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AN EXPLORATION AND EVALUATION OF CHOICE ARCHITECTURE INTERVENTIONS ON PERCEPTIONS OF JUSTICE

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Abstract

Justice has been argued to be a key ethical principle guiding interactions with other humans. The principle is embedded in the professional ethics code for the American Psychological Association and other professional organizations. In this thesis, I provide some evidence that prominent interventions aimed at helping people make better decisions are perceived as less just than others, and thereby do not fully respect the principle of justice. My studies are the first to suggest that a popular nudging strategy, framing, doesn't reliably perform better than the control (i.e., not receiving a positive or negatively framed message). However, well-constructed educational interventions often increase perceptions of justice, thereby respecting the principle of justice more fully. Study 1 was devoted to developing a measure of perceptions of 4 key types of justice (i.e., distributive, procedural, informational, and interpersonal). These perceptions of justice were contextualized in the plastic recycling domain. In Studies 2 and 3, I use the perceptions of justice measure created in Study 1 to measure (potentially differential) perceptions of justice of a hypothetical recycling company between two choice architecture interventions: framing nudges and education interventions. Results suggest that there may be both practical (e.g., lower satisfaction) and ethical (e.g., lower perceptions of justice) costs associated with framing nudge interventions that are not present in education interventions. Findings such as these may begin to justify more thorough evaluations of choice architecture interventions, including both practical (e.g., satisfaction) and ethical (e.g., perceptions of justice, among other values) considerations. I close by outlining this evaluation through Ethical Interaction Theory and discuss the tangible costs associated with perceptions of *injustice*.

Introduction

Justice has been held to be one fundamental value for evaluating human interactions. Justice has been thought to be relevant to evaluations in numerous areas including legal settings (e.g., what a just punishment is), social settings (e.g., what a just relationship is), business settings (e.g., what just compensation is), and the military (e.g., what a just war is). Entire bodies of literature have explored what justice is in each of those settings (Bekoff, 2017; Leventhal, 1980; Luban, 1980; van Ginneken & Hayes, 2017). However, the importance of justice is not limited to theory. There is a practical bite to understanding justice. Justice is at the heart of many professional codes of conduct including the American Psychological Association's General Ethical Principle D (Justice) (American Psychological Association, 2017). Issues involving justice are supposed to, at least in part, guide how professional psychologists interact with participants, structure their research, and guide what permissible conduct is. As these points illustrate, understanding and promoting justice is one core value concerning how to ethically interact with each other.

In this thesis, I identify, quantify, and evaluate interventions concerning perceptions of justice. Along the way, I'll review some theoretical reasons why justice has been thought to be important, identify some potentially useful ways to measure key elements of common conceptions of justice, and demonstrate that some of the theoretical reasons why justice has been thought to be important have some empirical support. I'll also suggest that in behavioral sciences, justice, especially as it applies to interventions to help people make better decisions, has often been overlooked. I will then use some of the principles and techniques offered by Ethical Interaction Theory to develop and test how interventions can influence perceptions of

justice not about the intervention itself (e.g., default nudge) but about the target of the intervention (e.g., the entity using the default nudge). Study 1 sought to develop a measure of perceptions of justice in which a four-factor structure was identified using exploratory, then confirmatory, factor analyses. The factor structure developed in Study 1 was conceptually supported by and derived from the literature. Study 2 used the measure developed in Study 1 to compare perceptions of justice of a hypothetical plastic recycling company between two different choice architecture interventions: education and framing nudges. Study 3 replicates and extends the findings of Study 2. Results from Study 2 and Study 3 suggest education interventions may be practically and ethically preferential to framing nudge interventions. I'll close by discussing some of the implications of these studies, how they can fit into an integrated Ethical Interaction theory, and offer some directions for future research.

Ethical Interactions

The decision sciences offer powerful and robust tools to influence people's decisions. These tools have been successfully deployed to help people in a variety of ways ranging from investing more in retirement savings to eating healthier foods (Benartzi & Thaler, 2013; Bucher et al., 2016). Often, one assumption is that these interventions are good and ethically permissible because they promote a decision that increases the chances of obtaining some good. After all, it seems reasonable to assume that investing in retirement and eating healthy foods are good because one would have more money or better health and almost all people want those things.

However, some care needs to be taken to clearly articulate what makes a "better" decision a better decision. To help illustrate some problems identifying what "better" decisions are, I will use some basic models in decision-making. Baron (2004) outlined a potential model of

decision-making where two main variables guide our decisions: beliefs and desires/values (Baron, 2004). Beliefs can be characterized as contentful mental representations of some state of the world (Pitt, 2022). For example, one can hold a true belief that Earth has one moon. This belief represents the world in some way (i.e., in a way in which the Earth has one moon). This belief would no longer be true if it was maintained in a world where the Earth did not have one moon (e.g., no moons, or more than one moon). Desires can be characterized as motivating factors to bring about some state of affairs (Schroeder, 2006). For example, I might desire a cup of coffee in the morning. So, that desire might motivate me to make a cup of coffee. Often, desires and values can be thought to be intimately connected. The way I will use the term 'value' is that a value is anything on which a meaningful comparison can be made (Chang, 1997). For example, I might desire the welfare of children more strongly than I desire the welfare of rocks. Here, a meaningful comparison can be made between the strength of my desire for children and rock welfare. On this definition, all desires are values (i.e., they can be stronger or weaker) but not all values are desires. If desires are motivational states, then there will be plenty of things that are values that do not involve motivational states (e.g., height of the Leaning Tower of Pisa; average temperature on Mars).

Philosophically, beliefs and desires are key components to decisions that generate intentions to act, and beliefs and desires factor into some models of the psychology of decision-making (Baron, 2004; Mele, 1989; Weirich, 2004). For example, if one *values* personal health, has a *belief* that going to the gym promotes health, one may form an *intention* to perform the *action* of working out three days a week after work (Zorbacare, 2023). All else being equal, if one were perfectly rational (e.g., no limitations of information, cognitive capacities, time, etc.) then it seems reasonable to assume that one should desire (most) what one values (most) (Baron,

2004; Dorsey, 2012; Weirich, 2004). Of course, humans are not these kinds of creatures (i.e., *homo economicus*), so often we make decisions that satisfy more weakly held values over more strongly held values for any number of reasons (e.g., through lack of information, lack of attention, time constraints) (Kahneman & Tversky, 1979).

Given this basic decision-making beliefs/values model, we can flesh out why sometimes identifying a correct decision is difficult. Here, a distinction between the *schematic* for a good decision and a *concrete* good decision might be helpful. The schematic for a good decision involves making decisions in accordance with one's (mostly deeply held) values along with one's beliefs (Baron, 2004; Weirich, 2004). So in this sense, the schematic for good decisions indicates decision "types." What I mean by concrete good decision is a decision "token," or a specific, particular decision. While there is general consensus about what the schematic for a good decision is, concrete decisions can admit a diversity of decisions that satisfy the schematic for a good decision. This distinction is important because sometimes it is assumed that there is only one concrete decision (token) that satisfies the schematic (type) (Thaler & Sunstein, 2003). Some choices, for example, just have a single, normatively correct answer, so making a better decision is just the decision that accords with that normative standard. For example, there simply is one correct answer for what (5x20) is. Hence, there is only one good concrete decision. Other decisions about life outcomes also often have an apparent normatively correct choice. For example, most people do not want to die. So, an intervention that increases decisions to vaccinate and decreases the risk of death is often thought to also be normatively correct and the intervention that encourages that choice is ethically permissible or even desirable (everything else being equal). In each of these cases, there is assumed to be value homogeneity (i.e., getting

the right answer to a math problem; not wanting to die). In cases of value homogeneity, there is only one good concrete decision—it is the one that helps people obtain that single value.

However, in cases of value heterogeneity, there is no single correct concrete decision (token). In such cases, it is not obvious what concrete decisions should be promoted by interventions. This proves difficult when we consider there is not currently a widely accepted approach to identifying a "good concrete decision" and we are not likely the kinds of creatures to, with certainty, identify what a "good concrete decision" is full stop. The controversy about what constitutes a good decision may be expected. Previous work has suggested that many of our core, fundamental, philosophical judgments about things like what is good or ethical are diverse but predictable (Feltz & Cokely, 2009). Those judgments are associated (and potentially caused) by factors that are irrelevant to the truth of the content of those judgments. Moreover, we find these same kinds of effects for experts who have studied these kinds of issues for decades (e.g., ethicists (Schwitzgebel & Cushman, 2012) or experts about moral responsibility (Schulz, Cokely, & Feltz, 2011). Because of the association with irrelevant factors, it is not likely that we would come to a consensus about what a "good concrete decision" is in many contexts because we cannot be sure what the single, correct value is.

To illustrate, let's imagine an individual steals a costly prescription medication. It's likely that most people believe that stealing is wrong. However, let's say this individual was stealing the medication for their sick partner because they couldn't afford it. Some may still believe that stealing the medication was wrong, but others may believe there is some justification in this action (Rest, Narvaez, Thoma, & Bebeau, 1999). This heterogeneity displays peoples' differential ordering of values and extends to many situations beyond the one detailed above. For decisions like those involving value heterogeneity, it is not likely that we could ever come to a

consensus on what the right value is and consequently, it would not be likely that we could have much confidence in what the "correct" decision or judgment would be. Hence, it seems prudent to be humble and inclusive when identifying what a good concrete decision would be.

Summarizing the discussion so far, the simple model for decision-making I have adopted gives us one potential schematic for how to go about evaluating good types of choices. The schematic might also have implications for evaluating choice tokens. In cases of value homogeneity like the math problem or not wanting to die, all decisions should be the same (given the same beliefs)—the decision should be 100 (i.e., 5x20) or get vaccinated. But in cases of value heterogeneity, there are potentially different good decisions even when holding beliefs fixed.

However, just because it might be unlikely that we could provide an acceptable account of what is always and everywhere valuable full stop to help identify good concrete decisions, we can make some progress in identifying what many people at least *think* is valuable. Empirically, some research has documented some commonly held values. Specifically, Schwartz (2012) posited a Theory of Basic Values in which ten values were outlined in a circular structure to illustrate the shared motivational emphases of adjacent values (see Figure 1). The distinguishing feature of each value is the type of goal or motivation (e.g., desire) it expresses, and these values were claimed to be universal due to their grounding in one or more of three universal requirements: 1. needs of individuals, 2. necessities of coordinated social interaction, and 3. survival and welfare needs of groups (Schwartz, 2012). Briefly, the ten values are as follows: self-direction (e.g., independent thought and action choosing, creating, exploring), stimulation (e.g., excitement, novelty, challenge in life), hedonism (e.g., pleasure or sensuous gratification for oneself), achievement (e.g., personal success through demonstrating competence according to

social standards), power (e.g., social status and prestige, control or dominance over people and resources), security (e.g., safety, harmony, and stability of society, relationships, and self), conformity (e.g., restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms), tradition (e.g., respect, commitment, and acceptance of the customs and ideas that one's culture or religion provides), benevolence (e.g., preserving and enhancing the welfare of those with whom one is in frequent personal contact), and universalism (e.g., understanding, appreciation, tolerance, and protection for welfare of all people and for nature) (Schwartz, 2012).

The reach of the values posited by Schwartz (2012) is far. These commonly held values are often reflected in many professional ethics codes. Initial evidence of the presence of these values can be observed through the American Psychological Association's (APA's) ethical principles of psychologists and code of conduct. Specifically, the APA outlines five general principles that we, as psychologists, should aspire to and that should guide and inspire our pursuit of the highest ethical ideals. Namely, these principles are (A) beneficence and nonmaleficence, (B) fidelity and responsibility, (C) integrity, (D) justice, and (E) respect for people's rights and dignity (American Psychological Association, 2017). Thinking of these principles with Schwartz's (2012) values in mind, universalism (i.e., understanding, appreciation, tolerance, and protection for welfare of all people and for nature (Schwartz, 2012)) is reflected within Principle D, justice (i.e., entitle all persons to access to and benefit from the contributions of psychology and to equal quality in the processes, procedures, and services being conducted by psychologists (APA, 2017)).

While these values are important to psychologists, this doesn't necessarily mean they are important to all people in all professions. This motivated a more in-depth exploration of whether

the values outlined in the APA general principles are also important to other professions. First, I determined the breadth in which I would search for these professional ethics codes in line with the occupational profiles outlined by the U.S. Bureau of Labor Statistics. There are twenty major groups outlined. I then obtained twenty professional ethics codes from various companies and organizations for each of the twenty major groups outlined. To ensure random sampling of these professional ethics codes, I then used a random number generator to randomly select ten of the twenty professional ethics codes for each of the major groups, resulting in a total of 200 professional ethics statements representing all groups outlined by the U.S. Bureau of Labor Statistics.

To analyze these professional ethics codes, I initially defined groups of synonyms for each of the five general principles outlined in the APA code of conduct. For this project, I focused on Principle D: Justice. The synonyms defined to search the codes for justice included equal*, fair*, impartial, just*, neutral, and objective (where * indicates any word that has the base before it, so just* can be just, justly, justice, justification, etc.). I then searched the ethics codes for the defined synonyms to identify the most frequent way in which justice is referred to. Fair* (e.g., fair, fairness, fairly, etc.) appeared the most in all ethics codes (see Figure 2), so I then examined how much fair (i.e., fair, fairness, fairly, etc.) appeared within the ethics codes of each of the occupational fields outlined in the U.S. Bureau of Labor Statistics (see Figure 3). It appears justice (through fairness) is at least present in every single occupational field, though claims about the importance of justice cannot be made due to natural variation in the length of ethics codes within each occupational domain.

Consequently, there could be ways to use some of these commonly held values to help evaluate how well interventions help people make “better” concrete decisions. In this thesis, I

focus on justice, which many people not only *think* is valuable but is often expressed in professional ethics codes.

Justice as an Illustrative Example

There is historical reason to believe that perceptions of justice form an ethical dimension on which interventions should be evaluated. First, some of the earliest philosophers (e.g., Socrates, Plato, Aristotle) have posited justice to be intrinsically valuable. Being just is good for its own sake and for nothing else. However, others (including those philosophers) also claim that being just is instrumentally valuable, meaning that justice can be a means to a desired value or end. For example, perceptions of justice are likely to be important for a company dependent upon customer loyalty (where perceptions of justice play an instrumental role in fostering customer loyalty) (Leventhal, 1980). Apart from perceptions of justice being intrinsically or instrumentally valuable, my review of professional ethics codes suggests that justice is somehow represented in many of them, including the American Psychological Association's ethics code (i.e., Principle D) (APA, 2017). If perceptions of justice have intrinsic, instrumental, or professional value, they are likely one important ethical dimension to evaluate choice architecture interventions on (see discussion Ethical Interaction Theory below).

While it is generally agreed that justice is valuable (i.e., intrinsically, instrumentally, or professionally), agreement about what justice is or how to measure it is lacking. There are a variety of potential reasons for this lack of agreement. One may be that for many contested philosophical issues, we are not the kinds of creatures, given current technologies, that are likely to uncover the *truth* about what 'justice' *is* as a mind-independent, non-conceptual, non-linguistic entity (unlike other entities where we do think we know what those things are

independent of what we think about them like ‘gold’ or ‘gravity’) (for more complete argument, see Feltz & Cokely, 2009 and the discussion above). Plausibly, the lack of consensus about what justice is leads to a variety of different ways to conceptualize and measure both justice as a whole and specific types of justice (Blader & Tyler, 2003; Colquitt et al., 2001). Due to the general inability to detach justice from contextual (e.g., mind-dependent, conceptual, linguistic) factors, I will be focusing solely on perceptions of justice rather than actual ‘states’ of justice. That is, I make no claim that the way I conceptualize and measure justice represents what justice *is* as a mind-independent, non-conceptual, non-linguistic truth.

The way I conceptualize perceptions of justice is based on my review of the theoretical literature on justice. This review has indicated that justice can be meaningfully captured by 4 distinct kinds of justice: distributive justice, procedural justice, interpersonal justice, and informational justice. Perceptions of *distributive justice* are thought to stem from cognitive, affective, and behavioral reactions to outcome distributions from a source (Adams, 1965; Adams & Freedman, 1976; Cohen-Charash & Spector, 2001). Distributive justice focuses on the perceived deservingness of rewards, punishments, and resources an individual/group may receive (Leventhal, 1980). For example, let’s imagine you’re at a bank. If you give the bank teller four quarters and they give you one dollar in return, you will likely perceive this as fair, as we know that these different monetary forms are of the same value. However, if the bank teller gave you two quarters in return, feelings of unfairness would likely arise, considering your greater contribution for less return.

Procedural justice can be thought of as the fairness of policies/processes contributing to outcomes embodying certain types of accepted principles (Lind & Tyler, 1988) (for a comprehensive review of procedural justice, see Leventhal, 1980). Continuing with the bank

example, suppose you only got two quarters back for the four you gave to the bank teller because of a policy the bank has in which it charges for currency changes. Given the rules, it's likely that this exchange would be determined to be procedurally just, as the bank teller was following a policy that is enforced for all individuals (even if it fails on other justice-relevant criteria).

Interpersonal justice is conceptualized as showing concern for individuals regarding the way outcomes are distributed (Greenberg, 1993). Politeness and civility are central concerns to interpersonal justice and can be demonstrated by providing polite and personal attention to individuals, especially in situations where individuals are expressing concern over distributions and the processes that led to those distributions (Carr, 2007). An individual will likely have greater perceptions of interpersonal justice if they feel heard and listened to when voicing concerns about the distribution of outcomes. If, upon asking why you only received two quarters in exchange for the four quarters you gave to the bank teller, the bank teller ignored your question and asked for the next person in line, it's likely feelings of interpersonal injustice would occur. These feelings would likely be absent with a polite explanation of why you received only two quarters upon your question.

Finally, *informational justice* deals with providing information or knowledge about procedures and distributions that demonstrate regard for people's concerns (Greenberg, 1993). Carr (2007) gives examples of engaging in informational justice, ranging from providing informative brochures to providing intricate, multifaceted explanations of complex services. When an individual initially perceives a situation as unfair or unjust, assuming the individual reaches out to the allocating agency, explanation of the distributions and how those distributions came about are likely to decrease perceptions of injustice. Wrapping up the bank example, let's say you were informed about the $0.50 charge due to the bank policy before you requested the

exchange. The teller then informed you this charge must be covered prior to any future transactions. You may not agree with this rule, but it's unlikely for feelings of informational injustice to arise, as you now have the knowledge to choose if you would like to proceed.

