda, 1990; Lodge and Taber, 2005; Taber and Lodge, 2006). Our study, which was pre-registered with the American Economic Association's (AEA) registry for randomized controlled trials (RCT ID: AEARCTR-0003247), aims to fill existing literature gaps by assessing whether a cultural frame about climate change exerts systematic influence on stated preferences for groundwater services and management.

We elicit stated groundwater preferences in the LMRB using a Choice Experiment (CE) survey conducted in Arkansas. We randomly expose some participants to an individualistic cultural frame about climate change and test for evidence of cultural cognition predicted by motivated reasoning. Following Jones and Song (2014), we use CT (Douglas and Wildavsky, 1982; Thompson et al., 1990) to inform hypotheses about cultural congruence and incongruence. Cultural Theory posits that individuals largely fall into four typologies (individualist, hierarch, egalitarian, and fatalist) of cultural cognition possessing distinct views about nature and that individuals form perceptions that reinforce these worldviews. For example, people with relatively individualistic worldviews will be skeptical of environmental risks because accepting the need to restrict commerce and industry to mitigate environmental risk is incongruent with their held values. In contrast, these types of policy interventions are congruent with egalitarian views about the negative impact of commerce and industry, so egalitarians will perceive greater degrees of environmental risk. Framed messaging in the media would be incongruent to an egalitarian, for example, if it involved framing from the perspective of commerce and industry.

2. SURVEY DESIGN AND METHODS

2.1 CE Design

We elicit groundwater preferences using a CE survey involving outcomes of the Mississippi River Valley Alluvial Aquifer (MRVA) in the LMRB, specifically, in the Delta region of eastern Arkansas. The MRVA is the third most used aquifer in the United States (US) and supports extensive irrigated agriculture, especially water-intensive rice production (USDA-NASS, 2014). We conduct our CE in the state of Arkansas because the state is the largest consumer of water from the MRVA and produces half of all rice grown in the US (USDA-ERS, 2018). Current rates of groundwater withdrawal from the MRVA are unsustainable (Konikow, 2015), and climate change consequences such as drought will exacerbate the problem by increasing withdrawals while simultaneously preventing natural recharge. Aquifer depletion threatens not only irrigated agriculture that is supported by the MRVA, but a range of market and non-market groundwater services. As policy makers weigh the optimal management of groundwater among competing uses and communicate priorities to key stakeholder and the public, evidence of how framing impacts preferences for different groundwater services is valuable.

We use a labelled CE design in which respondents choose among three alternatives for groundwater management, including a surface water infrastructure (SWI) alternative, a cap-and-trade (C/T) alternative, and a status quo (SQ) alternative involving no change to current MRVA groundwater management in Arkansas. We use a C/T groundwater permits marketplace because it is a relevant policy solution thought to demonstrate free-market principles that appeal to individualist cultural types. We include the alternative focused on surface water infrastructure subsidies to offer an alternative that would appeal more to non-individualists, such as egalitarian and hierarch cultural types. Information about each alternative is clearly provided to survey respondents, and they must successfully answer comprehension questions about each alternative before advancing in the survey.

Groundwater service attribute levels indicate MRVA outcomes for the year 2050 and, following Johnston et al. (2016), appear in terms of a percentage of current levels so that 100% indicates no change from current levels. To construct a groundwater scenario with realistic long-term dynamics, attribute levels presented for each alternative represent projections for the year 2050, and levels for the SQ alternative capture the evolving state of groundwater resources if no policy change occurs. We rely on existing hydrologic (Clark et al., 2013) and economic (Kovacs et al., 2015) simulation models to help in setting realistic attribute levels for the SQ alternative. The attributes and levels in our CE are in Table 1.

