# Study 1

**Introduction**

The purpose of Study 1 was to directly test how manipulating social consensus affects contemporary polarized beliefs. One goal was to determine if the social consensus manipulation, adapted from a similar scientific/social consensus manipulation by Keiichi Kobayashi (2018), would successfully generalize to an American audience. Additionally, we wanted to replicate the effects of this manipulation on a series of topics chosen explicitly for their perception of polarization in America (UHC, climate change, capital punishment), which diverges significantly from the original set of topics Kobayashi chose to use (climate change, blood type personality, nuclear power, and whale research).

**Method**

Study 1 analyzed the effects of social consensus using a within-subjects design. Participants were randomly assigned to either the low or high social consensus manipulation condition. Information about social consensus was presented for all four highly polarized issues. The primary outcome, attitude towards each topic, was measured both before and after presentation of social consensus information. The Institutional Review Board at the University of Missouri reviewed and approved all submitted materials for Study 1.

***Participants***

A total of 505 undergraduate students 18 years of age or older at the University of Missouri participated in this study. Participants were recruited through an online survey platform and were offered psychology course credit in exchange for their participation. Participants were asked to select categories that best described their race/ethnicity. Participants self-identified as: White (77%), Black (5.3%), Hispanic (6.7%), Asian (5.1%), Native American (0.39%), ‘other’ (2.4%), or ‘prefer not to say’ (1.8%). Participants also self-selected their preferred gender identity; 63.6% participants identified as ‘Female’, 33.5% ‘Male’, 1.4% ‘Gender Variant or Nonconforming’, and 1.6% ‘prefer not to say’. They ranged in age from 18 to 39 years (*M* = 18.9, *SD* = 1.99).

***Materials and Procedure***

To manipulate the perception of social consensus, participants were randomized into a ‘high social consensus’ or ‘low social consensus’ condition. Participants were first asked to estimate the proportion of the US population in 2018 that would be in support of each of the four issues (Climate Change, Universal Health Care, Death Penalty, and Slavery). Then, participants were given information about social consensus on each of these four issues. In both conditions, participants were given feedback consisting of the base rate of support that the general American public (in 2018) had for each topic. Except for the topic of slavery, participants in the ‘high social consensus’ condition saw results that were 20% higher than the true base rate, and participants in our ‘low social consensus’ condition saw results that were 20% lower than the true base rate. For example, if 65% of Americans agree that the Death Penalty is necessary in the US, the high social consensus condition would be told that 85% agree, and the low social consensus condition would be told that 45% agree. There was no manipulation of perception of support regarding the topic of slavery, due to potential ethical concerns.

After the social consensus information, participants were asked to indicate their degree of surprise with the stated level of public support and estimate levels of public levels support in 2023. Participants were then asked to identify their level of support for each topic. Next, participants completed individual difference measures on deontological and utilitarian orientation. Utilitarian reasoning can be defined as ethical judgement based on outcomes, not intentions. Likewise, deontological reasoning can be defined as ethical judgement based on whether or not behavior adheres to a preconceived set of ‘rules’, this includes concepts like ‘rights’, ‘ideals’, and explicitly recorded law. Finally, participants provided demographic information; see Appendix A for a complete listing of Study 1 materials.

***Measures***

**Primary Outcome.** Participant support for each topic was captured as continuous variable ranging from strong disagreement (0) to strong agreement (100) with the following statements: 1) “Greenhouse gas emissions generated by human activity has and will continue to change Earth's climate” (*Climate Change*); 2) “The US government needs to implement Universal Health Care because basic population needs are not being met.” (*Universal Health Care*); 3) “Capital Punishment (the Death Penalty) is necessary in the US” (*Death Penalty*), and 4) “Slavery, forced labor, and human trafficking are violations of human rights.” (*Slavery*).

This scale was included as a potential moderator of social consensus manipulation because prior research on the interaction between social consensus and deontology indicates that higher levels of deontological orientation results in less conformation to social consensus (Brady and Wheeler, 1996; Pincus, 2014). Six items measure deontological orientation (e.g., “Solutions to ethical problems are usually black and white”), and six items measure utilitarian orientation (e.g., “When people disagree over ethical matters, I strive for workable compromises”). Participant agreement with these statements was measured with 5-point Likert scales ranging from ‘Strongly Disagree’ (1) to ‘Strongly Agree’ (5). Each six-item subscale showed satisfactory internal consistencies with Cronbach’s α of .783 (deontology) and .750 (utilitarianism). Additionally, please see Appendix D, section 1, for further details and analysis regarding secondary outcomes and other individual difference measures in Study 1.