Justice and Libertarian Paternalism/Education

Choice architecture can be thought of as the environment in which people make decisions (Thaler & Sunstein, 2008). Some of these environments can be intentionally created. As mentioned in Chapter 1, the decision sciences have made substantial advances aimed at intentionally influencing people's choices. These advances can be used to help inform and create strategic decision-making environments. One type of environment that has been created can be described as embodying Libertarian Paternalistic policies. Libertarian Paternalistic policies are a form of soft paternalism that aim to guide decisions without formally restricting or substantially changing the incentives for any choice (e.g., monetary incentives, time incentives, punishments) (Thaler & Sunstein, 2008). The absence of incentive structures theoretically leaves the person free to choose otherwise without penalty, thereby characterizing the 'libertarian' part of Libertarian Paternalism. The 'paternalistic' part aims to increase a person's overall good by encouraging some choice (without changing incentive structures). But since the policies are paternalistic, such Libertarian Paternalistic policies are commonly thought to involve a moral violation as a result of their paternalistic nature (Gert & Culver, 1979; Tanner, 2021). However, libertarian paternalists argue that because the paternalistic violation is minor since one has the freedom to choose otherwise and the benefits large, such policies are ethically justified. Because the ethical costs of libertarian paternalist policies are thought to be modest, most evaluations of the effectiveness of different libertarian paternalistic policies focus primarily or even solely on

the good generated by a particular behavioral change due to the intervention (Mertens, Herberz, Hahnel, & Brosch, 2022). For example, an intervention aimed at increasing healthy eating in cafeterias is likely to be judged on its effectiveness in terms of how many healthier options are selected opposed to unhealthier options.

However, as is indicated by Ethical Interaction Theory, there are likely to be many elements contributing to whether an intervention produced a "good" decision. While the increase in a desired (or decrease in an undesired) targeted behavior is important, there are likely other dimensions that can be used to evaluate any choice architecture interventions, including libertarian paternalistic interventions (Mertens et al., 2022; Tanner & Feltz, 2022).

To illustrate in an applied context how one might use other, non-decision-outcome-based criteria to evaluate the ethics of a choice architecture, we can look to some work about recycled water acceptance. Tanner (2023) looked at two instances of choice architecture designed to increase acceptance of recycled water. One was an education condition where participants received some key facts about recycled water. The other was the use of a "default nudge" where one is either defaulted into or out of a recycled water program. The default nudge is an instance of a libertarian paternalistic policy because it encourages a choice while leaving open the option to choose otherwise. Tanner (2023) found that both interventions increased acceptance of recycled water. However, only the educational intervention showed a measurable increase in knowledge and decision consistency, two core elements of autonomy (another core value that many individuals and professionals recognize). While the equal increase in a desired behavior across interventions suggests the interventions work equally well, the discrepancy in the perseverance of autonomy suggests otherwise, suggesting a cost for the default nudge that is not present for the education.

Ethical Interaction Theory postulates that in addition to autonomy, another important element to evaluate interventions on is perceptions of justice. Here, another distinction will be important. I will distinguish between perceptions of justice of (i) a particular choice architecture (e.g., framing nudges) and (ii) perceptions of justice of an entity that uses choice architecture (e.g., companies that use framing nudges). To date, I am not aware of any work that has evaluated (ii)—perceptions of justice of entities who use Libertarian Paternalistic strategies. There have been studies that have examined some aspects of the perceived acceptability of different choice architecture interventions (point (i) above), with results indicating a preference for interventions that target deliberative processing (e.g., educational opportunities, reminders) compared to interventions that target automatic processing (e.g., framing, defaults, sequential ordering) (Felsen, Castelo, & Reiner, 2013; Jung & Mellers, 2016). Namely, across a variety of behaviors (e.g., eating, purchasing, exercising, investing) individuals who had received interventions targeting deliberative processing had significantly higher favorability of the option (with the decisional aid compared to a neutral option) compared to those who had received interventions targeting automatic processing (Felsen et al., 2013). Additionally, this increased favorability was correlated with how authentic participants perceived the selected decision would be to them (Felsen et al., 2013).

The domain in which I will be comparing perceptions of justice of different interventions is plastic recycling. Plastic recycling is a practically important domain due to the demand for responsible waste strategies considering the rate of plastic production (EcoWatch, 2014). Additionally, it's likely to be a good domain to compare (potentially differential) perceptions of justice. Several features that are unique to plastic recycling (e.g., heterogeneity across jurisdictions, lack of technology) may elicit feelings of injustice if one does not have a nuanced

understanding of plastic recycling (e.g., the costs and benefits associated with using and recycling plastic). For example, up until recently, it was a common belief among recyclers that all plastics were recyclable (i.e., plastics 1-7 inside of the recycling arrow symbol) (Howard & Abdelrahman, 2023). While most of these plastics, in theory, could be recycled, the process of recycling these plastics is different for each type. When a recycling company does not take certain types of plastic, it could be because there would be greater environmental costs in an attempt to recycle it than there would be if the plastic was sent to a landfill or burned for energy.

Increasing perceptions of distributive, procedural, interpersonal, and informational justice is likely to matter for plastic recycling. To advance plastic recycling infrastructure (i.e., be able to recycle plastics that aren't currently recyclable), buy-in from the community is likely needed. Satisfaction with plastic recycling companies is likely an important factor influencing their ability to develop and implement new technologies, and satisfaction (among many other recycling-relevant factors) is likely to be impacted by perceptions of justice of recycling companies. If individuals don't feel the outcomes (e.g., distributive), the procedures that led to these outcomes (e.g., procedural), their interactions with the company (e.g., interpersonal), and/or the information they are receiving (e.g., informational) are fair, satisfaction (and community buy-in) is likely to decrease. In the literature, perceptions of justice have predicted satisfaction with, willingness to purchase from, loyalty to, and recommendation likelihood of a company across several domains (Karatepe, 2006; Martínez-Tur, Peiró, Ramos, & Moliner, 2006; Maxham & Netemeyer, 2002). Because satisfaction and community buy-in are likely to be crucial in advancing plastic recycling infrastructure, perceptions of justice (which influence satisfaction and community buy-in) are likely to matter.

For this thesis, I will compare the perceptions of justice of two different choice architecture interventions—an educational intervention and a Libertarian Paternalistic framing nudge. The first method is through education about plastic recycling (i.e., education intervention). The goal of education interventions is to impart a *representative understanding* of the domain of the decision at hand. In an ideal world, all individuals would be completely informed about the decisions they make, but as previously stated, that is impractical (if not impossible). Consequently, one must identify quality information (usually with the help of experts in the field) to help individuals obtain enough relevant information to have a high-quality factual base to make decisions (in a given domain) (Feltz & Cokely, in press). This factual base provides individuals with a prognostic understanding of how the decision factors into one's own life and values. Additionally, an individual is considered to have a representative understanding when their understanding is relatively robust against bias given random additional relevant, or irrelevant bits of information (Feltz & Cokely, in press).

As previously mentioned, intentional choice architectures have historically been evaluated in terms of their ability to increase or decrease a target behavior. The target behavior I will use to compare these interventions is satisfaction with a plastic recycling company. If education interventions work equally well in terms of reaching a desired outcome (e.g., equally satisfied) as alternative forms of choice architecture (libertarian paternalistic policies) that have lower perceptions of justice, we should go with the education intervention, as it likely offers the additional benefit of greater perceptions of justice (Feltz & Cokely, in press). Increased (or preserved) perceptions of justice (because of a more representative understanding) are likely to have immediate impacts on recycler satisfaction with their respective recycling companies (or potential recycling companies). If individuals perceive communications and information from

their recycling company as frivolous, unreasonable, or even closed-off, it's not likely the company will receive support from these unsatisfied individuals.

Additionally, education interventions are likely to be well-suited for environments with evolving conditions, such as plastic recycling. Because there aren't currently good ways to recycle different types of plastic (e.g., ways that are cost/energy-effective and environmentally beneficial), researchers are currently developing new technologies to do so, which is likely to pose unique challenges for recyclers. Providing individuals with a representative understanding of plastic and plastic recycling is likely to increase their decision-making self-efficacy, generalizing the impacts of this intervention beyond the immediate decision at hand to novel conditions brought about by the development of innovative plastic recycling technology (Feltz & Cokely, in press).

The second method involves the use of libertarian paternalistic framing nudges. Framing refers to the presentation of statistical information in different but logically equivalent ways (Kahneman & Tversky, 1983). A classic study examining the effects of framing (and numerous studies since) used a disease paradigm in which participants are asked to select between two treatment options, one that is risk-seeking and one that is risk-averse (Kahneman et al., 1983). Although there is not a normatively correct answer (e.g., treatment selection for the disease), systematic differences have been observed depending on whether the options are presented in a gain frame (in terms of lives saved) or a loss frame (in terms of lives lost) (Feltz & Cokely, in press). When the options were presented in a gain frame (e.g., (A) 200 [out of 600] people saved or (B) one-third probability that 600 people will be saved and a two-thirds probability no one will be saved) most participants selected the risk-averse option (i.e., (A)) (Kahneman et al., 1983). When the options were presented in a loss frame (e.g., (C) 400 [out of 600] people will

die or (D) one-third probability that nobody will die and a two-thirds probability that 600 people will die) most participants selected the risk-seeking option (i.e., (D)) (Kahneman et al., 1983).

This gain/loss frame detailed above has expanded to practical implications. Framing is one of several types of choice architecture interventions present in environmental studies. However, research suggests that the effectiveness of framing within the environmental domain largely depends on what the intervention is targeting (Bimonte, Bosco, & Stabile, 2020). In some contexts, framing a message positively (i.e., gain) or negatively (i.e., loss) has little effect on observed environmental behavior (Nelson, Bauer, & Partelow, 2021). Positive (i.e., gain) framing has seen more consistent positive results, where it's believed positive frames produce positive attitudes towards taking action on climate change (Corner et al., 2015). Corner et al., (2015) argue that self-efficacy is impacted by framing, and negatively framing information can produce feeling of powerlessness and the sense that personal actions do not make a difference. Other research still suggests different findings, where loss framing is more promising when the focus is on behavior, intentions, or willingness to pay, whereas gain framing is more promising when interested in attitudes and beliefs (Homar & Cvelbar, 2021).

While nudges have been deemed generally successful in the literature, this success is observed primarily in the increase of a desired target behavior (or intention, willingness to pay, change in beliefs/attitudes) (Blumenthal-Barby & Burroughs, 2012; Goldstein, Johnson, Herrmann, & Heitmann, 2008). Because of the promotion of more passive decision-making strategies in framing nudges, the quality of the decision outcome depends on the wisdom and power of policymakers to shape environments in suitable ways (Feltz & Cokely, in press). While framing may be successful in influencing people to engage in a particular behavior or adapt a particular set of beliefs (e.g., greater satisfaction with a plastic recycling company), research

suggests that this behavior doesn't always hold when the nudge is removed from the decision environment (Van Rookhuijzen, De Vet, & Adriaanse, 2021). Additionally, there is little support that framing nudges generalize beyond the behavior of interest and may instead decrease one's decision-making self-efficacy (Feltz & Cokely, in press; Paunov, Wänke, & Vogel, 2019). Because framing nudges don't necessarily impart a representative understanding on individuals, I do not expect framing nudges to generalize to increase perceptions of justice of plastic recycling.

My hypotheses for this comparison between choice architectures (e.g., education interventions and framing nudge interventions) are as follows:

H1: Individuals who receive the education intervention will have greater perceptions of informational justice than individuals who do not receive the education.

H2: Individuals who receive the education intervention will be more satisfied with a hypothetical recycling company than individuals who do not receive the education intervention.

H3: Individuals who receive the positively framed nudge will be more satisfied with a hypothetical recycling company than individuals who receive the negatively framed nudge.

I conducted two studies for this thesis. The focus on Study 1 was on the creation and validation of a measure of perceptions of justice. Study 1 was broken into three parts, Study 1A, Study 1B, and Study 1C. Study 1A was used to run an exploratory factor analysis on the perceptions of justice items. Study 1B was used to run a confirmatory factor analysis on the perceptions of justice items based on the exploratory factor analysis in Study 1A. Study 1C was used to confirm the post-hoc revisions made to the factor structure in Study 1B. Study 2 then utilized this scale to measure potentially differential perceptions of justice in education and nudge interventions. Finally, Study 3 replicates the results of Study 2. Findings from these

studies suggest that framing nudges may have notable practical (e.g., satisfaction) and ethical (e.g., perceptions of justice) costs that education interventions appear to avoid.

Study 1A

Because perceptions of justice have not been previously explored in the literature in terms of choice architecture interventions, I first sought out to find a scale in line with the theoretical backing that posits four distinct constructs of justice (i.e., distributive, procedural, interpersonal, and informational). Through careful review of the literature, I found one measure that captures perceptions of justice (although this was not how it was operationalized) that were created to measure service fairness (Ting, 2013). These items, which were asked concerning the automotive service individuals received, were adapted from referring to the service staff to referring to a recycling company (see initial list of adapted items in Table 1).

Participants

For Study 1A, four hundred and ninety-three participants were recruited from CloudResearch (cloudresearch.com) and compensated for their participation in the study ($0.75). CloudResearch is an online participant recruitment platform that uses Amazon Mechanical Turk workers. CloudResearch has a proprietary list of approved workers to participate in studies. While participants recruited from Amazon Mechanical Turk are generally believed to be of acceptable quality for survey tasks compared to typical subject pools (e.g., university undergraduate subject pools), evidence suggests that data quality from samples gathered from CloudResearch can be better than using Amazon Mechanical Turk sampling alone (Peer, Rothschild, Gordon, Evernden, & Damer, 2021).

Participants ranged from 18 to 78 years old (M = 44.00, SD = 13.19) and 63.57% identified as female. Some participants were eliminated from analyses based on a priori data quality checks. First, all entries with zero responses were excluded (N = 39). Additionally, if participants responded to less than 50% of the items within the survey, they were excluded (N = 50). I also included some data screening procedures recommended for Amazon Mechanical Turk samples (Arndt, Ford, Babin, & Luon, 2022; Buchanan & Scofield, 2018; Leiner, 2016). I included two attention-check questions (e.g., "*There are less than 219 days in one calendar year*", "*There are 20 days in one week*"). I excluded participants if they responded with anything other than *false* to both items, eliminating 17 participants. I retained a total of 387 participants.

Methods and Materials

Perceptions of Justice

Because perceptions of justice have not been previously explored in the literature in terms of choice architecture interventions, I first sought out to find a scale in line with the theoretical backing that posits four distinct constructs of justice (i.e., distributive, procedural, interpersonal, and informational). Given this theoretical approach (i.e., 4 types of justice), there was no instrument that I found that measured all four types of justice in plastic recycling.

Within the literature, many scales measuring perceptions of justice are contextualized within the workplace (Ambrose & Schminke, 2009; Bies & Moag, 1986; Colquitt, 2001; Joy & Witt, 1992; Leventhal, 1976; Parker, Baltes, & Christiansen, 1997; Shapiro, Buttner, & Barry, 1994). Many scales were variations of the conceptualization and items put forth by Colquitt (2001), in which four types of perceptions of justice are measured (e.g., distributive, procedural, interpersonal, and informational). However, again, many of these scales assess perceptions of

justice within the workplace, where the context is different from plastic recycling. For example, the item “Does your (outcome) reflect the effort you have put into your work?” does not make much sense in the recycling setting. Often, the only tangible outcome individuals can see with plastic recycling is it physically being picked up (or dropped off). This type of question might make sense if individuals received feedback on their recycling performance, but that rarely occurs and was beyond the scope of this project.

There was one scale that measured perceptions of justice in relation to the automotive service individuals received and mapped onto the four-construct conceptualization of perceptions of justice (Ting, 2013). This context is more similar to plastic recycling, as they are both services (compared to performing work). For example, the item “Service staff help all customers get the outcomes they need without favoring any one group” is likely to be relevant to plastic recycling (and more closely reflects the standpoint of a customer in the interaction rather than an employee). Ting (2013) empirically tested 29 initial items assessing perceptions of justice in relation to the automotive service individuals received and initially conducted an exploratory factor analysis in which four latent factors were identified. A condensed list of the initial items was then re-tested in a confirmatory factor analysis (though it was on the same dataset). Because of this, I adapted all 29 items to plastic recycling, where all mentions of “service staff” were changed to “recycling companies” (see initial list of adapted items in Table 1).

In Study 1A participants were asked to report their level of agreement with 29 items assessing perceptions of distributive, procedural, interpersonal, and informational justice presented in Table 1.

Results

I first examined the descriptive statistics for each of the 29 items to ensure there were no normality violations. After confirming the response patterns to each item was approximately normal (e.g., skewness between -2 and +2 and kurtosis between -3 and +3 (DeCarlo, 1997) (see Table 2), I ran an exploratory factor analysis on all 29 items. I specified the factor model should be estimated through parallel analysis based on factor analysis (seed 1234) using principal axis factoring and oblique oblimin rotation (Howard, 2016; Watkins, 2018). All but two items (i.e., PROC3 and INTER9) loaded onto one of four factors (see Table 3). Items assessing perceptions of interpersonal justice and informational justice loaded onto their hypothesized factors. Items assessing perceptions of distributive and procedural justice did not load on the same factors as they had been in previous studies (Ting, 2013). However, this might not be shocking. In previous meta-analyses, distributive and procedural justice have been highly correlated across studies (Cropanzano & Ambrose, 2001; Hauenstein, McGonigle, & Flinder, 2001). Additionally, perceptions of distributive justice have been thought to influence perceptions of procedural justice, and procedural thought to influence distributive (Cropanzano et al., 2001). The overlap between distributive and procedural justice might be due to both perceptions being rooted in individuals' expectations of outcomes, regardless of whether it is about the outcomes themselves (distributive) or the processes in which those outcomes are allocated (procedural). After examining the two factors that both had items of distributive and procedural perceptions of justice, one factor dealt more with the outcomes and one factor dealt more with the procedures, so those factors were labeled accordingly.

In preparation for Study 1B, the two items that didn't load onto any of the four factors in the exploratory factor analysis in Study 1A were dropped (i.e., PROC3 and INTER9).

Additionally, items were eliminated from future analysis if they had a factor loading in Study 1A of less than 0.60. This threshold was adopted as the perceptions of justice scale has previously been developed and validated (though in a different domain), so factor loadings should be higher than that of a brand-new scale (Matsunaga, 2010). Additionally, because there were plenty of items for each factor, I only wanted to keep items considered very good indicators of their respective latent factors (i.e., factor loadings of 0.6+ are considered very good indicators) (Matsunaga, 2010). This eliminated an additional 9 items (see Table 3). This resulted in 18 items retained for Study 1B (see Table 4).

Study 1B

Participants

For Study 1B, five hundred and ten participants were recruited from CloudResearch (cloudresearch.com) and compensated for their participation in the study ($0.75). Participants ranged from 19 to 81 years old (M = 43.31, SD = 12.84), and 58.82% were female. Two participants did not wish to complete the survey. All entries with zero responses were excluded (N = 30). Additionally, if participants responded to less than 50% of the items within the survey, they were excluded (N = 58). Participants were again excluded from further analysis if they did not correctly respond to the two attention check questions used in Study 1A, eliminating 10 participants. I retained a total of 410 participants.

Methods and Materials

Eighteen of the original twenty-nine perceptions of justice items were presented to participants in Study 1B where participants were again asked to rate their level of agreement (see Table 4).