2.2 Cultural Frame Treatment

We randomly assigned respondents to two groups: a control group without exposure to the frame and a treated group that was provided the individualistic cultural frame about climate change and groundwater before answering the choice questions. We derived the content of our frame's narrative using CT, which measures belief systems along two dimensions known as grid and group (Thompson et al., 1990). The group dimension measures preferred levels of group interaction, while grid measures the degree to which these groups constrain beliefs and behavior (Thompson et al., 1990). Oriented orthogonally, these dimensions define four cultural types possessing distinct views about nature. Hierarchs (high grid, high group) see nature as precariously balanced and requiring skilled managers and experts to maintain stability and avoid calamity. Individualists (low grid, low group) view nature as extremely resilient and able to return to equilibrium as long as events run their natural course. Egalitarians (low grid, high group) view nature as dangerously fragile and susceptible to human activities that could destroy the environment if not undertaken with caution. Finally, fatalists (high grid, low group) see nature as a capricious and random thing and believe that good and bad things will happen no matter what they do (Jones and Song, 2014). Past CT studies have largely excluded fatalists on the grounds that "...the fatalistic solidarity does not motivate people to participate consistently in public debates" (Verweij et al., 2006: 822, as cited in Jones and Song, 2014). This exclusion from past studies makes it difficult to assess congruence and incongruence for the fatalist group. In line with previous studies, we omit the fatalist group from our analysis of CT variants.

Previous research identifies prevalent cultural stories in public discourse that relate to climate change and unique CT types (Ney and Thompson, 2000; Verweij et al., 2006). Jones and Song (2014) used these stories to construct experimental story frame treatments for egalitarian, hierarchical, and individualistic cultural frames. They described three CT stories: "Profligacy: An Egalitarian Story," "Lack of Global Planning: A Hierarchical Story," and "Business as Usual: An Individualistic Story." Each story frame included a setting, plot, characters, and a policy solution (moral), and these were populated with content from the three CT stories. We use the individualistic story from Jones and Song (2014) as a model for the cultural frame in our CE survey. Owing to the complexity of our CE design, sample size feasibility issues prevented us from including hierarchical and egalitarian frames in our experimental design. However, replicating framing treatments for each CT type is not necessary to identify if systematic framing effects predicted by motivated reasoning influence groundwater preferences.

As previously discussed, the motivated-reasoning model predicts the responses to our cultural frame stimulus. Frames draw attention to specific structures (e.g., characters and morals) which we imbue with meaning using CT. These elements generate cultural identifications (e.g., affect from hero characters) that allow individuals to quickly evaluate congruence or incongruence (Jones and Song 2014). We expect to observe two situations in our experiment. First, when an individualist encounters the individualistic frame that is congruent to their held values, we predict these respondents will filter the story favorably and allow its congruent content to inform their groundwater and policy preferences. In particular, we predict that individualists who encounter our frame will have a higher preference for a market-based groundwater policy alternative (Table 2).

2.3 Survey

Because we elicit preferences for policies implemented at the state level, we sample voting-aged residents across the state of Arkansas. Between August 27th and October 17th of 2018, we administered the CE survey using the survey research firm, Qualtrics. In total, 1,966 adult residents of Arkansas voluntarily accessed the internet-based survey from proprietary research panels and other internet sources. We designed the survey to be compatible with both traditional and mobile internet platforms. Respondents uniformly received a financial incentive for participating in the survey.

We randomize the assignment of question blocks and the order in which the choice sets appear in each block. Above each choice set is a reminder that socio-environmental attribute levels decline steadily and then remain constant into the future. The levels of the SQ alternative are fixed, so we place it always in the left most column of the choice set table to make it easy for respondents to compare alternatives across multiple sets. However, we randomize the placement of the columns for the SWI and C/T alternatives to avoid any ordering effects. Respondents assigned to the treatment group see an individualistic cultural frame about climate change following the bulleted groundwater information section of the survey.

Qualtrics filters responses for quality to remove duplicates from a single individual or any observation with a total response time less than one-third the median total response time. Incomplete responses are dropped from the analysis, leaving 1,946 usable survey responses and data for 29,190 choice occasions (each person sees five choice sets, and each choice set includes three choice occasions because there are three alternatives for each choice set). Of these, 8,790 choice occasions come from the 586 individuals in the treatment group who see the cultural frame about climate change, while 20,400 choice occasions come from the 1,360 individuals assigned to the control group. We collected a larger control sample for the purposes of a complementary study.