***Power and Statistical Analysis***

A minimum sample of 158 participants was needed to achieve 95% power for a linear multiple regression with the following parameters: ANOVA, repeated measures, between factors, an effect size of .25, an alpha of .05, two groups, two measurements, and .5 correlation among repeated measures. Power was determined a-priori using G-power 3.1.9.7 (Faul, Erdfelder, Lang, and Buchner, 2007; Faul, Erdfelder, Buchner, and Lang, 2009). Support for [topic] was treated as a continuous variable. We examined the effects of experimental condition (high or low social consensus) and individual differences (deontological and utilitarian orientation, health literacy, multiple measures of numeracy) on our outcome measure. We examined the main effect, as well as interactions between deontology and utilitarianism with our experimental conditions for our predictors. All tests were conducted in R and considered statistically significant when P <.05. We used R version 4.4.1 (R Core Team 2024).

***Study 1 Hypothesis***

We predicted that there would be a significant condition x time interaction (H1), such that there would be no difference between conditions at baseline, but an increase in support for high social consensus at time 2 (and a decrease for low social consensus).

**Results**

We tested our hypothesis with a series of within-subjects analysis of variance (ANOVA) models comparing support for our topic both before and after our social consensus manipulation. Each of our four ANOVA models was composed of our dependent variable (quantified as level of support for our issues), with the interaction of time and condition, as well as the simple effects of numeracy (subjective and objective), utilitarian orientation, deontological orientation, and health literacy as our predictors. To test H1, Study 1 used a 2 (pre-post) x 2 (high or low social consensus condition) mixed-subjects design, where condition was a between-subjects factor. Time was a within-subjects factor with the primary outcome, support for a topic, measured before and after participants completed the control or intervention condition.

***Social Consensus Manipulation***

In support of H1, there was a significant time x condition interaction, such that there was greater increase over time in support for the polarized issues in the high social consensus condition compared to the low social consensus condition. This pattern repeated itself across all three of our manipulated topics (UHC, capital punishment, climate change).

We observed a statistically significant linear main effect for our social consensus condition for 1) UHC, (ß = -8.688, *p* < 0.01); 2) capital punishment, (ß = -9.151, *p* < 0.01); and 3) climate change, (ß = -4.069, *p* < 0.01). Across all topics, the high social consensus condition caused more support, and the low social condition caused less support. We also observed a statistically significant linear main effect of time for UHC, (ß = -5.060, *p* = 0.0218), but not for capital punishment, (ß = -4.466, *p* = 0.086) or climate change, (ß = -2.637, *p* = 0.136). Most importantly, there was a statistically significant two-way interaction between the linear effect of time and condition, for 1) UHC, (ß = 7.600, p = 0.015), capital punishment, (ß = 8.238, p = 0.025); and 3) climate change, (ß = 5.614, p = 0.025). This clearly indicates that there is a differential effect of the intervention based on which social consensus condition the participants received. Additionally, see figure 1 below, illustrating this pattern of effects from pre- to post- intervention.

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| --- | --- | --- | --- |
| Fig. 1 - Data expressed as mean (SD) | | **IV 2: Social Consensus Condition** | |
| High Social Consensus | Low Social Consensus |
| **IV 1: Time** | Pre-Manipulation | UHC: 68.90 (25.24) | UHC: 67.43 (26.74) |
| Capital punishment: 40.94 (30.14) | Capital punishment: 40.60 (28.91 |
| Climate change: 76.01 (22.82) | Climate change: 77.81 (20.28) |
| Post-Manipulation | UHC: 72.96 (24.30) | UHC: 64.90 (27.18) |
| Capital punishment: 45.40 (32.12) | Capital punishment: 36.84 (28.72) |
| Climate change: 78.65 (21.45) | Climate change: 74.83 (22.93) |