Results

Items were again examined to ensure no normality assumptions were violated. After ensuring response patterns to the items were approximately normal (see Table 5), a confirmatory factor analysis informed by Study 1A was run on the items (see Figure 4 for hypothesized factor structure and Figure 5 for path coefficients and model fit). Initial fit indices of the four-factor CFA had an elevated RMSEA value and a significant chi-squared value, so the modification indices were examined. I examined the modification indices in order of magnitude (i.e., largest to smallest), and only made the modification if it made theoretical sense. After allowing the INTER1 and INTER2 item residuals to covary, the model fit was trending in the right direction (e.g., chi-squared p-value got larger, RMSEA got lower). This constraint had the highest modification index and made theoretical sense due to the semantic similarity between items (e.g., INTER1: The plastic recycling company is polite. INTER2: The plastic recycling company is respectful.). Two additional items strongly loaded onto multiple factors (e.g., PROC4 and INTER6). Because their respective factors had enough other items with good fit, these items were dropped. After these items were eliminated, the model displayed acceptable fit to the data (see Figure 6).

Study 1C

To confirm the factor structure with post-hoc revisions made in Study 1B, in Study 1C participants were presented sixteen perceptions of justice items (i.e., PROC4 and INTER6 were not presented because they were dropped from the factor structure in Study 1B) (see Figure 7).

Participants

Four hundred and sixty-seven participants were recruited for Study 1C from CloudResearch and were compensated for their participation ($0.75). Participants ranged from 20 to 79 years old (M = 42.25, SD = 13.61) and 61.83% were female. Eighteen participants did not provide any responses to the survey, so were excluded. Additionally, participants were excluded if they responded to less than 50% of the items within the survey (N = 19). Six participants were not allowed to continue due to their IP address being outside of the United States. Participants were again asked the same attention check questions that were presented in Study 1A and 1B and were excluded if they did not correctly respond to the items (N = 5). Finally, there was an additional attention check included within this study. Participants were instructed to respond to 13 items measuring objective knowledge of plastic recycling. Participants could respond that the 13 statements were true, false, or they could indicate that they did not know whether the statement was true or false. After responding to the 13 items, participants were asked how many items they believed they answered correctly. If participants responded "I don't know" to all 13 items, and indicated they believed they got more than 0 items correct, they were excluded from further analysis (N = 27). I retained a total of 392 participants for further analysis.

Methods and Materials

Sixteen items assessing perceptions of justice were presented to participants, where they were again asked to rate their level of agreement (see Table 6).

Results

Study 1C yielded similar factor loadings as were observed in Study 1B (see Figure 8). Two of the three fit indices (e.g., CFI and RMSEA) indicated the model had good fit, but the chi-square value was significant, suggesting model misfit. However, alternative interpretation of the chi-square statistic indicates that when the ratio of the chi-square statistic to the respective degrees of freedom is less than (or equal to) 2 (e.g., $\chi^2/df \leq 2$, $139.56/97 = 1.44 \leq 2$), this is indicative of acceptable model fit (Cole, 1987). Table 6 represents the final justice scale used in Study 2, with 16 total items.

Study 2

In Study 1, a measure of perceptions of justice was adapted to the recycling domain. This scale was created to measure potentially differential perceptions of (distributive, procedural, interpersonal, and informational) justice, which may be differentially influenced by choice architecture interventions (e.g., education and framing nudge). Study 2 was designed to test both the main effects and potential interaction of two choice architecture interventions (e.g., education and framing nudge) with two key outcome variables: satisfaction with a hypothetical recycling company and general (i.e., regarding recycling companies in general and not a particular hypothetical recycling company) perceptions of information justice.

Participants

Four hundred and ninety-five participants were recruited for Study 2 through CloudResearch and were compensated for their participation ($1.00). Participants ranged from 18 to 78 years old (M = 42.94, SD = 14.09) and 63.31% identified as female. Sixty-eight participants did not provide any responses to the survey, so were excluded. Additionally, participants were excluded if they responded to less than 50% of the items within the survey (N = 11). Eleven participants were not allowed to continue due to their IP address being outside of the United States. Ten participants did not consent to participating in the survey. Participants were again asked the same attention check questions that were presented in Study 1A, 1B, and 1C and were excluded if they did not correctly respond to the items (N = 10). Finally, there was an additional attention check included within this study. Participants were instructed to respond to 13 items measuring objective knowledge of plastic recycling. Participants could respond that the 13 statements were true, false, or they could indicate that they did not know whether the statement was true or false. After responding to the 13 items, participants were asked how many items they believed they answered correctly. If participants responded "I don't know" to all 13 items, and indicated they believed they got more than 0 items correct, they were excluded from further analysis (N = 48). There was also an attention check for individuals after viewing their respective (education/no education) video, asking them what the video they just watched was about (e.g., the no-education condition was asked "What was the video you just watched about?" and correct answer was *sea turtles* with *starfish, sharks,* and *jellyfish* as the other options; the education condition was asked "The video I just watched was about _____ recycling." and the correct answer was *plastic* with *paper, glass,* and *aluminum* as the other response options). All

participants correctly answered their attention checks, so no participants were excluded using this method. I retained a total of 337 participants for further analysis.

Methods and Materials

Participants received the following materials in order.

Intervention Materials

This study was a 2 (education/no education) x 3 (positive frame/neutral frame/negative frame) factorial in which the education intervention and the framing nudge were crossed. I chose this experimental design to explore the potential interaction of the nudge and education interventions. Previous research utilizing similar designs where education and nudge interventions are crossed has not found a consistent and significant interaction effect (Asif, 2023; Hoang, 2023; Tanner & Feltz, 2022). However, because I am focusing on a different domain, and because this is the first time I compared these interventions, I chose this design to explore potential interaction effects, although they were not hypothesized.

Education Intervention. Participants were first randomly assigned to either the education condition or the no education condition. In the education condition, participants watched a brief (i.e., 5:08 minutes) informative video about plastic recycling that was reviewed and deemed accurate by experts in the field. The content within the video contained what experts within the plastic recycling field believed the average person should know to recycle plastic effectively. In the no-education condition, participants were required to watch a brief irrelevant video (i.e., over the life cycle of sea turtles) that was the roughly same length (i.e., 5:15 minutes) as that of the video in the education condition. For both videos, the arrow to advance to the next screen was not available for participants until five minutes and fifteen seconds had elapsed to

ensure participants did not click through the video. To ensure participants watched their designated video, they were prompted to answer an attention check question (e.g., the no-education condition was asked "What was the video you just watched about?" and correct answer was *sea turtles* with *starfish, sharks,* and *jellyfish* as the other options; the education condition was asked "The video I just watched was about _____ recycling." and correct answer was *plastic* with *paper, glass,* and *aluminum* as the other response options).

Framing Nudge Intervention. After viewing either the education or no education video, participants were randomly assigned to the positive frame, the negative frame, or the neutral/no frame nudge condition. In the positive frame, participants were given an estimate of the percent of plastic waste a recycling company does recycle. In the negative frame, participants were given an estimate of the percent of plastic waste a recycling company does not recycle. In the neutral or no frame condition, participants were not given an estimate, and instead told that some plastic is, and some plastic is not recycled. The information presented to participants in the positive and negative frame is logically equivalent. Participants were presented with the following scenario:

> "Recycling Company A estimates that they [recycle/do not recycle/do recycle] [20-30%/70-80%/some] of the plastic they receive. Previously Recycling Company A did not accept certain types of plastic waste, but one day they announce that they will invest in new technologies to recycle plastic waste that they previously did not accept."

Participants were directed to carefully read the short passage and told that they would be answering a series of questions regarding the plastic recycling company mentioned in the passage.

Outcome Variables

There are two outcome variables of interest that participants responded to following the education (or no education) video and [one of] the positive, negative, or no framing nudge passage. The first set of items aimed to address one of the more traditional evaluation methods of choice architecture interventions (e.g., effectiveness in influencing outcomes). I wanted to examine whether one (or both) interventions could reliably alter satisfaction with a hypothetical recycling company. The second outcome variable of interest is perceptions of justice of these hypothetical recycling companies. In particular, I wanted to examine the (potentially differential) effects of the interventions on perceptions of informational justice.

Satisfaction. Participants were asked to indicate their level of agreement with five items that assessed satisfaction with Recycling Company A (e.g., I am satisfied with the types of plastic Recycling Company A accepts) as well as willingness to support Recycling Company A (e.g., Recycling Company A should get a tax break for investing in new technology to recycle plastic waste) (see Table 7 for items and item descriptives).

Perceptions of Justice. Participants were asked to indicate their level of agreement with the 16 perceptions of justice items identified in Study 1C (see Table 6).

Covariates

To begin examining correlations between variables of interest and in preparation for structural equation modeling I included several covariates. The Framework for Skilled Decisions (Skilled Decision Theory) builds upon previously hypothesized normative models of decision-making, where decisions are a combination of one's values and one's beliefs (Baron, 2004; Cokely et al., 2018). Specifically, this model accounts for the opportunity of knowledge gain, as

well as the influence of statistical numeracy (see Figure 9). This model motivated the covariates included.

Subjective Knowledge. A measure of subjective knowledge was collected to assess how much people believed they knew about plastic recycling. Participants responded to one item in which they rated their agreement (i.e., 6-point Likert scale) with the statement, "I think that I know a lot about plastic recycling." This measure of subjective knowledge maintains the structure in which subjective knowledge has been assessed in the literature (i.e., self-report; Afroz, Rahman, Mehedi Masud, & Akhtar, 2017; Goldsby, 1998). Subjective knowledge was collected as a proxy of confidence within the Skilled Decision Framework.

Objective Knowledge. Participants completed a measure of objective knowledge of plastic recycling through the validated 13-item Outcomes of Plastic Recycling Knowledge Scale (OPRKS) (Holt et al., 2023) (see Table 8 for items and item descriptives). Participants could indicate whether they believed each of the statements was true, false, or they could indicate that they didn't know. Correct responses were coded as 1 and incorrect and 'I don't know' responses were coded as 0. Participants' objective knowledge was represented by the summed score (e.g., 0-13).

The OPRKS was included to address one, often overlooked, contributor to pro-environmental (beliefs/values/intentions/actions). Objective knowledge is fairly novel in its establishment to predicting recycling related tendencies (Holt et al., 2023). Additionally, this measure represents the knowledge latent factor in the Framework for Skilled Decisions.

Multilayer Plastic Knowledge. Participants completed a 9-item measure of objective knowledge of multilayer plastics that was created in conjunction with experts in the field (i.e., experts in chemical pyrolysis) (see Table 9 for items and item descriptives). Participants could

indicate whether they believed each of the statements was true, false, or they could indicate that they didn't know. Correct responses were coded as 1 and incorrect and 'I don't know' responses were coded as 0. Participants' objective knowledge was represented by the summed score (e.g., 0-9).

This measure of more specific objective knowledge of plastic was included to ensure participants actually gained information from the education intervention. The video for the education intervention gives a brief overview of all plastics but focuses a great deal on a specific type of plastic (i.e., multilayer plastic). With inclusion of this measure, knowledge gain from the education intervention should be apparent, as individuals are less likely to have specialized knowledge (i.e., objective knowledge of multilayer plastic) compared to general knowledge (i.e., objective knowledge of plastic) all things being equal (e.g., no one educated specifically on multilayer plastic). Additionally, this measure can supplement objective knowledge measured via the OPRKS as the knowledge latent factor in the Framework for Skilled Decisions.

Environmental Concern. Best & Mayerl (2013) operationalized environmental concern as the range of environmentally related perceptions, emotions, knowledge, values, attitudes, and behaviors. We included this measure from Best & Mayerl (2013) because concern for the environment typically correlates with pro-environmental actions such as recycling (Best, 2010; Meneses & Palacio, 2005). Participants indicated their agreement with 6 items (e.g., "I would be willing to separate more different kinds of recyclables in the future") on a 7-point Likert-scale (see Table 10 for items and item descriptives). I used a mean of responses to the environmental concern scale in all analyses.

Numeracy. A measure of numeracy was included, as previous research has documented superior (i.e., expert-like) decision-making abilities in those (i.e., non-experts) with greater

practical probabilistic reasoning (i.e., higher levels of numeracy) (Cokely et al., 2018). Participants were allowed to freely respond to a seven-item adapted version of the Berlin Numeracy Test (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012). Each item had one correct answer (e.g., "Imagine we are throwing a five-sided die 50 times. On average, out of these 50 throws how many times would this five-sided die show an odd number (1, 3, or 5)?" were the correct answer is 30). Participants were given a value of 1 for each correct answer, and 0 for each incorrect answer. I added the number of items each participant correctly answered, where numeracy values could range from 0 (i.e., all items incorrect) to 7 (i.e., all items correct), for further analysis.

Results

To test my first hypothesis that those who received the education intervention would have higher perceptions of informational justice than those who didn't, I ran a 2 (education/no-education) x 3 (positive frame/neutral frame/negative frame) ANOVA, with informational justice as the outcome variable. Descriptive information for each condition can be found in Table 11. Hypothesis testing can be found in Table 12. There was a significant main effect of education ($F(1,332) = 4.00$, $p < 0.05$, $\eta^2 = 0.011$) and a significant main effect of the framing nudge ($F(2,332) = 9.16$, $p < 0.001$, $\eta^2 = 0.052$). The interaction was not significant ($F(2,332) = 0.10$, $p = 0.91$, $\eta^2 = 0.000$). A descriptive plot and the fully expanded post-hoc comparisons can be found in Figure 10 and Table 13 respectively.

To test my second and third hypotheses that those who receive the education intervention (compared to not receiving it) and those who received the positively framed nudge (compared to receiving the negatively framed nudge) would be more satisfied with a hypothetical recycling company, I ran another 2 x 3 ANOVA, but with satisfaction as the outcome variable. Descriptive

information for each condition can be found in Table 14. Hypothesis testing and post-hoc comparisons can be found in Tables 15 and 16, respectively. A descriptive plot can be found in Figure 11. There was a significant main effect of education ($F(1,332) = 6.75$, $p < 0.05$, $\eta^2 = 0.016$) and a significant main effect of the framing nudge ($F(2, 332) = 37.73$, $p < 0.001$, $\eta^2 = 0.180$). The interaction was not significant ($F(2, 332) = 1.99$, $p = 0.14$, $\eta^2 = 0.010$).

Though not explicitly hypothesized, I also ran additional (2 x 3) ANOVAs with the other justice constructs as outcome variables (e.g., distributive, procedural, interpersonal). When perceptions of distributive justice was the outcome variable, there was only a significant main effect of the framing nudge ($F(2, 332) = 6.49$, $p < 0.01$, $\eta^2 = 0.037$). The main effect of education ($F(1, 332) = 1.96$, $p = 0.16$, $\eta^2 = 0.006$) and the interaction ($F(2, 332) = 1.56$, $p = 0.21$, $\eta^2 = 0.009$) were not significant. When perceptions of procedural justice was the outcome variable, there was again only a significant main effect of the framing nudge ($F(2, 332) = 3.33$, $p < 0.05$, $\eta^2 = 0.020$). The main effect of education ($F(1, 332) = 0.16$, $p = 0.69$, $\eta^2 = 0.000$) and the interaction ($F(2, 332) = 0.62$, $p = 0.54$, $\eta^2 = 0.004$) were not significant. Finally, when interpersonal justice was the outcome variable, there was only a significant main effect of the framing nudge ($F(2, 332) = 4.77$, $p < 0.01$, $\eta^2 = 0.028$). The main effect of education ($F(1, 332) = 0.04$, $p = 0.84$, $\eta^2 = 0.000$) and the interaction ($F(2, 332) = 0.69$, $p = 0.50$, $\eta^2 = 0.004$) were not significant.

Table 17 displays basic descriptive information and the correlations between all collected variables. To make the correlations meaningful for the framing nudge conditions (i.e., not interpretable in initial coding where 0 = negative frame, 1 = neutral frame, 2 = positive frame), I either had to not include this variable in the analysis, or find a way to recode it. After examining the differences between framing conditions (i.e., negative, neutral, positive) there were never

significant differences between those in the positive and neutral frame, as long as they were in the same education condition (i.e., no significant differences between positive educated and neutral educated, and positive not educated and neutral not educated). To confirm, I ran t-tests in which the two groups I was comparing were those who received the positively framed information and those who received the neutrally framed information. I ran several t-tests where various key variables were the outcome variables (see Table 18). After confirming there was no significant difference between those who received the positively and neutrally framed nudge, I re-coded the framing nudge variable (e.g., 0 = negative, 1 = neutral/positive).

In Study 2 I tested the impacts of education interventions and framing nudges on participants' perceptions of informational justice and satisfaction with a hypothetical recycling company. There was a significant (small) main effect of education and a significant (medium) main effect of the frame on perceptions of informational justice. Both education and frame had small significant main effects on satisfaction with a hypothetical recycling company. There were not significant interactions for either ANOVA (i.e., when outcome was perceptions of informational justice or satisfaction).

Study 3

In Study 3, I identified significant differences in perceptions of informational justice between those who received the education intervention and those who did not, in line with my first hypothesis. I also demonstrated differences in satisfaction with a hypothetical recycling company (mentioned in the framing condition), where those who were educated were significantly more satisfied with the hypothetical company than those who were not. Upon reviewing these results, I noticed that while the satisfaction items pertained to the hypothetical

recycling company, items assessing perceptions of (all types of) justice pertained to recycling companies in general. To eliminate this discrepancy (by specifying the items assessing perceptions of justice pertained to the hypothetical recycling company) and increase the reliability of the results in Study 2, I ran one final study.

Participants

Four hundred and seventy-three participants were recruited for Study 3 from CloudResearch and were compensated for their participation ($1.00). Participants ranged from 18 to 74 years old (M = 40.75, SD = 12.14) and 62.56% were female. Twenty-seven participants did not provide any responses to the survey, so were excluded. Additionally, participants were excluded if they responded to less than 50% of the items within the survey (N = 14). Thirteen participants were not allowed to continue due to their IP address being outside of the United States. Participants were again asked the same attention check questions that were presented in Study 1A, 1B, 1C, and 2A and were excluded if they did not correctly respond to the items (N = 8). Finally, there was an additional attention check included within this study. Participants were instructed to respond to 13 items measuring objective knowledge of plastic recycling. Participants could respond that the 13 statements were true, false, or they could indicate that they did not know whether the statement was true or false. After responding to the 13 items, participants were asked how many items they believed they answered correctly. If participants responded "I don't know" to all 13 items, and indicated they believed they got more than 0 items correct, they were excluded from further analysis (N = 5), resulting in four hundred and six participants being retained for further analysis.

Methods and Materials

All methods and materials utilized in Study 3 were identical to those in Study 2 with one exception. Rather than the perceptions of justice items referring to recycling companies in general, the items were revised to explicitly pertain to the hypothetical recycling company participants were introduced to in their framing condition.