Addressing our research questions requires knowledge about each respondent's cultural type. We measure cultural type using twelve CT questions (see Appendix C) – three questions for each cultural type: individualist, egalitarian, hierarch, and fatalist (e.g., Dake, 1991; 1992; Wildavsky and Dake, 1990; Herron and Jenkins-Smith, 2006; Jones and Song, 2014) – which were administered prior to the choice sets and randomized. Respondents answer each CT question by placing themselves on a scale from 1 to 7, where 1 is "strongly disagree" and 7 is "strongly agree." Factor analysis of the indicators shows that they load on four unique latent dimensions corresponding to each of the cultural types. We generate factor scores for each cultural type, and the type with the highest factor score is that respondent's cultural type.

3. EMPIRICAL MODEL

The utility function to model our choice data is strictly additive, and the probability that a respondent chooses a particular alternative is a function of the alternative's attributes and levels. A multinomial logit (MNL) specification (McFadden 1974) models this utility for our data involving three alternatives and six attributes, but the MNL's independence of irrelevant alternatives (IIA) property restrictively assumes independence between choice tasks. This is not a realistic assumption for our data. To account for the panel structure of our data and allow attribute correlation within an unobserved portion of utility across alternatives and choice situations, we estimate mixed logit models with random parameters, allowing preferences to vary across individuals (e.g., Revelt and Train 1998, Hensher and Greene 2003). Results of an MNL model using the pooled data set are included in Appendix D and were used as starting values for the simulated maximum likelihood estimations of the mixed logit models. Goodness-of-fit statistics confirm that mixed logit is the preferred model. In estimating random parameters, we model each as a distribution of individual preference coefficients with a mean and standard deviation and estimate standard errors for each.

To analyse the discrete choice data using mixed logit, let the utility for an individual *n* for alternative *j* in choice situation *t* be given by

$$u_{njt} = x'_{njt}\beta_n + \varepsilon_{njt}, \quad (1)$$

where x'_{njt} represents a vector of alternative-specific groundwater service attribute levels including benefits and costs, β_n represents a vector of coefficients that are fixed for an individual across choice situations but vary across individuals, and ε_{njt} is distributed i.i.d. extreme value type I.

Individual *n* chooses alternative *i* in choice situation *t* if $u_{nit} > u_{nmt} \; \forall m \neq i$.

Conditional on β, this probability is the standard logit formula

$$L_{nit}(\beta_n) = \frac{exp(x'_{nit}\beta_n)}{\sum_{j=1}^{J} exp(x'_{njt}\beta_n)}. \tag{2}$$

The conditional probability that individual *n* chooses a sequence of alternatives $(i_{n1}, i_{n2}, \ldots, i_{nT})$ over *T* choice situations is

$$L_n(\beta) = \prod_{t=1}^{T} \left(\frac{exp(x'_{nit}\beta_n)}{\sum_{j=1}^{J} exp(x'_{njt}\beta_n)} \right). \tag{3}$$

We integrate out over all values of β to get the unconditional choice probability,

$$P_n = \int L_n(\beta) f(\beta) d\beta. \tag{4}$$

The log-likelihood function is then,

$$LL(\beta) = \sum_{n=1}^{N} \ln(L_n(\beta) f(\beta) d\beta). \tag{5}$$

Given that there is no closed form of $LL(\beta)$, the probabilities are approximated through simulation. The simulated log-likelihood function is defined as

$$SLL(\beta) = \sum_{n=1}^{N} \ln \left(\frac{1}{R} \sum_{r=1}^{R} \left(\prod_{t=1}^{T} \left(\frac{exp(x'_{nit}\beta_r)}{\sum_{j=1}^{J} exp(x'_{njt}\beta_r)} \right) \right) \right), \tag{6}$$

where β_r are random draws from the density $f(\beta)$, and R is the number of draws.