A graph with purple dots and black lines

Description automatically generated with medium confidence

***Discussion***

The results for Study 1 are consistent with the prior literature on the effect of social conformity. The manipulation of social consensus (whether in support or opposition of a position) resulted in a small but significant increase in alignment with that consensus. Methodologically speaking, one major area of concern that was not addressed in this study was alternative methods for manipulation of support for a given topic. While manipulation of social consensus was effective, there are real concerns about the ethics of presenting a ‘false consensus’ in the process of informing and shaping public opinion. In practice, several other axes of behavior exist that have potential to be leveraged to change public support for contemporary topics. Many extremely polarizing topics are felt with ‘moral conviction’, thus, it seems to be a plausible direction to manipulate perspective change. Finally, all three manipulated topics for Study 1 were chosen due to prior literature indicating the topic as highly polarized (climate change, capital punishment) or because there is plausible reason to believe ethical concerns would affect the issue (Universal Health Care). However, we have not looked at how manipulations that can lead to perspective change could be different in the context of a ‘non-polarized’ topic. Therefore, we planned to incorporate an intentionally ‘non-polarized’ topic for our next study. With these issues in mind (manipulating moral conviction, choosing a non-polarized topic), Study 2 was initiated.

# Study 2

**Introduction**

The purpose of Study 2 was to directly test how manipulating moral conviction affects support for polarized beliefs. One goal was to determine if the moral conviction manipulation, adapted from Kodapanakkal (2021) and Clifford (2019) would be successful for a series of topics chosen explicitly for their perception of polarization in America (UHC, climate change, capital punishment), as well as an explicitly non-polarized topic (exercise), which diverges significantly from the original topics used by Kodapanakkal (crime-surveillance technologies and hiring algorithms) and Clifford (genetically modified food, factory farming). The four topics selected were designed to vary in the baseline level of attitude strength and polarization; climate change and capital punishment are known to be issues that society views with significant attitude strength and polarization, exercise is seen as an issue with weak attitude strength that is non-polarized, and UHC was chosen as an issue that plausibly has polarization, but has not been explicitly examined through that lens in prior literature (Wright et al., 2008; Stein, 2017; Bump, 2015). Additionally, we wanted to determine which of the four different moral conviction manipulations would have the greatest effect on changing perceptions of moral conviction. Finally, we wanted to see if the moral conviction manipulations would affect non-polarized belief (e.g., exercise) differently from the three polarized beliefs.

**Method**

Study 2 analyzed the effects of the moral conviction manipulation on polarized and non-polarized beliefs using a between-subjects design. Participants were randomly assigned to either one of four moral conviction manipulations: 1) Moral Responsibility, 2) Moral Piggybacking, 3) Pragmatic, 4) Hedonic, or a control condition. Each of the experimental conditions framed the benefits of a given perspective using either objective moral value, personal economic value, or personal enjoyment value. The primary outcome, support for a given topic, was measured after presentation of the moral conviction manipulation. The Institutional Review Board at the University of Missouri reviewed and approved all submitted materials for Study 2.

***Participants***

A total of 208 undergraduate students 18 years of age or older at the University of Missouri participated in this study. Participants were recruited through an online survey platform and were offered psychology course credit in exchange for their participation. For this study, we did not collect any demographic information.

***Materials and Procedure***

For each of our four issues (UHC, climate change, capital punishment, and exercise), participants in our experimental conditions were asked to read a short essay and then respond to a series of survey questions; Participants in our control condition were not asked to read any essay and instead were directly provided with the survey questions. To manipulate the perception of moral conviction, participants were randomly assigned to receive one of five conditions: 1) control, 2) moral responsibility, 3) moral piggybacking, 4) pragmatic, 5) hedonic; See Appendix B for the text of all five conditions. Thus, each participant in our experimental condition would be provided with four essays, one for each topic, that all share the same moral framing.

Participants in the ‘moral responsibility’ condition were given essays that consisted of language emphasizing moral concepts such as ‘obligation’ or ‘responsibility’ and explicitly emphasizing moral costs and benefits. Participants in the ‘moral piggybacking’ condition were given essays that directly linked the topic to another commonly understood moral concept, such as ‘freedom of speech’, justice for all’, or the ‘inherent value of human life’. Participants in the ‘pragmatic’ condition were given essays that directly highlighted the personal economic and rational benefits, such as reduced taxes, increased income, or increased health. Participants in the ‘hedonic’ condition were given essays that emphasized personal enjoyment or pleasure-based benefits such as ‘improved mood and health’ or ‘visiting a beautiful beach’. All essays were readable at a high school level, as assessed by a Flesh-Kincaid readability score. Additionally, essays within categories had comparable word counts.