Results

Confirming Factor Structure

In order to ensure that changing the wording in the items assessing perceptions of justice did not alter the factor structure, I ran an *exploratory* factor analysis to ensure items were loading similarly to Study 1(A-C). After entering all perceptions of justice items into an EFA, it indicated there were three latent factors. Items assessing perceptions of informational and interpersonal justice loaded cleanly onto their respective factors, but items assessing perceptions of distributive and procedural justice loaded onto one factor (with the exception of one item-PROC3) (see Table 19). As observed in Study 1A, this isn't abnormal, as perceptions of distributive and procedural justice are often closely intertwined (Cropanzano & Ambrose, 2001; Hauenstein, McGonigle, & Flinder, 2001). However, when I manually constrained the model to having four latent factors, the items loaded as previously established (see Table 20).

Hypothesis Testing

To test my first hypothesis that those who received the education intervention would have higher perceptions of informational justice than those who didn't, I ran a 2 (education/no-education) x 3 (positive frame/neutral frame/negative frame) ANOVA, with informational justice

as the outcome variable. Descriptive information for each condition can be found in Table 11 and Figure 12. There was a significant main effect of education ($F(1,400) = 24.41$, $p < 0.001$, $\eta^2 = 0.055$) and a significant main effect of the framing nudge ($F(2,400) = 7.11$, $p < 0.001$, $\eta^2 = 0.032$). The interaction was not significant ($F(2,400) = 0.24$, $p = 0.79$, $\eta^2 = 0.001$).

To test my second and third hypotheses that those who receive the education intervention (compared to not receiving it) and those who received the positively framed nudge (compared to receiving the negatively framed nudge) would be more satisfied with a hypothetical recycling company, I ran another 2 x 3 ANOVA, but with satisfaction as the outcome variable. Descriptive information for each condition can be found in Table 14 and Figure 13. There was a significant main effect of education ($F(1,400) = 33.20$, $p < 0.001$, $\eta^2 = 0.068$) and a significant main effect of the framing nudge ($F(2, 400) = 26.93$, $p < 0.001$, $\eta^2 = 0.110$). The interaction was not significant ($F(2, 400) = 2.18$, $p = 0.11$, $\eta^2 = 0.009$).

Though not explicitly hypothesized, I also ran additional (2 x 3) ANOVAs with the other justice constructs as outcome variables (e.g., distributive, procedural, interpersonal). When perceptions of distributive justice was the outcome variable, there was a significant main effect of education ($F(1, 400) = 19.48$, $p < 0.001$, $\eta^2 = 0.043$) and a significant main effect of the framing nudge ($F(2, 400) = 14.84$, $p < 0.001$, $\eta^2 = 0.066$). The interaction ($F(2, 400) = 0.27$, $p = 0.76$, $\eta^2 =0.001$) was not significant (see Figure 14). When perceptions of procedural justice was the outcome variable, there was a significant main effect of education ($F(1, 400) = 4.12$, $p < 0.05$, $\eta^2 = 0.010$) and a significant main effect of the framing nudge ($F(2, 400) = 12.36$, $p < 0.001$, $\eta^2 = 0.057$). The interaction ($F(2, 400) = 0.83$, $p = 0.44$, $\eta^2 = 0.004$) was not significant (see Figure 15). Finally, when interpersonal justice was the outcome variable, there was a significant main effect of education ($F(1, 400) = 9.52$, $p < 0.01$, $\eta^2 = 0.023$) and a significant

main effect of the framing nudge ($F(2, 400) = 3.86$, $p < 0.05$, $\eta^2 = 0.018$). The interaction ($F(2, 400) = 0.28$, $p = 0.75$, $\eta^2 = 0.001$) was not significant (see Figure 16).

Structural Equation Modeling

Based on the results thus far, it appears that those who were educated were consistently more satisfied and had greater perceptions of (particularly, informational) justice than those who were not educated. Additionally, it appears that those who were in both the neutral and positive framed nudges maintained satisfaction and perceptions of (particularly, informational) justice compared to those who received the negative frame. However, as seen in Tables 17 and 22, the variables I collected are not independent (nor did I expect them to be).

To provide a more holistic picture of the differential mechanisms utilized by education and frame interventions (i.e., examine variable shared and unique variance), and illustrate the importance of perceptions of informational justice on factors likely important to the plastic recycling industry (e.g., satisfaction), I ran a structural equation model in line with the Framework for Skilled Decisions (Cokely et al., 2018). As throughout much of Studies 2 and 3, satisfaction with a hypothetical recycling company and perceptions of informational justice were the two outcome variables I was interested in. As outlined in the introduction, informational (along with other types of) perceptions of justice are likely to mediate relations between predictor variables and satisfaction with recycling companies (both real and hypothetical). Specifically, perceptions of informational justice are likely to be impacted by receiving (or not receiving) the education intervention along with both prior and gained knowledge. Additionally, the predictive ability of perceptions of informational justice on satisfaction has been documented in the literature (Karatepe, 2006). As observed in the 2x3 ANOVAs, framing nudges also had an

impact, though more directly (i.e., not mediated by knowledge, as frames don't impart a representative understanding).

The path model largely supported these claims (see Figure 17). Receiving the education intervention as well as previous knowledge had significant direct and indirect (through multilayer plastic knowledge) effects on perceptions of informational justice. Satisfaction with Recycling Company A (e.g., the hypothetical recycling company participants read and responded to these items about) was significantly and uniquely predicted by receiving the (positive/neutral opposed to negative) frame, multilayer plastic knowledge, and substantially, perceptions of informational justice. Though not all relations within the model were exactly as predicted (as I will examine below as well as in the discussion), this model provides initial evidence in support of the claim that education interventions may work through deliberate processing (e.g., type 2, mediated by knowledge acquisition), while framing nudges may work through automatic processing (e.g., type 1, direct effects).

Though most of the hypotheses in the model were supported, there was a significant negative predictive relationship between multilayer plastic knowledge and perceptions of informational justice. Because (general) knowledge positively predicts perceptions of informational justice (as hypothesized, where education interventions impart knowledge resulting in greater perceptions of informational justice), it seemed intuitive that multilayer plastic knowledge would also positively predict perceptions of informational justice.

It appeared that there was an interaction somewhere within the model. To assess the location of the interaction, I initially ran a fully unconstrained multigroup model (where I specified whether one received the education intervention as the grouping variable). This model served as my baseline model for future model comparisons. I then identified the path with the

most similar path coefficient between groups (e.g., multilayer knowledge to perceptions of informational justice), constrained that parameter (to be equal across groups), and compared the (constrained single parameter) model to the fully unconstrained model. If the unconstrained model does not fit significantly better than the constrained model, there is no interaction (difference in the predictive relationship between variables) across groups. I continued constraining a single parameter and comparing each model to the fully unconditional model until I had tested all paths (see Table 23). There was only one model that fit significantly worse than the unconstrained model, the model where the path from framing nudge to satisfaction was constrained, indicative that there is an interaction here. Finally, I constrained all parameters except the path from framing nudge to satisfaction, and compared this model to the fully unconstrained model to ensure the models do not have significantly different fit (see Table 24).

Discussion

Through this thesis, I have created a way to measure perceptions of justice in plastic recycling and have provided evidence about how they may change as a result of different choice architecture interventions. In Study 1(A-C), I adapted and factor-analyzed items assessing perceptions of distributive, procedural, interpersonal, and informational justice. In Study 2 and Study 3, I used the scale created in Study 1 to compare perceptions of justice and satisfaction with a hypothetical recycling company between individuals who received an education (or no education) and a (negatively, neutrally, or positively) framed nudge. In line with my hypotheses, participants who received the education intervention had greater satisfaction and perceptions of informational justice with a hypothetical recycling company than individuals who did not receive the education intervention. Framing also had substantial impacts on satisfaction and perceptions

of informational justice, but not necessarily as hypothesized. Positive framing did lead to significantly greater satisfaction and perceptions of informational justice compared to those who received negative framing but was never significantly different from those who received a neutral frame (within the same education level, so both educated or not educated). Finally, structural equation modeling suggests there are multiple ways in which perceptions of informational justice can be influenced.

To my knowledge, results from Studies 2A & B are the first in comparing (if and to what extent) education and libertarian paternalistic framing interventions impact perceptions of justice. Choice architecture interventions have historically been evaluated on a practical dimension (e.g., their ability to increase or decrease a target behavior/belief/attitude) with only recent research beginning to examine ethical dimensions on which to evaluate choice architecture interventions (Asif, 2023; Hoang, 2023; Tanner 2021, 2023). These studies are the first to compare different choice architecture interventions on the ethical dimension of justice.

In examining results from Study 3 in particular (where the wording of the justice items was specified to Recycling Company A rather than recycling companies in general), both the frame and the education had significant main effects (both when satisfaction with a hypothetical recycling company and perceptions of informational justice were the outcome variables). However, upon examining post-hoc results, the positive frame never results in significantly greater satisfaction than the neutral frame (regardless of education status) and in fact, those who received the neutral frame were sometimes more (although not significantly) satisfied than those who received the positive frame (see Figure 18). Both the positive and neutral frames were repeatedly significantly more satisfied than those who received the negative frame. It is worth noting that the significant main effect of framing would've been interpreted as desirable for

positive frames, had I not included the neutral condition revealing the true nature of what is driving the variability. This suggests that it might not be the positive frame that increases satisfaction (in the difference we're seeing) but instead the negative frame that decreases satisfaction. When perceptions of informational justice are the outcome variable, positive frames only do better than neutral frames when they are paired with the education intervention and the neutral condition is uneducated (see Figure 19). In short, these findings suggest that (positively/negatively) framed nudges appear to hurt, rather than help (compared to a neutral message) satisfaction and perceptions of informational justice. Education routinely (but not always) resulted in significantly greater satisfaction and perceptions of informational justice. These findings suggest that there might be important practical (i.e., satisfaction) and ethical (i.e., perceptions of justice) costs associated with libertarian paternalistic interventions that have not previously been explored nor documented in the literature. In contrast, education interventions appear to largely circumvent these costs (i.e., also promote satisfaction with a hypothetical recycling company without decreasing perceptions of (informational) justice). Even a modest interpretation of the results outlined in Study 3 suggests that practically speaking (i.e., in terms of satisfaction) both the (positive/neutral) frame and education intervention "work" equally well (i.e., result in comparable levels of satisfaction).

Because the interventions appear to work equally well practically speaking (meaning both interventions increase satisfaction with a hypothetical recycling company), we need additional evaluation criteria. Ethical Interaction theory puts forth a hybrid model of intervention evaluation, combining practical considerations with ethical ones. If the frame and education interventions don't have significant practical distinctions (and even if they do), there are several ethical considerations on which to evaluate these interventions. While Ethical Interaction theory

puts forth multiple (i.e., autonomy, beneficence, etc.), the ethical consideration I am concerned with is (perceptions of) justice. Again, while perceptions of informational justice were significantly impacted by the frame and education, the effect size of education is roughly double that of the frame (at least in Study 3). In examining post-hoc differences, those who were educated almost always had significantly higher perceptions of informational justice than those who were not educated. Additionally, significant differences between conditions are almost always across levels of education (i.e., comparing those who were educated to those who were not, where those who were educated had significantly higher perceptions of informational justice). It appears, then, if one were evaluating these two interventions on the ethical dimension of justice, that the education intervention better preserves perceptions of informational justice (compared to the frame intervention).

Within this paper, perceptions of justice have primarily been discussed within the recycling domain, but the implications for perceptions of justice, or *injustice*, reach far. Let's take a look at several real, tangible, current events stemming from a single (domain) perception of injustice. For the last seventy-five years, Palestinians have faced a plethora of tragedies and devastation, most recently increasing on October 7th, 2023. Completely ignoring the ethical argument of the attacks, as that extends far beyond the scope of a single academic paper, I would like to focus on the individuals witnessing these current events and their actions in response.

Individuals across the globe have been and are currently participating in organized actions to protest (their respective) government action (or inaction), one example being in support of the Boycott, Divestment, and Sanctions (BDS) campaign (McMahon, 2014). One of the central pillars of the movement, and the one I will draw upon to contextualize present-day costs of perceptions of injustice, is boycotting (for a more holistic review of the history,

motivation, and general overview of the BSD movement, see McMahon, 2014). Importantly, the boycotts called for by the BDS movement are intentionally constrained to abstaining from the commodities and services of companies involved with policies that violate Palestinian rights and international law, as outlined above (McMahon, 2014). One company in particular that has been at the heart of many calls to action is Starbucks. Following the recent increase in bombardment on Palestine, a Starbucks union social media account stated, "Solidarity with Palestine," which was met with rage calling for 'termination even with a union contract,' resulting in the removal of the social media post (O'Driscoll, 2023). This, along with primary investors and investments made by the company, led to a call to boycott the company (due to compliance with companies involved with policies that violate Palestinian rights and international law).

Since then, Starbucks has felt the effects. Many news stations reported on the continual drop of Starbucks stock prices (citing a variety of reasons for this drop, including boycotts), resulting in an estimated $12 billion loss (Fabino, 2023; Thaler, 2023; The Economic Times, 2023). Noteworthy, this reported drop in value happened during a time of the year when, historically, Starbucks experiences its highest sales (i.e., through seasonal offerings) (Macrotrends, 2010). It's not important in and of itself that Starbucks lost billions of dollars, but what is important is why. As mentioned, various reasons were cited for this drop in worth, but BDS-related boycotts were frequently cited. In fact, the CEO of Starbucks blamed the sales drop on 'misperceptions' of the company's stance on the 'Israel-Hamas war' (Meyersohn, 2023).

Because of the natural frame of singular news articles, I wanted to examine how big of a 'ripple' this was making for Starbucks (e.g., amid the launch of new products, season offers, and other Starbucks-related news, how often were news articles focused on BDS-related actions). To do this, I did a google search of "Starbucks" in February 2024. I selected the "News" tab at the

top (limited results to only news articles), and limited the return of results to those only from the past month. I only examined article titles (not subtitles, summaries, etc.) and recorded the number of articles referencing BDS activities (such as consumer boycotts, protests, and worker strikes). I thoroughly examined the first 20 pages of results (totaling 200 news articles) and found that 40 article titles directly referenced boycotts, protests, and/or strikes. That is 20% of all news posted by or about Starbucks (e.g., news articles from a google search of "Starbucks" within the last 30 days) covering the effects of the BDS movement.

This drop in sales and value is something Starbucks and other companies (such as McDonald's, Disney, Puma, Chevron, Boeing, etc.) are currently devising strategies to overcome and is a result (even if only partially) of action(s) taken rooted in perceptions of injustice. The consequences of these perceptions have caught the attention of the company's social media strategists and even its CEO, who specifically cited the boycotts. For companies who need sales (i.e., money) to thrive, the cost of neglecting perceptions of justice (or not addressing perceptions of injustice) seems apparent.

While these findings do offer an exciting, novel path forward for research evaluating choice architecture interventions, they do not come without limitations. First, and notably, the outcome variables used in Studies 2 and 3 assess feelings toward a hypothetical recycling company that participants briefly read a few sentences about. Practically speaking, there are likely to be many contextual factors that impact satisfaction with one's local recycling company that I was unable to capture here. It's possible that jurisdiction-specific logistics can lead to an increase or decrease in satisfaction (and perceptions of informational justice). Second, the data collected for Studies 2A and 2B were the first times the educational video was fielded upon creation. There may be bits of information present that do a lot of "the work" (i.e., contribute the

most to the knowledge gain observed in the multilayer knowledge instrument) while other parts don't. Due to the nature of the data collected, I was not able to examine this possibility at this time. However, this is a step that will be executed in the future to fine-tune the educational video. Third, all data was collected virtually through a Qualtrics survey. While I did try to include ways to determine how focused participants were (e.g., education intervention question, attention checks, checks for straight-lining) it's possible that participants didn't fully attend to the video or the items (though I do have evidence of knowledge gain as seen between the difference in multilayer knowledge scores between education and no education conditions). Additionally, this limits the generalizability of these results, as all participants were U.S. based and computer literate.

While these findings fill a gap in evaluating choice architecture interventions, there are important considerations. Through conceptual review of the literature, it's likely that justice is one value that may be intrinsically, instrumentally, and/or professionally important. However, it's also likely that justice isn't the only ethical consideration in which choice architecture interventions should be evaluated on. Rather, justice is one ethical consideration that should be weighed alongside other ethical considerations (e.g., autonomy, beneficence, integrity, fidelity and responsibility). It's possible that in some situations, justice violations associated with libertarian paternalistic policies are not severe, and the [autonomy/beneficence/integrity/fidelity and responsibility] benefits are significantly greater in libertarian paternalistic policies compared to education interventions. Future research should focus on more holistic ethical evaluations (e.g., cost benefits analyses) where all ethical principles are considered. Beyond pure ethical evaluations, considerations from said evaluations should be integrated into broader, more formal cost-benefit analyses, such as those outlined in Ethical Interaction Theory (Feltz & Cokely, in

press). This heuristic evaluation allows for comparison between interventions of interest on practical grounds (e.g., policy feasibility, implementation requirements, robustness and durability) as well as ethical grounds (e.g., impacts on autonomy, consumer risks and benefits, disparities and unequal impact) (Feltz & Cokely, in press).

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Table 1

Adapted items to measure perceptions of distributive, procedural, interpersonal, and informational justice

Type of Justice	Item ID	Item
Distributive	DIST1	The plastic recycling company helps all recyclers get the outcomes they need without favoring any one group.
	DIST2	The plastic recycling company produces desired results for all recyclers without bias of any kind.
	DIST3	The plastic recycling company delivers good outcomes for all recyclers regardless of who they are.
	DIST4	In general, the plastic recycling company delivers reasonable results for all customers.
	DIST5	I can get the same recycling outcome as others do.
	DIST6	The plastic recycling company provides the amount of service I expect.
	DIST7	The plastic recycling company provides the services that they promise.
	DIST8	The plastic recycling company provides the quality of service I expect.
Procedural	PROC1	The process of working with the plastic recycling company is generally fair.
	PROC2	The activities of the plastic recycling company are conducted without bias.
	PROC3	The processes involving the plastic recycling company attempt to meet all customer needs.
	PROC4	The procedures used by the plastic recycling company are consistent across customers.
	PROC5	Recycling waiting time is reasonable.
	PROC6	I can appeal if I feel recycling service is not being provided.
	PROC7	The process of the recycling service is smooth.
Interpersonal	INTER1	The plastic recycling company is polite.
	INTER2	The plastic recycling company is respectful.
	INTER3	The plastic recycling company treats recyclers with dignity.
	INTER4	The plastic recycling company is courteous.

	INTER5	The plastic recycling company is friendly.
	INTER6	The plastic recycling company treats me with an unbiased attitude.
	INTER7	The plastic recycling company is honest.
	INTER8	The plastic recycling company is considerate.
	INTER9	The plastic recycling company works hard for me.
Informational	INFO1	The plastic recycling company gives timely and specific explanations.
	INFO2	The plastic recycling company gives thorough explanations.
	INFO3	The plastic recycling company provides reasonable explanations.
	INFO4	The plastic recycling company tailors their explanations to meet recycler needs.
	INFO5	The plastic recycling company gives open communication with customers.