Our data varied the timing, duration, and magnitude of expenses associated with the cost attribute for purposes related to a separate study (details available on the AEA registry for randomized controlled trials, RCT ID: AEARCTR-0003247). We simplify modeling here by using present-value costs computed with the results of a Convex Time Budget (CTB) questionnaire that we employed in our survey to allow for estimating time preferences (i.e., discount rate). See Andreoni et al. (2015) for a description of the CTB approach.

4. RESULTS

We present in Table 3 the results of the mixed logit models including only main effects and no assumed interactions (specification I). Model I.a shows the results from the pooled data set. We also estimate models using sub-samples defined by CT type. Models I.b (egalitarian), I.c (hierarch), and I.d (individualist) show the results of sub-sample models for each CT type (*sans* fatalist). Table 4 presents the models for specification II where we include interaction effects for the individualistic cultural frame. For each of the pooled and sub-sample models (a, b, c, and d), we test the hypothesis that preferences for those exposed to the cultural frame treatment are equal to preferences for those not exposed (H_0: $\beta^{Narrative} - \beta^{No\text{-}Narrative} = 0$). We compute Likelihood Ratio (LR) tests between the nested models of specification I and specification II (Table 5).

We reject the null hypothesis for the pooled models (I.a and II.a) at the 10% level and conclude that specification II is the preferred model. Results for Model II.a indicate significant and positive mean preferences among the Arkansas population for the SWI policy alternative (ASC2) as well as for groundwater services associated with buffer value, water quality, jobs from agriculture, and infrastructure integrity. The parameter for cost is significant and negative, as theory predicts. Mean preference for the C/T policy alternative (ASC1) is not significantly different from zero. The standard deviation for each of the random parameters is significant, suggesting there is considerable variability in the population with respect to groundwater policy preferences. Though Model II.a is the preferred pooled model, its interaction terms do not provide evidence of significant framing effects on preferences. Accounting for the treatment interaction significantly improves model fit despite the lack of evident effect in the interaction terms. In particular, preference for wildlife services is no longer significant, suggesting that the positive preference for wildlife services indicated in Model I.a could be capturing unaccounted framing effects, to some degree. With substantial variability in preferences across the population and no clear predicted effect, the pooled model may obscure potentially competing influences (e.g., congruence and incongruence) of the individualistic cultural frame exerted upon different cultural types.

By segmenting the population according to CT type, we test for influences of cultural cognition in response to the individualistic cultural frame. The first prediction is that individualist cultural types will exhibit an influence of cultural congruence with the frame that aligns to their own worldview, strengthening related preferences and perhaps weakening others. Based upon the LR test for the individualist models (I.d and II.d) we fail to reject the null hypothesis at any reasonable confidence level and cannot conclude that specification II is preferred over specification I. As with the pooled data, individualists exhibit no evidence of framing effects and consequently no evidence of cultural congruence. Results of Model I.d indicate that individualists show no preference for either policy alternative and value only water quality among the groundwater service attributes. Preferences vary significantly even among individualist cultural types.

The second prediction is that non-individualist cultural types will exhibit the influence of cultural incongruence in response to the individualistic cultural frame. Results of the LR tests show that we reject the null hypotheses for egalitarians (10% level) and hierarchs (1% level) and conclude that specification II is preferred over specification I. This indicates a significant influence from the cultural frame treatment on groundwater preferences, and interaction terms provide evidence for an incongruency effect.

Main effects for Model II.b indicate that egalitarians exhibit significant positive preferences for both C/T and SWI policy alternatives and also significantly value water quality provision and subsidence avoidance (infrastructure integrity). Mean coefficients show greater preference for the SWI alternative compared to C/T, while standard deviations show SWI preferences also vary less widely in the population than do C/T preferences. Model II.c demonstrates that hierarchs value jobs from agriculture and (drought) buffer but possess no preference for either of the proposed policy alternatives. Coefficients for buffer and jobs show mean preferences of similar magnitude, though individual preferences for jobs vary twice as much as preferences for groundwater buffer.