***Measures***

**Primary outcome.** Moral conviction was assessed using eight items which were selected from prior work on the topic, scored as an average. The first three elements of the measure reflect a ‘lay understanding’ of moral conviction, that assesses not just a person’s personal attitude about a topic, but their perception of moral conviction for that topic in general (e.g., [topic] could be described as a moral issue). The last five elements of the measure assess whether or not the individual themselves sees their stance on an issue as based on morality (e.g., My attitude about [topic] is a reflection of my core moral beliefs and convictions). All items were captured as continuous variables ranging from strong disagreement (-50) to strong agreement (50). In addition, participant support levels for each issue were captured using similar methods to Study 1, except support was scored from strong disagreement (-50) to strong agreement (50) with the following statements: 1) “Greenhouse gas emissions generated by human activity has and will continue to change Earth's climate” (c*limate change*); 2) “The US government needs to implement Universal Health Care because basic population needs are not being met.” (*UHC*); 3) “Capital Punishment (the Death Penalty) is necessary in the US” (*capital punishment*), and 4) “Regular exercise is necessary for Americans.” (e*xercise*).

**Secondary Outcomes.** Openness to belief change on each issue was assessed with a single item direct measure (e.g., How open are you to changing your mind about [topic]). Participant agreement with this statement was measured on a continuous scale ranging from extremely unlikely (-50), to extremely likely (50). Participant’s perception of essay persuasiveness was assessed likewise assessed with a single item direct measure (e.g., How persuasive was the above essay on your beliefs regarding [topic]). Agreement with this statement was measured on a continuous scale ranging from extremely unpersuasive (-50), to extremely persuasive (50).

***Power and Statistical Analysis***

A sample size of 157 was determined using G-power 3.1.9.7 with the following parameters: ANCOVA – an effect size of .35, an alpha of .05, and a power of .95. Support for the four beliefs that were surveyed (climate change, death penalty, UHC, exercise) was treated as a continuous variable. We examined the effects of experimental condition (four moral conviction intervention conditions and a control) on our outcome measures. We examined the main effect. All tests were conducted in R and considered statistically significant when P <.05. We used R version 4.4.1 (R Core Team 2024) and the following R packages: data.table v. 1.16.0 (Barrett et al. 2024), emmeans v. 1.10.4 (Lenth 2024), gdata v. 3.0.1 (Warnes et al. 2024), gtable v. 0.3.5 (Wickham and Pedersen 2024), gtsummary v. 2.0.2.9009 (Sjoberg et al. 2021), hrbrthemes v. 0.8.7 (Rudis 2024), janitor v. 2.2.0 (Firke 2023), knitr v. 1.48 (Xie 2014, 2015, 2024), lme4 v. 1.1.35.5 (Bates et al. 2015), MASS v. 7.3.60.2 (Venables and Ripley 2002), mediation v. 4.5.0 (Imai, Keele, and Yamamoto 2010; Imai, Keele, and Tingley 2010; Imai et al. 2010, 2011; Imai and Yamamoto 2013; Tingley et al. 2014), mgcv v. 1.9.1 (S. N. Wood 2003, 2004, 2011; S. N. Wood et al. 2016; S. N. Wood 2017), modelsummary v. 2.2.0 (Arel-Bundock 2022), multcomp v. 1.4.26 (Hothorn, Bretz, and Westfall 2008), psych v. 2.5.3 (William Revelle 2025), quantreg v. 5.98 (Koenker 2024), reshape2 v. 1.4.4 (Wickham 2007), rmarkdown v. 2.28 (Xie, Allaire, and Grolemund 2018; Xie, Dervieux, and Riederer 2020; Allaire et al. 2024), sensemakr v. 0.1.6 (Cinelli, Ferwerda, and Hazlett 2024), texreg v. 1.39.4 (Leifeld 2013), tidyverse v. 2.0.0 (Wickham et al. 2019), webshot2 v. 0.1.1 (Chang 2023).