Table 2

Justice item descriptives for Study 1A

Item	*M*	*SD*	Skewness	Kurtosis
DIST1	4.97	1.38	-0.52	-0.25
DIST2	5.07	1.36	-0.51	-0.24
DIST3	5.17	1.31	-0.65	-0.01
DIST4	5.27	1.22	-0.83	0.80
DIST5	5.40	1.29	-1.10	1.16
DIST6	5.26	1.35	-1.09	1.04
DIST7	5.37	1.20	-0.85	0.69
DIST8	5.25	1.34	-1.05	0.84
PROC1	5.41	1.21	-1.04	1.04
PROC2	5.29	1.28	-0.59	-0.04
PROC3	5.18	1.31	-0.91	0.65
PROC4	5.36	1.26	-0.94	0.91
PROC5	5.28	1.23	-0.64	0.19
PROC6	4.47	1.36	-0.34	0.08
PROC7	5.29	1.35	-1.07	0.94
INTER1	5.17	1.25	-0.59	0.14
INTER2	5.24	1.22	-0.56	0.10
INTER3	5.19	1.24	-0.57	0.10
INTER4	5.22	1.23	-0.68	0.34
INTER5	5.18	1.26	-0.64	0.30
INTER6	5.34	1.25	-0.77	0.37
INTER7	4.99	1.23	-0.31	-0.18
INTER8	5.09	1.26	-0.54	0.02
INTER9	5.07	1.35	-0.69	0.17
INFO1	4.85	1.35	-0.51	-0.28
INFO2	4.66	1.39	-0.40	-0.36
INFO3	4.80	1.38	-0.42	-0.37

INFO4	4.71	1.38	-0.37	-0.21
INFO5	4.86	1.36	-0.57	0.00

Note. Items rated on a 7-point Likert scale.

Table 3

Perceptions of justice exploratory factor analysis for Study 1A

Item ID	Distributive	Procedural	Interpersonal	Informational
DIST6	**0.84**			
DIST8	**0.74**			
PROC5	**0.69**			
DIST7	0.56			
PROC7	0.52			
PROC1	0.47			
DIST2		**0.92**		
DIST3		**0.90**		
DIST1		**0.81**		
PROC2		**0.65**		
DIST4		0.58		
PROC4		0.53		
DIST5		0.43		
INTER5			**0.96**	
INTER4			**0.96**	
INTER1			**0.94**	
INTER2			**0.93**	
INTER3			**0.77**	
INTER8			**0.74**	
INTER7			0.58	
INTER6			0.49	
INFO2				**0.99**
INFO3				**0.87**
INFO1				**0.74**
INFO4				**0.72**
INFO5				**0.68**
PROC6				0.43
PROC3	-	-	-	-
INTER9	-	-	-	-

Note. Bolded items indicate items kept for Study 1B confirmatory factor analysis.

Table 4

Perceptions of justice items for Study 1B

Type of Justice	Study 1A Item ID	New Item ID	Item
Distributive	DIST6	DIST1	The plastic recycling company provides the amount of service I expect.
	DIST8	DIST2	The plastic recycling company provides the quality of service I expect.
	PROC5	DIST3	Recycling waiting time is reasonable.
Procedural	DIST1	PROC1	The plastic recycling company helps all recyclers get the outcomes they need without favoring any one group.
	DIST2	PROC2	The plastic recycling company produces desired results for all recyclers without bias of any kind.
	DIST3	PROC3	The plastic recycling company delivers good outcomes for all recyclers regardless of who they are.
	PROC2	PROC4	The activities of the plastic recycling company are conducted without bias.
Interpersonal	INTER1	INTER1	The plastic recycling company is polite.
	INTER2	INTER2	The plastic recycling company is respectful.
	INTER3	INTER3	The plastic recycling company treats recyclers with dignity.
	INTER4	INTER4	The plastic recycling company is courteous.
	INTER5	INTER5	The plastic recycling company is friendly.
	INTER8	INTER6	The plastic recycling company is considerate.
Informational	INFO1	INFO1	The plastic recycling company gives timely and specific explanations.
	INFO2	INFO2	The plastic recycling company gives thorough explanations.
	INFO3	INFO3	The plastic recycling company provides reasonable explanations.
	INFO4	INFO4	The plastic recycling company tailors their explanations to meet recycler needs.
	INFO5	INFO5	The plastic recycling company gives open communication with customers.

Table 5

Justice item descriptives for Study 1B and IC

Item	Study	*M*	*SD*	Skewness	Kurtosis
DIST1	1B	4.57	1.48	-0.48	-0.32
	1C	4.33	1.40	-0.47	-0.46
DIST2	1B	4.62	1.43	-0.50	-0.11
	1C	4.36	1.37	-0.42	-0.38
DIST3	1B	4.67	1.39	-0.43	0.03
	1C	4.53	1.31	-0.43	0.06
PROC1	1B	4.18	1.46	-0.10	-0.39
	1C	4.02	1.33	-0.17	-0.06
PROC2	1B	4.12	1.47	-0.05	-0.47
	1C	4.09	1.32	-0.21	-0.17
PROC3	1B	4.30	1.52	-0.26	-0.43
	1C	4.25	1.34	-0.22	-0.13
PROC4	1B	4.38	1.44	-0.16	-0.26
	1C	-	-	-	-
INTER1	1B	4.66	1.20	-0.24	0.71
	1C	4.52	1.15	-0.24	0.62
INTER2	1B	4.74	1.22	-0.31	0.64
	1C	4.61	1.15	-0.04	0.19
INTER3	1B	4.73	1.21	-0.27	0.70
	1C	4.55	1.24	-0.34	0.38
INTER4	1B	4.72	1.23	-0.27	0.66
	1C	4.56	1.14	-0.23	0.18
INTER5	1B	4.72	1.21	-0.26	0.73
	1C	4.58	1.18	-0.12	0.10
INTER6	1B	4.69	1.19	-0.14	0.53
	1C	-	-	-	-
INFO1	1B	4.47	1.43	-0.32	0.05

	1C	4.27	1.27	0.01	-0.15
INFO2	1B	4.34	1.47	-0.26	-0.23
	1C	4.16	1.31	-0.12	-0.27
INFO3	1B	4.48	1.40	-0.21	-0.06
	1C	4.33	1.25	-0.09	-0.23
INFO4	1B	4.39	1.37	-0.16	-0.18
	1C	4.30	1.24	-0.16	0.06
INFO5	1B	4.34	1.43	-0.26	-0.18
	1C	4.29	1.28	-0.36	-0.05

Note. Items rated on 7-point Likert scale.

Table 6

Perceptions of justice items presented in Study 1C and retained for Study 2

Type of Justice	Item ID	Item
Distributive	DIST1	The plastic recycling company provides the amount of service I expect.
	DIST2	The plastic recycling company provides the quality of service I expect.
	DIST3	Recycling waiting time is reasonable.
Procedural	PROC1	The plastic recycling company helps all recyclers get the outcomes they need without favoring any one group.
	PROC2	The plastic recycling company produces desired results for all recyclers without bias of any kind.
	PROC3	The plastic recycling company delivers good outcomes for all recyclers regardless of who they are.
Interpersonal	INTER1	The plastic recycling company is polite.
	INTER2	The plastic recycling company is respectful.
	INTER3	The plastic recycling company treats recyclers with dignity.
	INTER4	The plastic recycling company is courteous.
	INTER5	The plastic recycling company is friendly.
Informational	INFO1	The plastic recycling company gives timely and specific explanations.
	INFO2	The plastic recycling company gives thorough explanations.
	INFO3	The plastic recycling company provides reasonable explanations.
	INFO4	The plastic recycling company tailors their explanations to meet recycler needs.
	INFO5	The plastic recycling company gives open communication with customers.

Table 7

Satisfaction with a hypothetical recycling company (Recycling Company A) descriptive information

Item ID	Item	Study	*M*	*SD*
SAT1	I am satisfied with Recycling Company A.	2A	4.72	1.37
		2B	4.97	1.11
SAT2	I am satisfied with the types of plastic Recycling Company A accepts.	2A	4.62	1.39
		2B	4.91	1.16
SAT3	Recycling Company A is doing a good job.	2A	4.81	1.38
		2B	5.14	1.09
SAT4	I trust Recycling Company A.	2A	4.48	1.29
		2B	4.73	1.07
SAT5	I know Recycling Company A has a good reason for the certain kinds of plastic they don't accept.	2A	4.96	1.30
		2B	5.05	1.22

Table 8

OPRKS items and item descriptives assessing objective knowledge of plastic recycling

Item ID	Item	T/F	Study	% correct
OPRKS1	Recycling creates at least 3 times the jobs landfilling does.	T	2A	45.86
			2B	43.48
OPRKS2	Recycling 1 ton of plastic saves more than 20 cubic yards of landfill space.	T	2A	58.88
			2B	57.25
OPRKS3	It takes more than a year for a recycled product to be back on the shelf.	F	2A	21.01
			2B	23.91
OPRKS4	By using reusable drink containers an average person can eliminate the need for over 50 disposable bottles per year.	T	2A	81.36
			2B	80.44
OPRKS5	Over 20% of plastic is used once and then discarded.	T	2A	74.85
			2B	69.93
OPRKS6	Recycling plastic reduces carbon dioxide emissions.	T	2A	57.69
			2B	56.16
OPRKS7	Recycling a single plastic water bottle saves enough energy to run a 100-watt bulb for over 2 hours.	T	2A	34.62
			2B	33.33
OPRKS8	Recycling creates at least 10 times the jobs that incinerating does.	T	2A	34.02
			2B	27.17
OPRKS9	Over 1 billion Styrofoam coffee cups are thrown away every year by Americans.	T	2A	71.01
			2B	67.75
OPRKS10	Recycling 1 ton of simple plastic saves the energy equivalent of leaving a 100 W lightbulb on for 5 years.	T	2A	36.10
			2B	34.78
OPRKS11	Recycling is over a $100 billion industry in the U.S.	T	2A	50.00
			2B	51.09
OPRKS12	Plastic constitutes less than 50% of trash floating on the ocean’s surface.	F	2A	53.55
			2B	56.52

OPRKS13	The average American throws away more than 150 pound of plastic per year.	T	2A 2B	74.26 75.73

Table 9

Items and item descriptives assessing multilayer knowledge

Item ID	Item	T/F	Study	% correct(*)
MULTI1	Multilayer plastic films require more plastic for packaging meat than plastic film made of a single type of plastic.	F	2A	17.80 (78.33)
			2B	19.20 (90.57)
MULTI2	Multilayer plastic films are regularly recycled.	F	2A	69.14 (64.38)
			2B	67.39 (69.89)
MULTI3	Multilayer plastic films can be replaced by films consisting of a single layer without adding weight.	F	2A	14.24 (75.00)
			2B	20.65 (84.21)
MULTI4	Multilayer plastic films can be replaced by films consisting of a single layer without compromising function.	F	2A	28.49 (79.17)
			2B	31.52 (82.75)
MULTI5	Multilayer packaging films have different layers of materials that are difficult to separate.	T	2A	70.03 (61.44)
			2B	70.29 (67.01)
MULTI6	Multilayer plastic packaging can extend the shelf life for fresh products compared to singlelayer plastic packaging.	T	2A	61.13 (66.50)
			2B	59.78 (78.18)
MULTI7	Multilayer plastic has layers that can prevent transfer of oxygen through the film.	T	2A	60.53 (56.86)
			2B	63.41 (64.57)

MULTI8	Multilayer plastic has layers that can prevent transfer of moisture through the film.	T	2A	62.32 (55.24)
			2B	67.31 (66.13)
MULTI9	Multilayer plastic has layers that can prevent transfer of light through the film.	T	2A	27.00 (50.55)
			2B	34.78 (61.46)

Notes. *Values in (parentheses) in the "% correct" column represent the percent of those who responded correctly that received the education intervention

Table 10

Environmental concern items and item descriptives

Item	Study	*M* (*)	*SD*
I fear that we are going to drown in all the waste we produce.	2A	4.94	1.62
	2B	4.84	1.56
In the discussion of environmental topics, the importance of the waste problem is exaggerated.*	2A	2.39 (5.62)	1.40
	2B	2.46 (5.54)	1.36
I would be willing to pay higher fees if that would result in a more environmentally friendly waste disposal.	2A	4.52	1.69
	2B	4.70	1.59
Waste lying around on streets or sidewalks makes me quite upset.	2A	5.89	1.00
	2B	5.80	1.05
The United States is commendable with regard to waste separation and recycling; there is not much to improve.*	2A	2.46 (5.54)	1.40
	2B	2.38 (5.62)	1.37
I would be willing to separate more different kinds of recyclables in the future.	2A	5.67	1.23
	2B	5.88	1.08

Note. *items reverse-coded

Table 11

Study 2 and 3 Descriptive Statistics for 2x3 ANOVA and Informational Justice as the Outcome Variable

Education	Framing Nudge	Study	*N*	*M*	*SD*
Education	Positive	2	57	4.68	1.14
		3	74	5.00	0.97
	Neutral	2	59	4.63	1.18
		3	73	5.00	0.93
	Negative	2	57	4.10	0.91
		3	63	4.52	1.12
No Education	Positive	2	55	4.50	1.27
		3	63	4.49	0.95
	Neutral	2	52	4.31	1.05
		3	66	4.43	1.14
	Negative	2	58	3.85	1.28
		3	67	4.13	0.91

Table 12

2 (education/no education) x 3 (negatively, neutrally, positively framed nudge) ANOVA for Studies 2A and 2B with perceptions of informational justice

	Study	*df*	*F*	*p*	η^2
Education	2A	1	4.00	0.04	0.011
	2B	1	24.26	< 0.001	0.055
Framing Nudge	2A	2	9.16	< 0.001	0.052
	2B	2	7.11	< 0.001	0.032
Education*Framing Nudge	2A	2	0.10	0.91	0.000
	2B	2	0.24	0.79	0.001
Residuals	2A	332			
	2B	400			

Table 13

2x3 ANOVA Informational Justice Post-Hoc Comparisons for Studies 2A and 2B

Condition		Condition		Study	Mean	*SE*	*t*	p_{tukey}
Frame	Education	Frame	Education		Difference			
Negative	No	Neutral	No	2A	-0.46	0.22	-2.12	0.281
				2B	-0.31	0.17	-1.75	0.498
		Positive	No	2A	-0.65	0.22	-3.01	**0.033**
				2B	-0.36	0.18	-2.05	0.318
		Negative	Yes	2A	-0.25	0.21	-1.19	0.843
				2B	-0.40	0.18	-2.26	0.212
		Neutral	Yes	2A	-0.78	0.21	-3.68	**0.004**
				2B	-0.87	0.17	-5.14	**< 0.001**
		Positive	Yes	2A	-0.83	0.21	-3.88	**0.002**
				2B	-0.87	0.17	-5.14	**< 0.001**
Neutral	No	Positive	No	2A	-0.19	0.22	-0.84	0.959
				2B	-0.06	0.18	-0.31	1.000
		Negative	Yes	2A	0.21	0.22	0.96	0.932
				2B	-0.09	0.18	-0.53	0.995
		Neutral	Yes	2A	-0.32	0.22	-1.45	0.697
				2B	-0.57	0.17	-3.33	**0.012**
		Positive	Yes	2A	-0.37	0.22	-1.66	0.556
				2B	-0.56	0.17	-3.32	**0.012**
Positive	No	Negative	Yes	2A	0.40	0.22	1.83	0.447
				2B	-0.04	0.18	-0.21	1.000
		Neutral	Yes	2A	-0.13	0.22	-0.60	0.991
				2B	-0.51	0.17	-2.97	**0.037**
		Positive	Yes	2A	-0.18	0.22	-0.83	0.962
				2B	-0.51	0.17	-2.96	**0.038**
Negative	Yes	Neutral	Yes	2A	-0.53	0.21	-2.47	0.136
				2B	-0.47	0.17	-2.75	0.069
		Positive	Yes	2A	-0.58	0.22	-2.68	0.082
				2B	-0.47	0.17	-2.74	0.070
Neutral	Yes	Positive	Yes	2A	-0.05	0.21	-0.24	1.000
				2B	0.00	0.17	0.02	1.000

Table 14

Study 2 and 3 Descriptive Statistics for 2x3 ANOVA and Satisfaction as the Outcome Variable

Education	Framing Nudge	Study	*N*	*M*	*SD*
Education	Positive	2	57	5.00	0.95
		3	74	5.15	0.82
	Neutral	2	59	5.24	0.71
		3	73	5.18	0.85
	Negative	2	57	4.35	1.23
		3	63	4.59	1.04
No Education	Positive	2	55	4.93	0.81
		3	63	4.51	1.03
	Neutral	2	52	5.05	1.00
		3	66	4.92	0.84
	Negative	2	58	3.77	1.24
		3	67	3.88	1.03

Table 15

2 (education/no education) x 3 (negatively, neutrally, positively framed nudge) ANOVA for Studies 2A and 2B with satisfaction

	Study	*df*	*F*	*p*	η^2
Education	2A	1	6.75	0.01	0.016
	2B	1	33.20	< 0.001	0.068
Framing Nudge	2A	2	37.73	< 0.001	0.180
	2B	2	26.93	< 0.001	0.110
Education*Framing Nudge	2A	2	1.99	0.14	0.010
	2B	2	2.18	0.12	0.009
Residuals	2A	332			
	2B	400			

Table 16

2x3 ANOVA Satisfaction Post-Hoc Comparisons for Studies 2A and 2B

Condition		Condition		Study	Mean	*SE*	*t*	p_{tukey}
Frame	Education	Frame	Education		Difference			
Negative	No	Neutral	No	2A	-1.28	0.19	-6.65	< **0.001**
				2B	-1.04	0.16	-6.38	< **0.001**
		Positive	No	2A	-1.16	0.19	-6.10	< **0.001**
				2B	-0.63	0.16	-3.83	**0.002**
		Negative	Yes	2A	-0.59	0.19	-3.11	**0.024**
				2B	-0.71	0.16	-4.31	< **0.001**
		Neutral	Yes	2A	-1.48	0.19	-7.91	< **0.001**
				2B	-1.30	0.16	-8.22	< **0.001**
		Positive	Yes	2A	-1.24	0.19	-6.56	< **0.001**
				2B	-1.26	0.16	-8.01	< **0.001**
Neutral	No	Positive	No	2A	0.12	0.20	0.63	0.989
				2B	0.41	0.17	2.47	0.135
		Negative	Yes	2A	0.70	0.19	3.60	**0.005**
				2B	0.33	0.17	1.99	0.350
		Neutral	Yes	2A	-0.19	0.19	-1.01	0.914
				2B	-0.27	0.16	-1.67	0.552
		Positive	Yes	2A	0.05	0.19	0.24	1.000
				2B	-0.23	0.16	-1.44	0.703
Positive	No	Negative	Yes	2A	0.57	0.19	3.01	**0.034**
				2B	-0.08	0.17	0.48	0.997
		Neutral	Yes	2A	-0.32	0.19	-1.68	0.549
				2B	-0.67	0.16	-4.18	< **0.001**
		Positive	Yes	2A	-0.08	0.19	-0.40	0.999
				2B	-0.64	0.16	-3.96	**0.001**
Negative	Yes	Neutral	Yes	2A	-0.89	0.19	-4.75	< **0.001**
				2B	-0.59	0.16	-3.69	**0.003**
		Positive	Yes	2A	-0.65	0.19	-3.44	**0.009**
				2B	-0.56	0.16	-3.47	**0.008**
Neutral	Yes	Positive	Yes	2A	0.24	0.19	1.28	0.793
				2B	0.04	0.15	0.24	1.000

Table 17

Study 2 Correlation Table

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Education	-	-	-												
2. Framing Nudge	-	-	0.02	-											
3. Satisfaction	4.72	1.13	0.14*	0.42 ***	-										
4. Intentions	4.86	1.29	0.12*	0.41 ***	0.82 ***	-									
5. Info Justice	4.34	1.18	0.11*	0.23 ***	0.47 ***	0.43 ***	-								
6. Dist Justice	4.63	1.24	0.08	0.18 ***	0.50 ***	0.41 ***	0.63 ***	-							
7. Proc Justice	4.47	1.34	0.03	0.14*	0.44 ***	0.36 ***	0.56 ***	0.65 ***	-						
8. Inter Justice	4.64	0.98	0.01	0.15**	0.38 ***	0.34 ***	0.66 ***	0.61 ***	0.53 ***	-					
9. Subjective Knowledge	3.54	1.39	0.01	-0.12*	0.05	0.05	0.18 **	0.08	0.06	0.10	-				
10. Objective Knowledge	6.93	3.08	-0.07	-0.07	-0.02	0.01	0.13*	0.04	0.09	0.16 **	0.14 **	-			
11. Confidence	5.21	2.92	-0.07	-0.12*	0.02	0.02	0.12*	0.00	0.05	0.11	0.27 ***	0.67 ***	-		
12. Multilayer Knowledge	4.10	2.38	0.40***	-0.07	0.12*	0.13*	0.09	-0.01	-0.01	0.09	0.16 **	0.32 ***	0.24 ***	-	
13. Environ Concern	5.37	0.97	-0.03	0.09	-0.07	0.07	-0.04	-0.06	-0.04	-0.02	0.09	0.16 **	0.06	0.10	-
14. Numeracy	3.09	1.78	-0.03	-0.10	0.01	-0.02	-0.06	-0.05	-0.08	-0.03	0.08	0.08	0.12*	0.1*	0.01

Notes. Education was coded 0 = no education, 1 = education. Framing nudge was coded as 0 = negative frame, 1 = neutral OR positive frame (see Table 18). Values for satisfaction, intentions, subjective knowledge, perceptions of informational, distributive, procedural, and interpersonal justice, and environmental concern ranged from 1-7 (measures with more than one item were averaged). Objective knowledge and confidence could range from 0 to 13. Multilayer knowledge could range from 0 to 9. Numeracy could range from 1 to 7.