The interaction terms in Model II.b (egalitarians) and Model II.c (hierarchs) provide evidence for a cultural incongruency effect due to cultural framing about climate change. For example, those hierarchs who see the individualistic cultural frame demonstrate significantly lower preference for the "jobs from agriculture" groundwater service compared to hierarchs in the control group. This comports with our prediction that non-individualist types will show diminished preference for attributes related to commerce and industry in response to the incongruent individualistic frame. We also predict that these groups will show increased preference for other groundwater attributes not so directly related to commerce and industry. Model II.c shows that hierarchs in the treatment group do exhibit significantly greater preference for wildlife services relative to the control group. All other interaction terms, including those for the ASC's, indicate no change in preference in response to the treatment frame, still consistent with the theorized prediction for incongruence (Table 2).

Similar framing effects indicating incongruency are evident among egalitarians in Model II.b. In particular, those exposed to the frame show significantly greater preference for groundwater buffer. Preference for jobs does not differ from those in the control group. As with hierarchs, all other interaction terms indicate no change in preference owing to the treatment.

5. DISCUSSION AND CONCLUSIONS

This paper offers some of the first evidence into how climate change framing influences policy preferences for managing critical resources impacted by climate change. In particular, we show that framing and cultural values can influence in predictable ways people's preferences for responding to groundwater shortage, a problem exacerbated by climate change.

We find that egalitarian types and hierarch types demonstrate evidence of a cultural incongruency effect in their groundwater preferences in response to an individualistic cultural frame. Hierarchs show strengthened preference for wildlife service provision and lower preference for the provision of jobs from agriculture. Egalitarians show greater preference for groundwater buffer. On the other hand, we fail to confirm the hypothesis that individualist types demonstrate a cultural congruency effect in response to the same frame. This could be evidence that people respond more strongly to incongruence than to congruence in the case of groundwater policy preferences. Another possible explanation is that the C/T policy alternative might not be completely congruent with the individualistic worldview, limiting the congruency effect. In particular, the government cap on groundwater pumping that facilitates the C/T permit market could run counter to individualist preferences, as the status quo essentially allows limitless pumping from the aquifer. Based on the results of the ASCs for the two policy preferences, only egalitarians clearly prefer a new policy to manage groundwater use beyond the status quo, so there is no clear evidence that individualists prefer a C/T alternative. Another potentially important implication relates to the findings that hierarch types respond to individualistic framing with increased preference for wildlife services. Because these services support popular fishing and water fowl sports in the region, hierarch types in particular are perhaps more resolute in valuing the protection of these services when presented with free-market policy arguments.

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Table 1. Choice Experiment attribute definitions and levels

Attribute	Definition	Levels†
Buffer Quantity	The percentage of current acres with adequate groundwater for 5 consecutive drought years	25%‡, 40%, 55%, 70%
Water Quality	The percentage of current acres with adequate groundwater quality for irrigation	75%‡, 80%, 85%, 90%
Jobs from Irrigated Agriculture	The percentage of current (120,000) jobs	80%‡, 90%, 100%, 110%
Wildlife Diversity & Abundance	The percentage of current wildlife diversity and abundance	75%‡, 80%, 85%, 90%
Infrastructure Integrity	The percentage of current infrastructure integrity	75%‡, 80%, 85%, 90%
Cost to Household (lump)^	The one-time dollar increase in state income taxes	$0‡, $30, $90, $150, $210, $270
Cost to Household (perpetual)^	The permanent dollar increase in state income taxes	$0‡, $12, $24, $36, $48, $60

† Levels indicate outcomes for the year 2050 and 100% indicates no change from current levels.

‡ Indicates status quo level

^ We varied the timing and magnitude of the cost attribute for purposes related to a separate study (details are available on the AEA registry for randomized controlled trials, RCT ID: AEARCTR-0003247). We compute present-value costs for each respondent using the results of a Convex Time Budget (CTB) questionnaire that we employed in our survey to allow for estimating individual discount rates (Andreoni et al., 2015).