***Study 2 Hypothesis:***

Our first hypothesis (H1) predicted that the moral conviction manipulation would be a significant predictor of support for our four topics (e.g., our hypothesis had no *a-priori­* directional effect), as compared to the control condition. Additionally, our second hypothesis (H2) is that the moral piggybacking and moral responsibility interventions would increase moral conviction relative to the control, and that the pragmatic and hedonic interventions would decrease moral conviction relative to the control.

**Results**

We tested both hypotheses with an ANCOVA model comparing our outcome measure (support or level of moral conviction for [topic]) after our moral conviction manipulation. Significant differences will be explored further with Tukey’s HSD test.

***Moral Conviction Manipulation – Support for [Topic]***

Each of our four ANCOVA models was composed of our dependent variable (quantified as level of support for our issues), with condition and openness to belief change as our ‘simple effect’ predictors. To test H1, we conducted an ANCOVA model with our moral conviction manipulation as a between-subjects factor.

There was mixed support for H1, as our moral conviction manipulation had no main effect on support for: 1) UHC, (*F* (4, 198) = 0.235, *p* = 0.918); 2) capital punishment, (*F* (4, 201) = 0.901, *p* = 0.464); 3) climate change, (*F* (4, 199) = 0.364, *p* = 0.834); or 4) exercise, (*F* (4, 200) = 1.442, *p* = 0.222). However, there was a significant main effect of openness to belief change on support for UHC (*F* (1, 198) = 6.825, *p* < .001) and exercise (*F* (1, 200) = 2.819, *p* < .01). Further examination indicated that the homogeneity of variance assumption was violated, as the ‘experimental condition’ x ‘openness to belief change’ interaction was significant for the topic of UHC (*F* (4, 198) = 3.924, *p* < .01). Given that this assumption was violated, we re-examined this data with a multiple regression model instead, predicting support for our topic with the predictors of experimental condition, ‘openness to belief change’, and their interaction. For the topic of UHC, we found a significant main effect of openness to belief change (ß = 0.3919, *p* < .01) and the pragmatic condition (ß = 11.816, *p* < .05), as well as significant interactions between openness to belief change and the pragmatic conditions (ß = -0.5181, *p* < .01).

***Moral Conviction Manipulation – Level of Moral Conviction Regarding [Topic]***

Each of our four ANCOVA models was composed of our dependent variable (quantified as level of moral conviction regarding [topic]), with condition and openness to belief change as our ‘simple effect’ predictors. We also plan on examining the interaction of ‘condition’ and ‘openness to belief change’ to test the homogeneity of variance assumption. To test H2, we conducted an ANCOVA model with our moral conviction manipulation as a between-subjects factor.

There was no support for H2, as our moral conviction manipulation had no main effect on moral conviction felt for: 1) Universal Health Care, (*F* (4, 196) = 1.76, *p* = 0.138); 2) Capital Punishment, (*F* (4, 196) = 0.507, *p* = 0.731); 3) Climate Change, (*F* (4, 196) = 1.335, *p* = 0.258); or 4) Exercise, (*F* (4, 196) = 0.376, *p* = 0.826). Experimental conditions resulted in no differences in level of moral conviction regardless of the topic. However, there was a significant effect of openness to belief change on moral conviction for: 1) Climate Change (*F* (1, 199) = 5.276, *p* < 0.05) and 2) Capital Punishment (*F* (1, 201) = 4.847, *p* < .05), such that greater openness to belief change predicted greater perceived moral conviction.

***Discussion***

The results for Study 2 provide evidence of two main points. First, we were able to find that in some cases, our moral conviction manipulation had a significant interaction with openness to belief change, predicting increased support for a [Topic]. However, this evidence was mixed, as our moral conviction manipulation itself did not have a main effect on support for the topics. Notably, we did see that openness to belief change did have a significant main effect. Secondly, we found mixed evidence supporting H2, namely, that while our moral conviction manipulation did not directly affect moral conviction towards the topic, the individual difference of greater openness to change did accurately predict increased moral conviction. Furthermore, we found a novel result indicating that the topic of UHC had significantly greater openness to belief change.

The next step is to empirically test the relationship between moral conviction and social consensus. Study 3 was designed to examine whether the effectiveness of social consensus can be increased by decreasing moral conviction, and conversely, if experimentally ‘inoculating’ individuals against the effect of social consensus can be achieved through increasing perceived moral conviction.