Table 18

Study 2 t-tests for positive and neutral framed nudge

Outcome	*t*	*p*
Satisfaction	1.61	0.11
Informational justice	-0.71	0.48
Distributive justice	-1.36	0.18
Procedural justice	-0.50	0.62
Interpersonal justice	-1.45	0.15
Objective knowledge	-0.45	0.65
Environmental concern	0.08	0.94

Table 19

Initial EFA on perceptions of justice factor structure for Study 3

Item ID	Distributive/Procedural	Interpersonal	Informational
DIST1	0.61		
DIST2	0.57		
DIST3	0.83		
PROC1	0.81		
PROC2	0.85		
PROC3	-		
INTER1		0.88	
INTER2		0.88	
INTER3		0.80	
INTER4		0.88	
INTER5		0.91	
INFO1			0.74
INFO2			0.86
INFO3			0.87
INFO4			0.73
INFO5			0.75

Table 20

EFA constrained to four factors on perceptions of justice factor structure for Study 3

Item ID	Distributive	Procedural	Interpersonal	Informational
DIST1	0.86			
DIST2	0.88			
DIST3	0.77			
PROC1		0.85		
PROC2		0.90		
PROC3		-		
INTER1			0.87	
INTER2			0.88	
INTER3			0.81	
INTER4			0.90	
INTER5			0.94	
INFO1				0.71
INFO2				0.92
INFO3				0.88
INFO4				0.78
INFO5				0.77

Table 21

Study 3 post hoc comparisons with perceptions of justice as the outcome variable

	Positive Educated	Neutral Educated	Negative Educated	Positive Not Educated	Neutral Not Educated
Positive Educated	-				
Neutral Educated	*NS*	-			
Negative Educated	Positive Educated	Neutral Educated	-		
Positive Not Educated	**Positive Educated**	*NS*	*NS*	-	
Neutral Not Educated	**Positive Educated**	**Neutral Educated**	*NS*	*NS*	-
Negative Not Educated	**Positive Educated**	**Neutral Educated**	*NS*	*NS*	*NS*

Note. NS = non-significant (i.e., the post-hoc comparison between conditions was not significant). The condition specified indicates the condition that had significantly higher perceptions of informational justice. Bolded items (i.e., conditions) indicate statistically significant differences between conditions. Non-bolded items (i.e., conditions) indicate marginally significant differences between conditions.

Table 22

Study 3 Correlation Table

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Education	-	-	-												
2. Framing Nudge	-	-	0.06	-											
3. Satisfaction	4.96	0.92	0.33 ***	0.29 ***	-										
4. Intentions	5.10	1.06	0.21 ***	0.28 ***	0.83 ***	-									
5. Info Justice	4.74	1.03	0.23 ***	0.22 ***	0.59 ***	0.49 ***	-								
6. Dist Justice	4.84	1.03	0.23 ***	0.26 ***	0.78 ***	0.74 ***	0.69 ***	-							
7. Proc Justice	4.75	1.17	0.14 *	0.24 ***	0.63 ***	0.58 ***	0.57 ***	0.69 ***	-						
8. Inter Justice	4.78	0.97	0.19 **	0.13 *	0.51 ***	0.47 ***	0.71 ***	0.62 ***	0.55 ***	-					
9. Subjective Knowledge	3.57	1.13	0.05	0.14 *	0.22 ***	0.22 ***	0.16 **	0.14 *	0.09	0.14 *	-				
10. Objective Knowledge	6.78	3.30	-0.02	0.06	0.14 *	0.14 *	0.11	0.06	0.04	0.19 **	0.27 ***	-			
11. Confidence	5.11	3.00	0.01	0.03	0.17 **	0.19 **	0.12	0.10	0.02	0.15 *	0.39 ***	0.73 ***	-		
12. Multilayer Knowledge	4.34	2.60	0.55 ***	0.06	0.17 **	0.11	0.05	0.04	0.01	0.05	0.15 *	0.29 ***	0.27 ***	-	
13. Environ Concern	5.40	0.94	-0.02	0.09	0.02	0.18 **	-0.10	-0.02	-0.08	-0.08	0.16 **	0.16 *	0.12 *	0.08	-
14. Numeracy	2.99	1.90	0.00	0.02	0.00	0.04	-0.04	0.01	0.08	0.00	-0.12	-0.10	-0.09	0.11	0.08

Notes. Education was coded 0 = no education, 1 = education. Framing nudge was coded as 0 = negative frame, 1 = neutral OR positive frame (see Table 18). Values for satisfaction, intentions, subjective knowledge, perceptions of informational, distributive, procedural, and interpersonal justice, and environmental concern ranged from 1-7 (measures with more than one item were averaged). Objective knowledge and confidence could range from 0 to 13. Multilayer knowledge could range from 0 to 9. Numeracy could range from 1 to 7.

Table 23

Multigroup model comparisons for each path

Model	*df*	χ^2 diff	RMSEA diff	*p*
1. Fully unconstrained	4			
2. Multilayer knowledge to informational justice	5	0.00	0.00	0.97
3. Multilayer knowledge to satisfaction	5	0.91	0.00	0.34
4. Knowledge to informational justice	5	1.00	0.00	0.32
5. Framing nudge to informational justice	5	1.06	0.02	0.30
6. Knowledge to multilayer knowledge	5	1.90	0.07	0.17
7. Framing nudge to satisfaction	5	4.96	0.14	0.02*
8. Informational justice to satisfaction	5	1.55	0.05	0.21

Notes. $^{*}p < 0.05$. Descriptions in the model column explain the parameter (path) held constant in each model (2-8). Values for each model (2-8) illustrate the model comparisons between each model and the fully unconstrained model (model 1).

Table 24

Constrained and unconstrained model comparison

Model	*df*	χ^2 diff	RMSEA diff	*p*
1. Fully unconstrained	4			
2. All paths constrained except framing nudge to satisfaction	10	6.47	0.02	0.37

Figure 1

Ten value structure of Schwartz's (2012) Theory of Basic Values

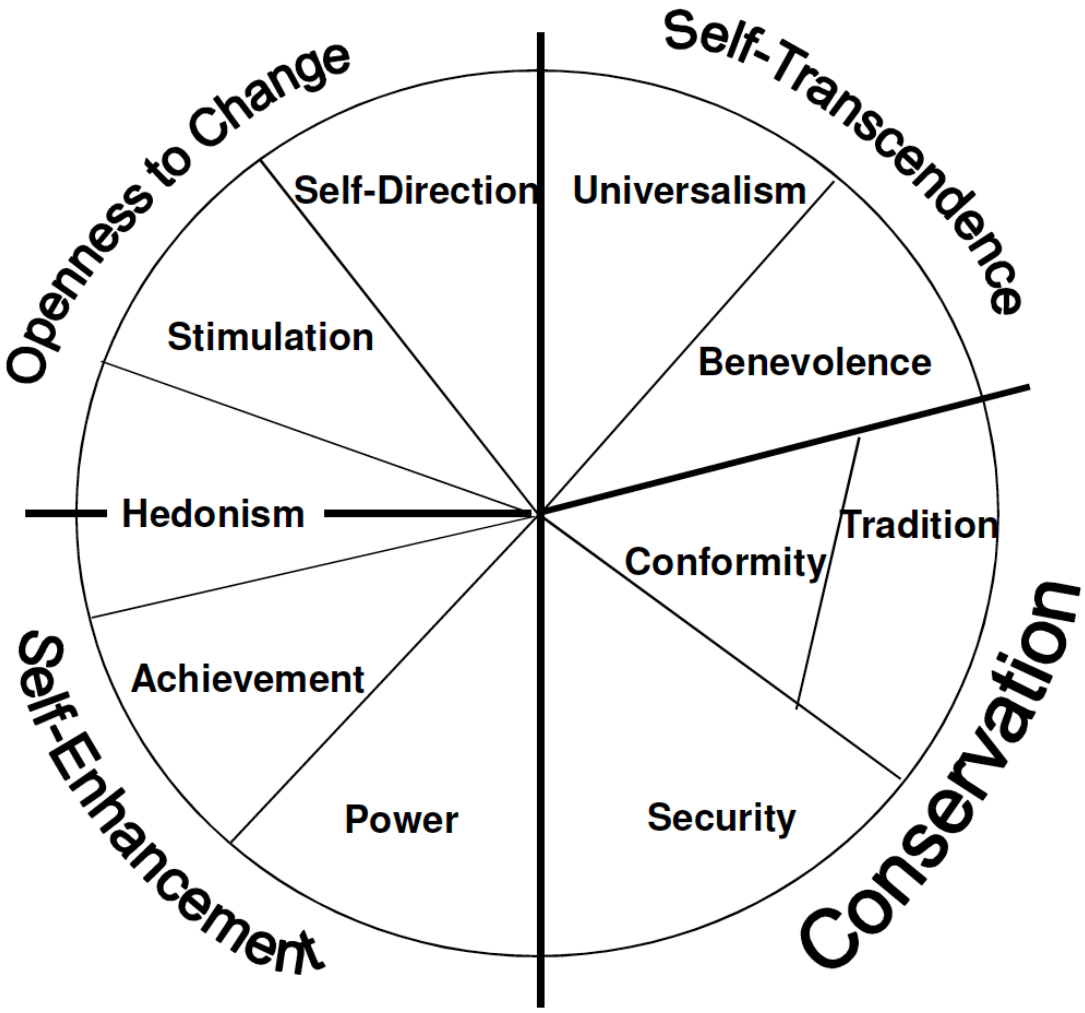
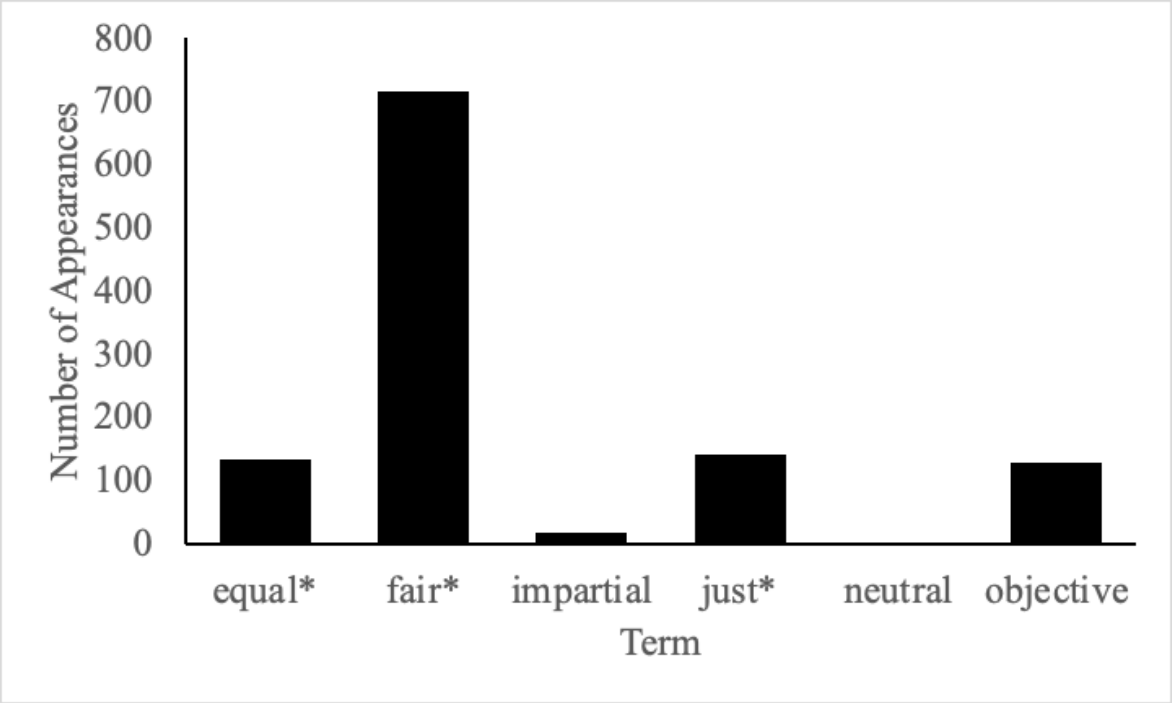


Figure 2

Exploratory analysis of justice terminology in professional ethics codes



Notes. *indicates any suffix corresponding with base word, so equal* could be equal, equally, equality, equalness, etc.

Figure 3

Frequency of justice terminology within each occupational domain

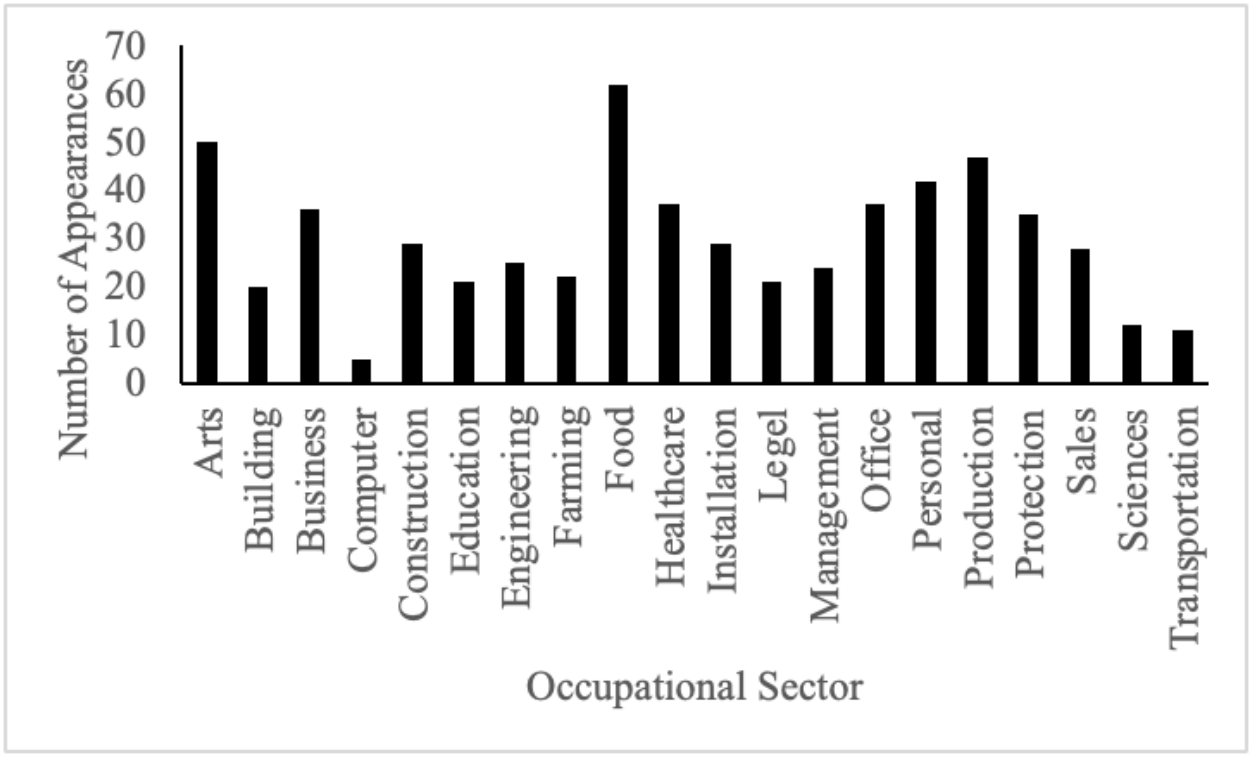


Figure 4

Hypothesized factor structure for Study 1B

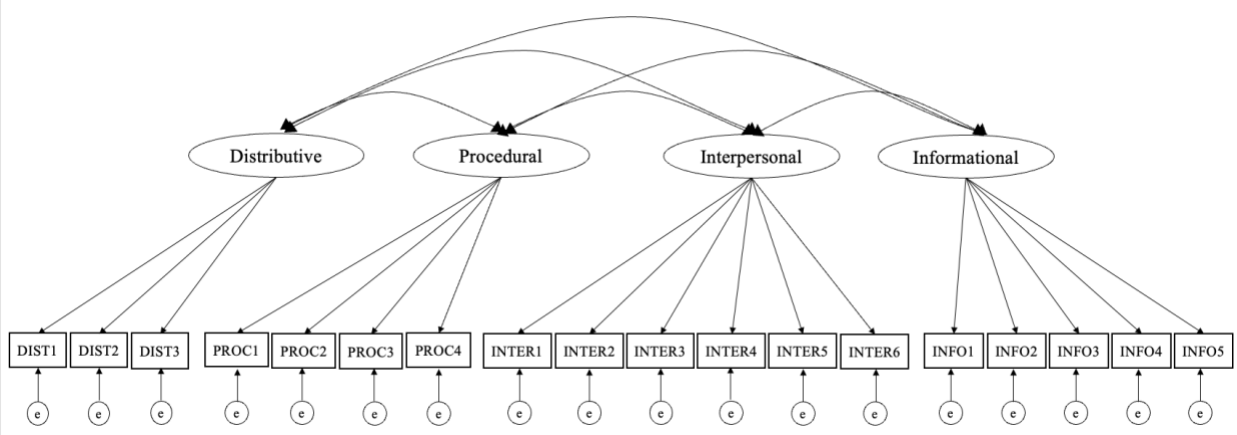
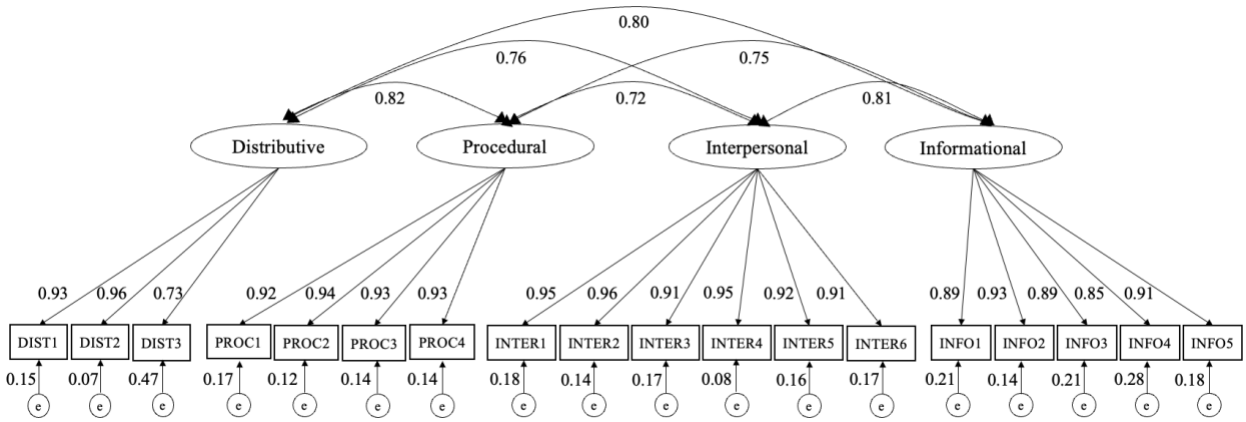