Table 2. Predicted framing treatment effects on policy preferences and groundwater service preferences

Policy Preferences	
CT Variant	Hypothesis – Narrative Influence
Egalitarian	No change or lower preference for market-based alternative. No change or greater preference for subsidized surface water infrastructure alternative
Hierarch	No change or lower preference for market-based alternative. No change or greater preference for subsidized surface water infrastructure alternative
Individualist	Greater preference for market-based alternative. No change or lower preference for subsidized surface water infrastructure alternative

Groundwater Service Preferences	
CT Variant	Hypothesis – Narrative Influence
Egalitarian	No change or lower preference for groundwater services related to commerce and industry (jobs from agriculture). No change or greater preference for social and environmental services (buffer, water quality, wildlife habitat, infrastructure integrity).
Hierarch	No change or lower preference for groundwater services related to commerce and industry (jobs from agriculture). No change or greater preference for social and environmental services (buffer, water quality, wildlife habitat, infrastructure integrity).
Individualist	Greater preference for groundwater services related to commerce and industry: jobs from agriculture. No change or lower preference for social and environmental services (buffer, water quality, wildlife habitat, infrastructure integrity)

Table 3. Results of the mixed logit choice models: specification I

Parameter†	I.a (pooled)	I.b (egalitarian)	I.c (hierarch)	I.d (individualist)
ASC1 (C/T)	0.0015 (0.1813)	1.1714*** (0.3977)	-0.0677 (0.4190)	-0.5770 (0.4850)
Standard deviation (SD)	3.1648*** (0.2449)	3.2741*** (0.6194)	3.5999*** (0.6566)	4.4548*** (0.6824)
ASC2 (SWI)	0.3887** (0.1766)	1.6696*** (0.3863)	0.3853 (0.4178)	-0.0526 (0.4673)
SD	2.9430*** (0.2682)	2.9235*** (0.6283)	3.5294*** (0.6185)	4.2723*** (0.6970)
Buffer	0.0079*** (0.0019)	0.0061 (0.0042)	0.0123*** (0.0044)	0.0055 (0.0049)
SD	0.0113*** (0.0033)	0.0241*** (0.0053)	0.0203* (0.0105)	0.0191*** (0.0069)
Quality	0.0254*** (0.0056)	0.0187 (0.0121)	0.0222* (0.0124)	0.0515*** (0.0169)
SD	0.0551*** (0.0111)	0.0813*** (0.0212)	0.0390* (0.0219)	0.1544*** (0.0232)
Jobs	0.0089*** (0.0031)	0.0016 (0.0065)	0.0130* (0.0072)	0.0068 (0.0082)
SD	0.0153** (0.0075)	0.0331*** (0.0106)	0.0334* (0.0188)	0.0556*** (0.0113)
Infrastructure	0.0136*** (0.0049)	0.0244** (0.0098)	0.0099 (0.0113)	0.0190 (0.0129)
SD	0.0559*** (0.0086)	0.0524*** (0.0159)	0.0679*** (0.0173)	0.0703*** (0.0231)
Wildlife	0.0095** (0.0048)	0.0071 (0.0099)	0.0047 (0.0111)	0.0138 (0.0130)
SD	0.0373*** (0.0106)	0.0626*** (0.0190)	0.0408*** (0.0155)	0.0624** (0.0286)
Cost	-0.0056*** (0.0003)	-0.0069*** (0.0008)	-0.0074*** (0.0008)	-0.0089*** (0.0010)
Log L	-8835.6	-1940.2	-1972.0	-1886.8
N	29190	6690	7695	6570
AIC	17743.2	3952.4	4016.0	3845.6

† Standard Errors are given in parentheses

*significant at 10%, **significant at 5%, ***significant at 1%

Table 4. Results of the mixed logit choice models with treatment interactions: specification II