Figure 5

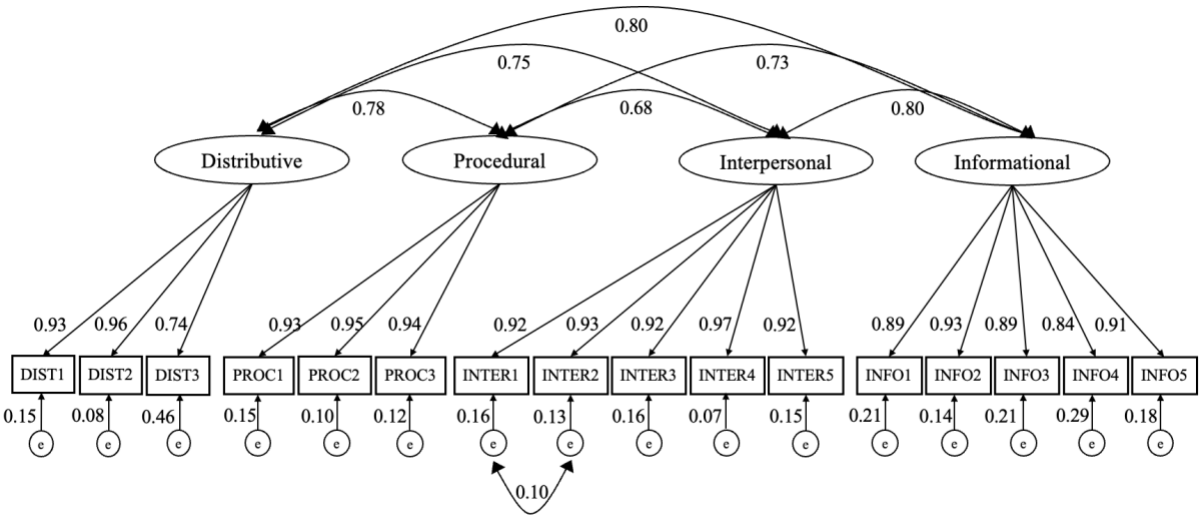
Initial confirmatory factor analysis for Study 1B



Note. $\chi^2(129) = 387.37$, $p < 0.001$, CFI = 0.999, RMSEA = 0.070, RMSEA 90% CI = 0.062-0.078.

Figure 6

Modified confirmatory factor analysis for Study 1B



Note. $\chi^2(97) = 115.51$, $p = 0.097$, CFI = 1.00, RMSEA = 0.022, RMSEA 90% CI = 0.000-0.035. Alterations to the CFA include dropping 2 items (i.e., PROC4 and INTER6) and allowing INTER1 and INTER2 to covary.

Figure 7

Hypothesized factor structure for Study 1C

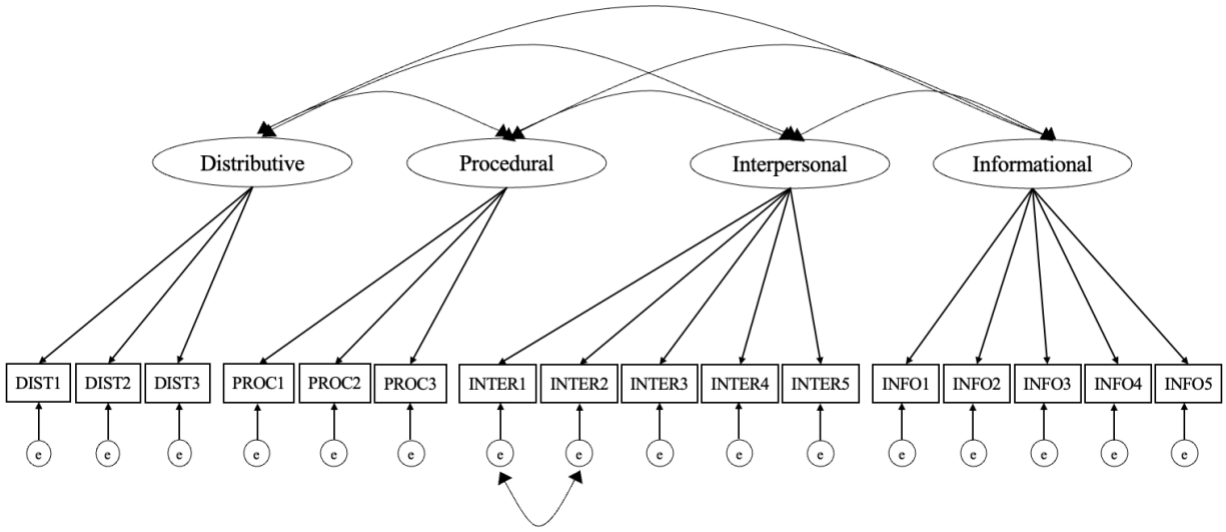
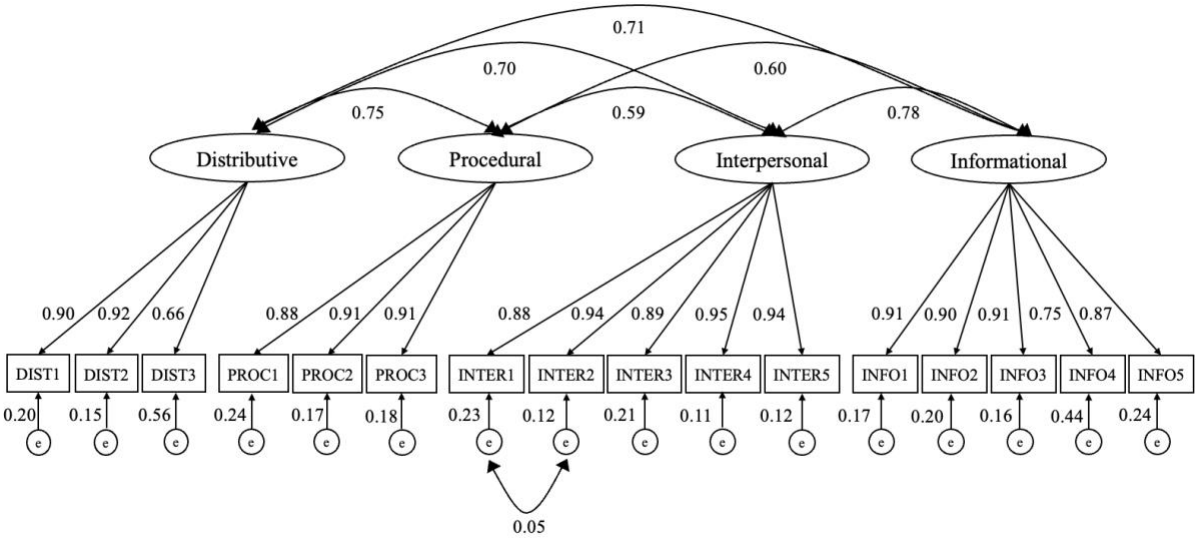


Figure 8

Confirmatory factor analysis for Study 1C



Note. $\chi^2(97) = 139.56$, $p = 0.003$, CFI = 1.00, RMSEA = 0.033, RMSEA 90% CI = 0.02-0.045.

Figure 9

Hypothesized Skilled Decision Theory model

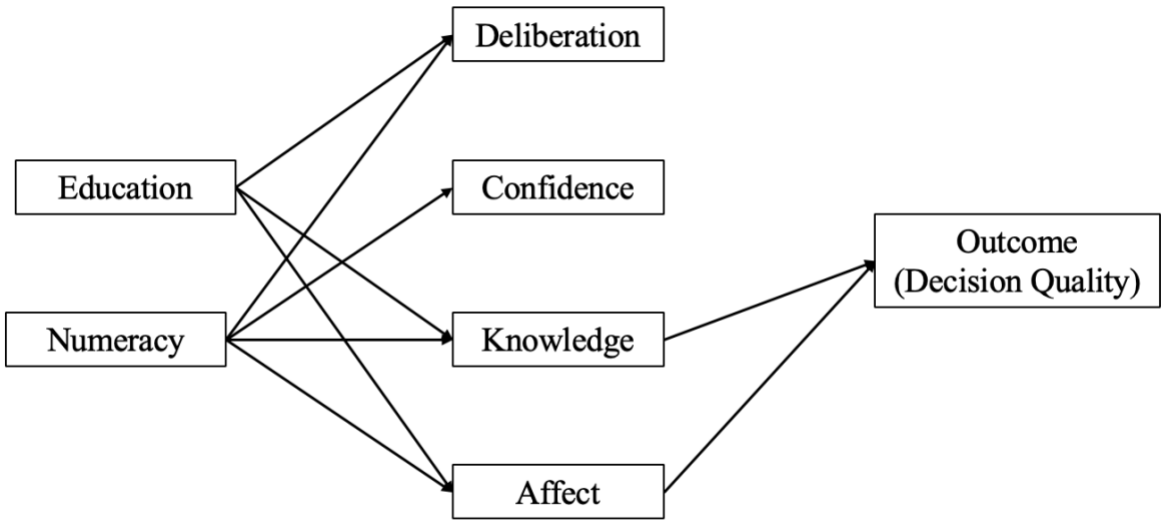
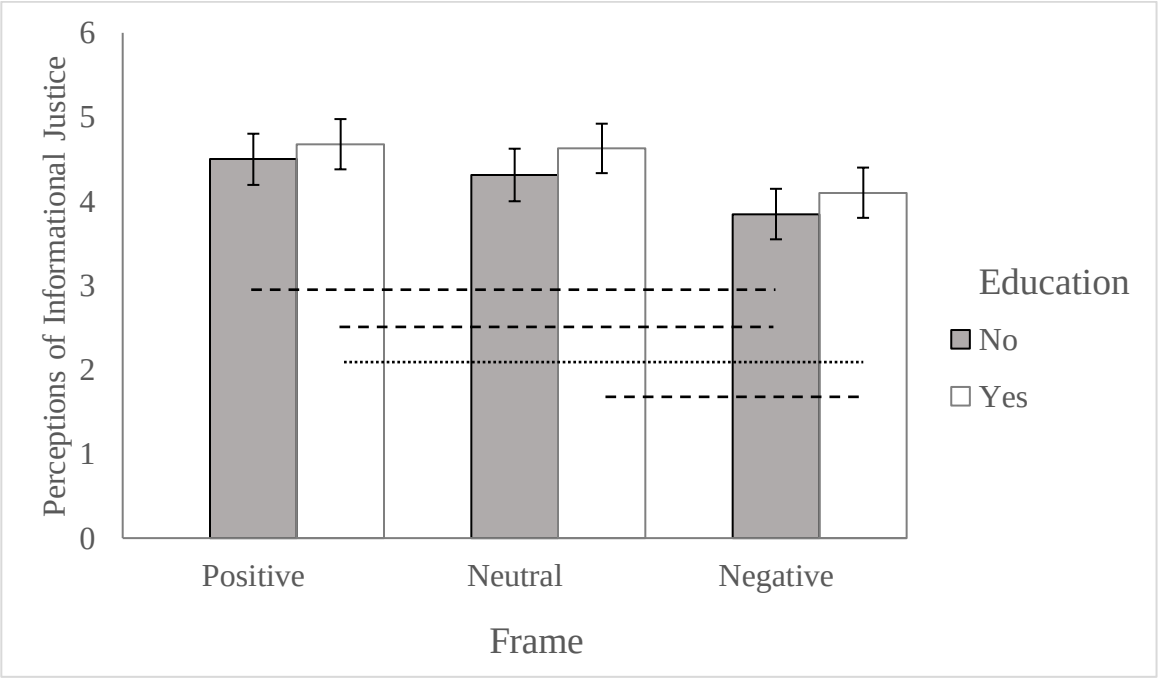


Figure 10

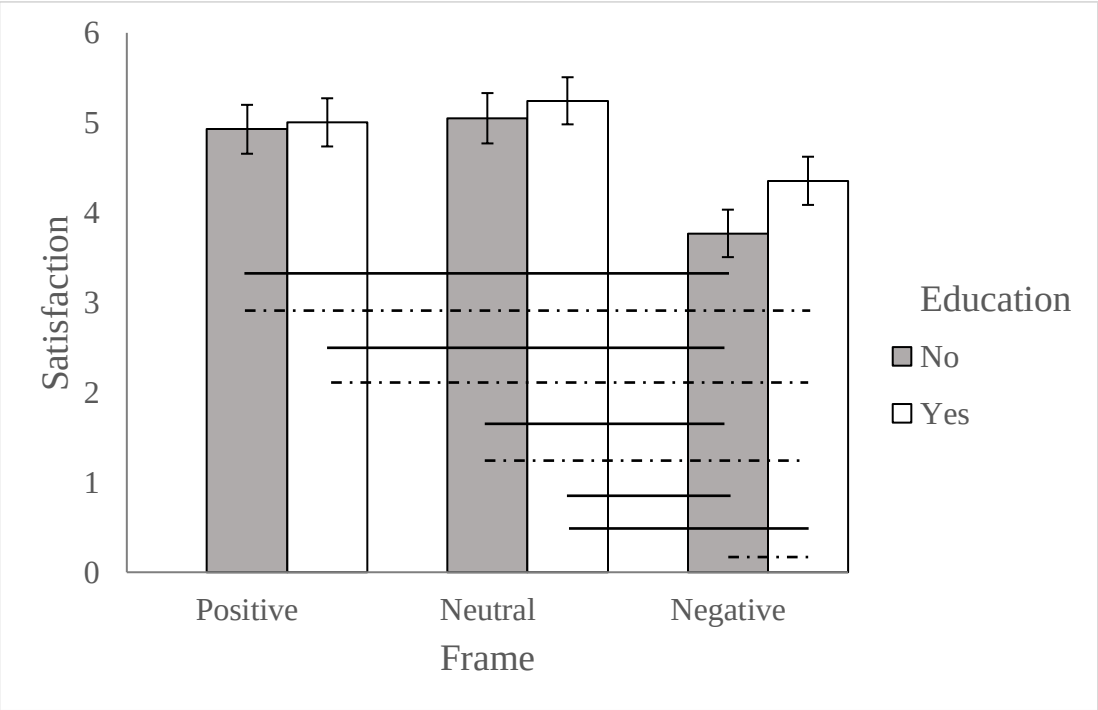
2 (education/no education) x 3 (positive/neutral/negative frame) ANOVA with perceptions of informational justice for Study 2



Notes. Marginal means for each condition with 95% CIs. Solid lines indicate $p_{tukey} < 0.001$. Dashed lines indicate $p_{tukey} < 0.01$. Dash-dotted lines indicate $p_{tukey} < 0.05$. Dotted lines indicate $p_{tukey} < 0.1$.

Figure 11

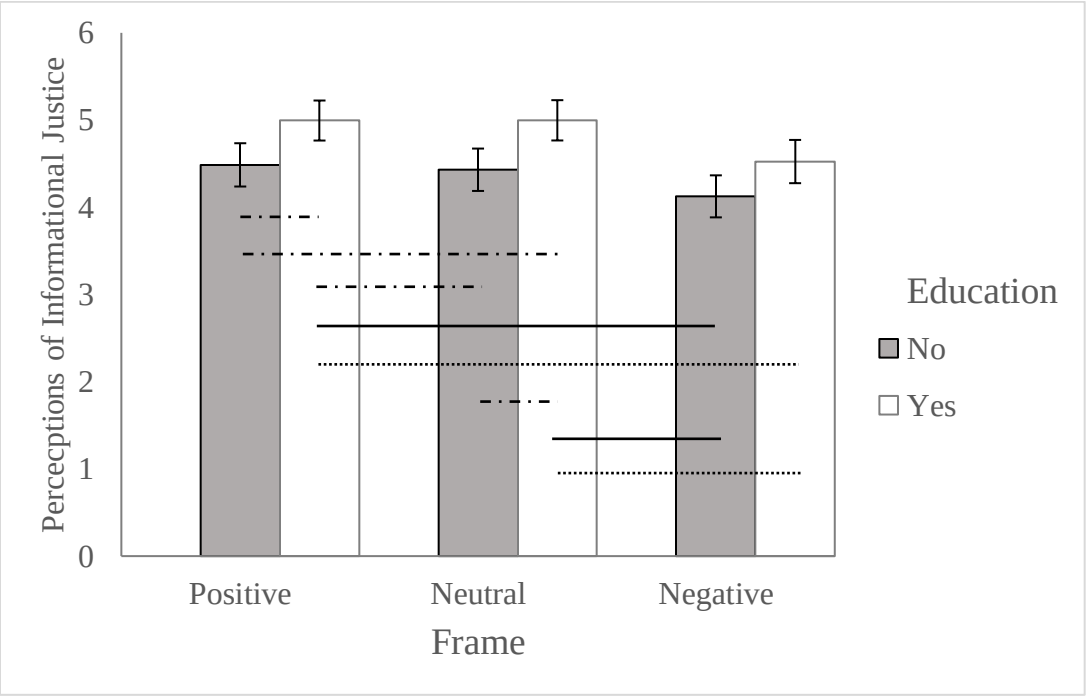
2 (education/no education) x 3 (positive/neutral/negative frame) ANOVA with satisfaction with a hypothetical recycling company for Study 2



Notes. Marginal means for each condition with 95% CIs. Solid lines indicate $p_{tukey} < 0.001$. Dashed lines indicate $p_{tukey} < 0.01$. Dash-dotted lines indicate $p_{tukey} < 0.05$. Dotted lines indicate $p_{tukey} < 0.1$.

Figure 12

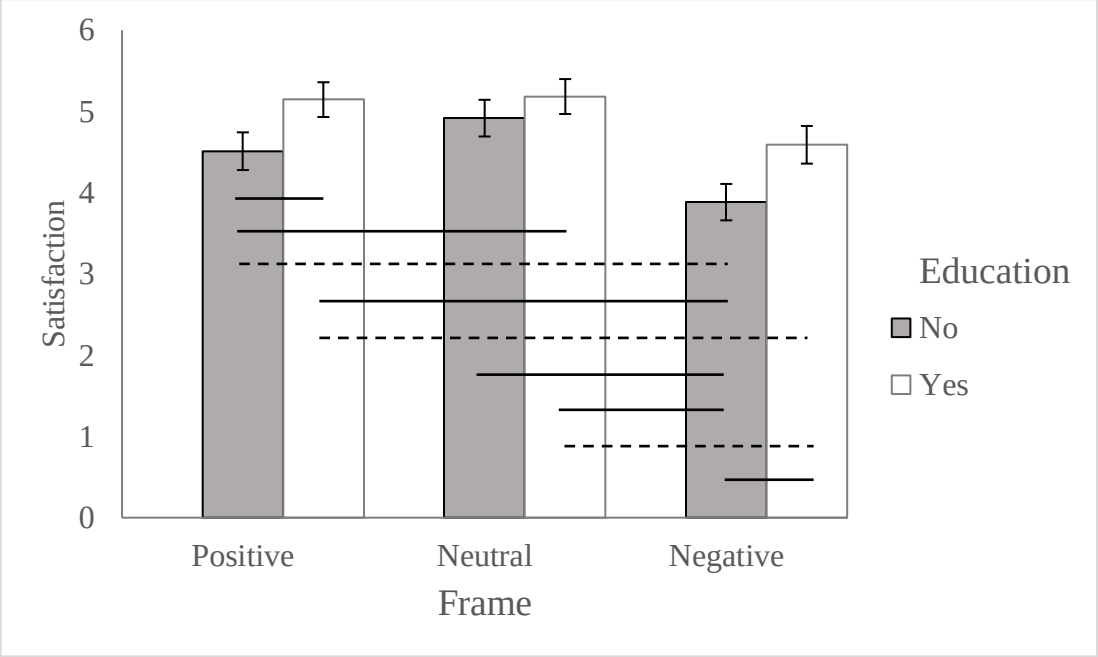
2 (education/no education) x 3 (positive/neutral/negative frame) ANOVA with perceptions of informational justice for Study 3



Notes. Marginal means for each condition with 95% CIs. Solid lines indicate $p_{tukey} < 0.001$. Dashed lines indicate $p_{tukey} < 0.01$. Dash-dotted lines indicate $p_{tukey} < 0.05$. Dotted lines indicate $p_{tukey} < 0.1$.

Figure 13

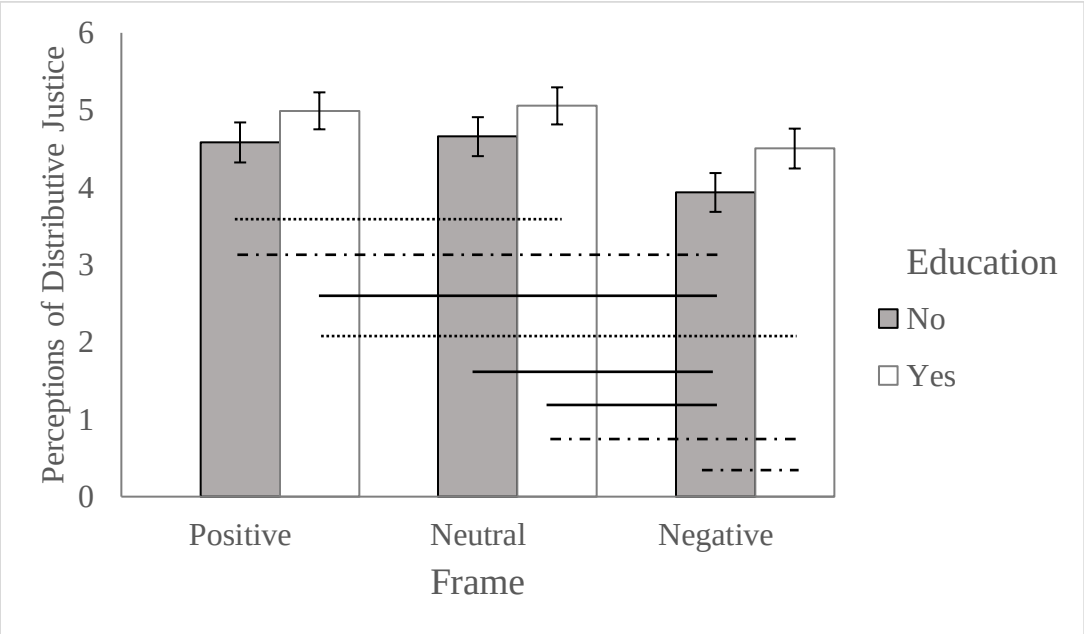
2 (education/no education) x 3 (positive/neutral/negative frame) ANOVA satisfaction for Study 3



Notes. Marginal means for each condition with 95% CIs. Solid lines indicate $p_{tukey} < 0.001$. Dashed lines indicate $p_{tukey} < 0.01$. Dash-dotted lines indicate $p_{tukey} < 0.05$. Dotted lines indicate $p_{tukey} < 0.1$.

Figure 14

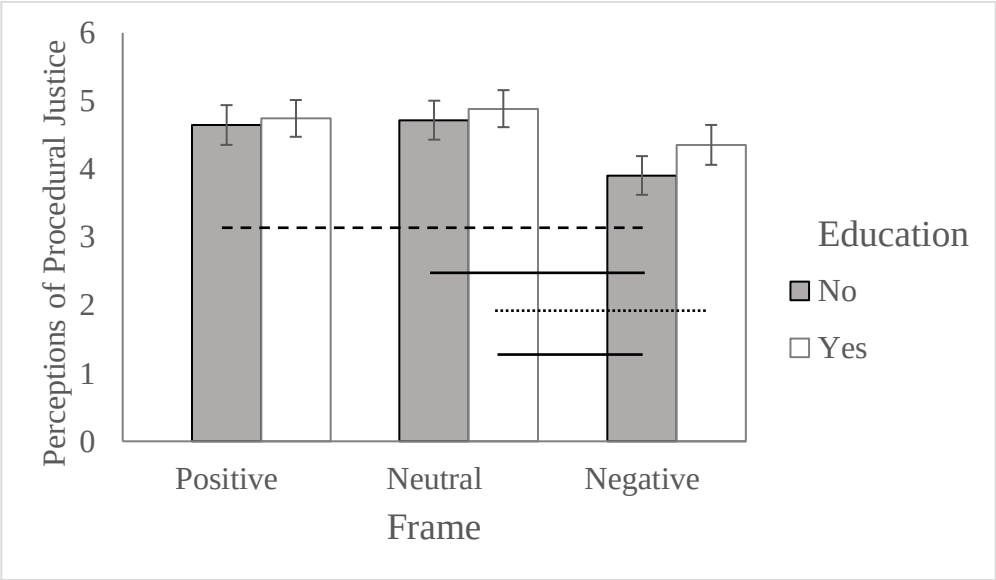
2 (education/no education) x 3 (positive/neutral/negative frame) ANOVA perceptions of distributive justice for Study 3



Notes. Marginal means for each condition with 95% CIs. Solid lines indicate $p_{tukey} < 0.001$. Dashed lines indicate $p_{tukey} < 0.01$. Dash-dotted lines indicate $p_{tukey} < 0.05$. Dotted lines indicate $p_{tukey} < 0.1$.

Figure 15

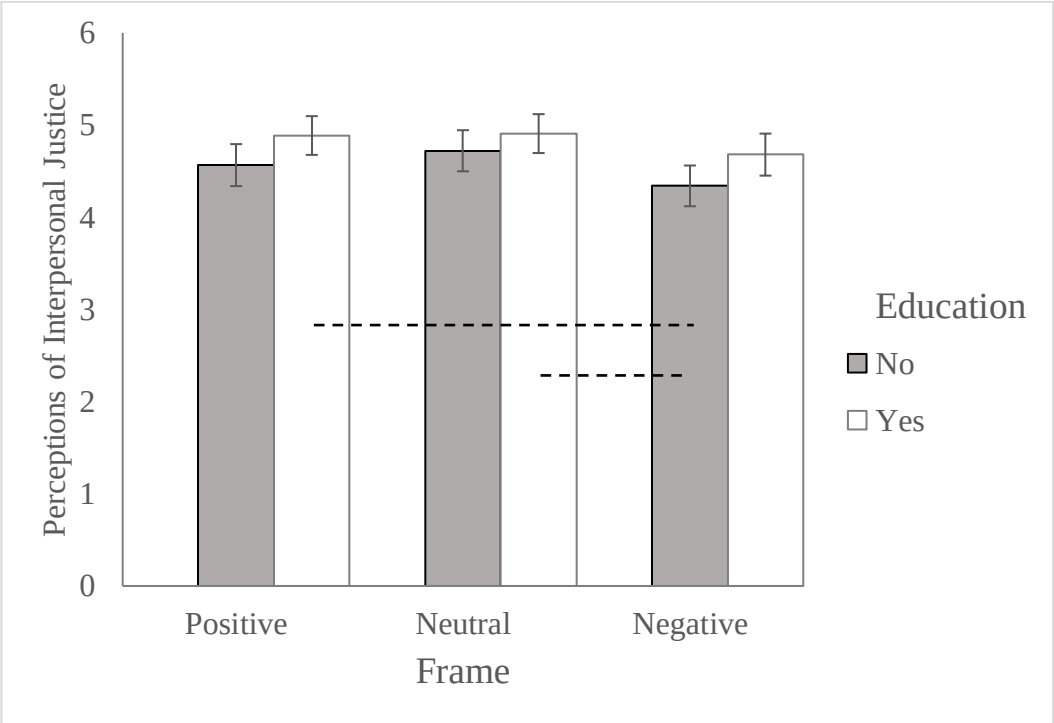
2 (education/no education) x 3 (positive/neutral/negative frame) ANOVA perceptions of procedural justice for Study 3



Notes. Marginal means for each condition with 95% CIs. Solid lines indicate $p_{tukey} < 0.001$. Dashed lines indicate $p_{tukey} < 0.01$. Dash-dotted lines indicate $p_{tukey} < 0.05$. Dotted lines indicate $p_{tukey} < 0.1$.

Figure 16

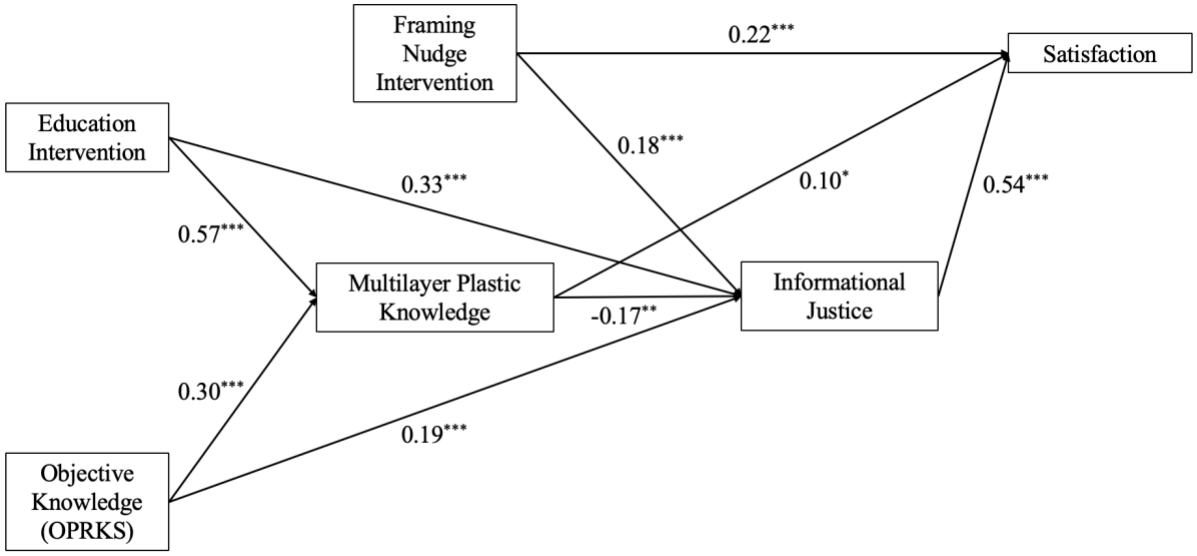
2 (education/no education) x 3 (positive/neutral/negative frame) ANOVA perceptions of interpersonal justice for Study 3



Notes. Marginal means for each condition with 95% CIs. Solid lines indicate $p_{tukey} < 0.001$. Dashed lines indicate $p_{tukey} < 0.01$. Dash-dotted lines indicate $p_{tukey} < 0.05$. Dotted lines indicate $p_{tukey} < 0.1$.

Figure 17

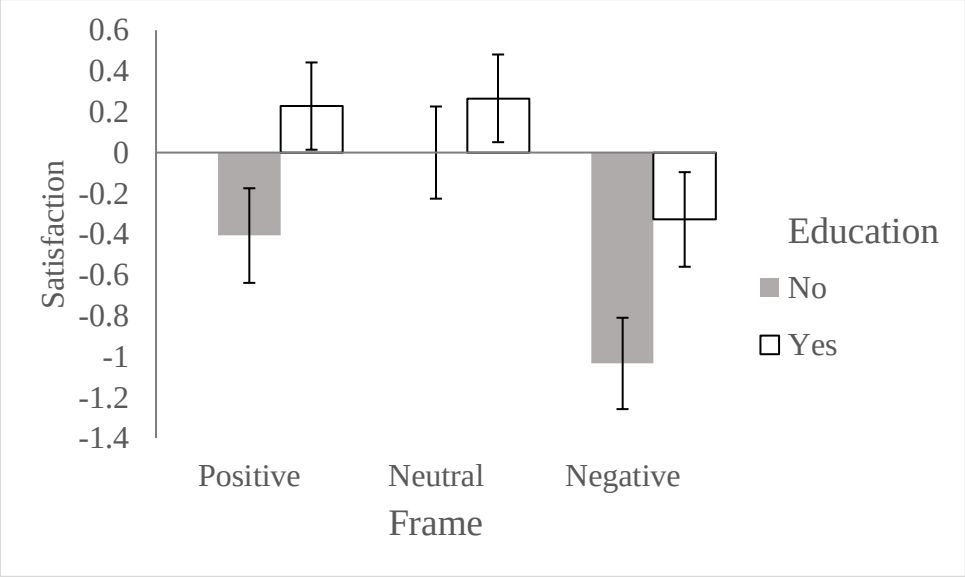
Study 3 structural equation model predicting satisfaction in line with Skilled Decision Theory



Notes. $\chi^2(3) = 6.75$, $p = 0.08$, CFI = 0.99, TLI = 0.97, AIC = 3829.30, BIC = 3877.37, RMSEA = 0.05 (90% CI = 0.00-0.11), SRMR = 0.02. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$. All path coefficients are standardized. Education intervention coded a 0 = no education 1 = education. Framing nudge intervention coded as 0 = negative frame 1 = neutral or positive frame (see Table 18).

Figure 18

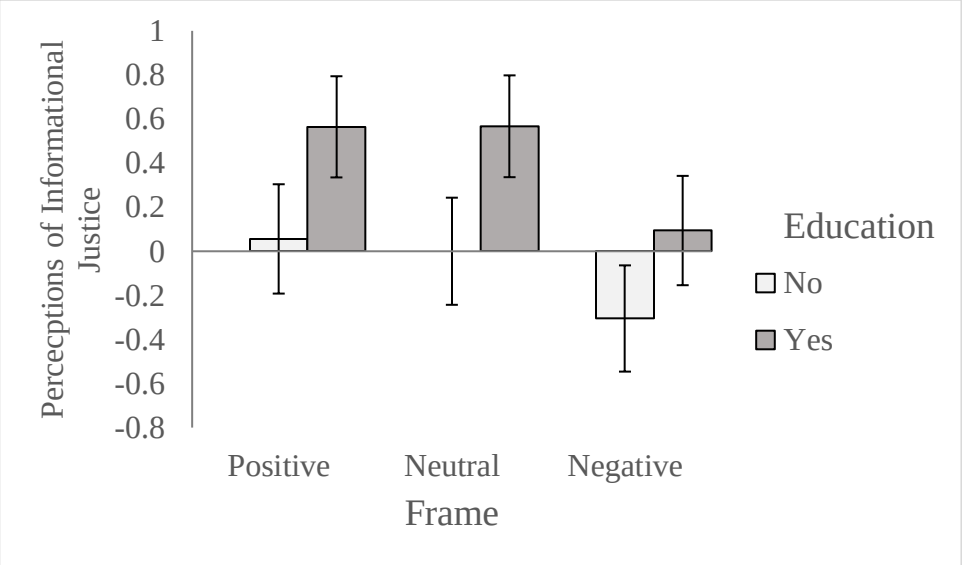
Mean differences in satisfaction between each condition and the 'control group' in Study 3



Notes. I categorized the uneducated, neutral frame condition as the 'control' condition (as they did not receive framed information and were not educated). Values in the chart reflect the (marginal mean of each condition – the marginal mean of the neutral uneducated condition, resulting in the neutral uneducated condition being the "center" or 0). Error bars represent 95% CI of raw marginal means (see Figure 13 for bar chart of raw marginal means).

Figure 19

Mean differences in perceptions of informational justice between each condition and the 'control group' in Study 3



Notes. I categorized the uneducated, neutral frame condition as the 'control' condition (as they did not receive framed information and were not educated). Values in the chart reflect the (marginal mean of each condition – the marginal mean of the neutral uneducated condition, resulting in the neutral uneducated condition being the "center" or 0). Error bars represent 95% CI of raw marginal means (see Figure 12 for bar chart of raw marginal means).