Parameter†	I.a (pooled)	I.b (egalitarian)	I.c (hierarch)	I.d (individualist)
ASC1 (C/T)	0.0658 (0.2034)	0.9229* (0.4748)	-0.1236 (0.4730)	-0.4604 (0.5457)
Standard deviation (SD)	2.9537*** (0.2524)	3.3963*** (0.6184)	3.5235*** (0.5956)	4.2716*** (0.6922)
ASC2 (SWI)	0.4760** (0.2018)	1.4948*** (0.4513)	0.4214 (0.4728)	0.1092 (0.5317)
SD	2.9726*** (0.2643)	2.7993*** (0.6390)	3.5864*** (0.5952)	4.2062*** (0.7092)
Buffer	0.0059*** (0.0022)	0.0011 (0.0050)	0.0130** (0.0052)	0.0037 (0.0054)
SD	0.0099*** (0.0028)	0.0249*** (0.0057)	0.0263*** (0.0058)	0.0139** (0.0064)
Quality	0.0230*** (0.0065)	0.0245* (0.0146)	0.0198 (0.0144)	0.0522*** (0.0187)
SD	0.0584*** (0.0103)	0.0855*** (0.0226)	0.0428* (0.0219)	0.1400*** (0.0221)
Jobs	0.0075** (0.0035)	-0.0018 (0.0079)	0.0183** (0.0086)	0.0047 (0.0091)
SD	0.0175*** (0.0050)	0.0376*** (0.0114)	0.0436*** (0.0105)	0.0456*** (0.0133)
Infrastructure	0.0105* (0.0055)	0.0291** (0.0120)	0.0028 (0.0130)	0.0187 (0.0147)
SD	0.0417*** (0.0089)	0.0558*** (0.0158)	0.0695*** (0.0167)	0.0683*** (0.0241)
Wildlife	0.0061 (0.0056)	0.0100 (0.0120)	-0.0137 (0.0127)	0.0069 (0.0145)
SD	0.0452*** (0.0094)	0.0672*** (0.0200)	0.0445*** (0.0173)	0.0597** (0.0261)
ASC1 x Narrative	0.2943 (0.3308)	0.4631 (0.7805)	0.7006 (0.7848)	-0.3452 (0.8909)
ASC2 x Narrative	0.1303 (0.3319)	0.2866 (0.7442)	0.5300 (0.7874)	-0.6083 (0.8851)
Buffer x Narrative	0.0034 (0.0034)	0.0189** (0.0083)	-0.0053 (0.0086)	0.0046 (0.0089)
Quality x Narrative	-0.0009 (0.0101)	-0.0170 (0.0234)	-0.0081 (0.0227)	-0.0025 (0.0296)
Jobs x Narrative	-0.0004 (0.0056)	0.0145 (0.0128)	-0.0268* (0.0139)	0.0067 (0.0150)
Infrastructure x Narrative	0.0048 (0.0085)	-0.0131 (0.0196)	0.0186 (0.0208)	0.0028 (0.0225)
Wildlife x Narrative	0.0088 (0.0087)	-0.0053 (0.0194)	0.0659*** (0.0201)	0.0210 (0.0227)
Cost	-0.0056*** (0.0003)	-0.0070*** (0.0008)	-0.0077*** (0.0008)	-0.0088*** (0.0010)
Log L	-8829.6	-1934.1	-1961.6	-1884.4
N	29190	6690	7695	6570
AIC	17745.2	3954.3	4009.2	3854.8

† Standard Errors are given in parentheses

*significant at 10%, **significant at 5%, ***significant at 1%

Table 6. Results of Likelihood Ratio tests between specifications I and II

Hypotheses (H_0: $\beta^{Narrative} - \beta^{No-Narrative} = 0$)	χ^2 (p-value)	Conclusion
Pooled	12.07 (p=0.098)	Reject (at 10%)
Egalitarian	12.18 (p=0.095)	Reject (at 10%)
Hierarch	20.88 (p=0.004)	Reject (at 1%)
Individualist	4.83 (p=0.681)	Fail to reject