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Translated Attributes as Choice Architecture: Aligning Objectives and Choices Through Decision Signposts

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Abstract. Every attribute can be expressed in multiple ways. For example, car fuel economy can be expressed as fuel efficiency ("miles per gallon"), fuel cost in dollars, or tons of greenhouse gases emitted. Each expression, or "translation," highlights a different aspect of the same attribute. We describe a new mechanism whereby translated attributes can serve as decision "signposts" because they (1) activate otherwise dormant objectives, such as proenvironmental values and goals, and (2) direct the person toward the option that best achieves the activated objective. Across three experiments, we provide evidence for the occurrence of such signpost effects as well as the underlying psychological mechanism. We demonstrate that expressing an attribute such as fuel economy in terms of multiple translations can increase preference for the option that is better aligned with objectives congruent with this attribute (e.g., the more fuel-efficient car for those with proenvironmental attitudes), even when the new information is derivable from other known attributes. We discuss how using translated attributes appropriately can help align a person's choices with their personal objectives.

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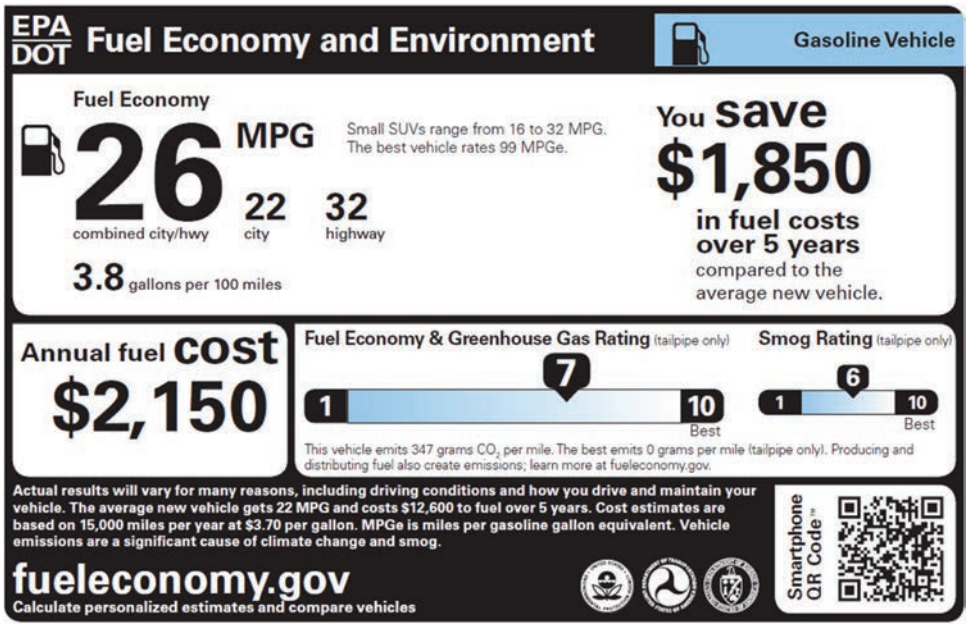
1. Introduction

Choice options typically vary on multiple attributes. For example, a car's attributes include price, fuel economy, safety rating, and type of navigation system. In turn, each attribute can have multiple translations, that is, different ways the attribute can be expressed. For instance, a car's fuel economy can be expressed in different ways. Figure 1 shows the U.S. Environmental Protection Agency (EPA) fuel economy and environment label, which expresses fuel economy in terms of miles travelled per gallon of fuel, the estimated annual fuel cost (AFC), and a 1-to-10 greenhouse gas rating (GGR), among others. These different expressions, which we term "translated attributes," are closely related to each other and highly correlated. Nevertheless, each translation also highlights different aspects of the same attribute. A fundamental decision faced by policy makers is to determine how much information should be presented to people to help them make better decisions for themselves and for society. On the one hand, more information could overwhelm a person. On the other, less information could deprive a person of important facts.

Little may be gained by presenting one translated attribute instead of another because the two translated attributes are often perfectly correlated. From a strictly rational point of view, translated attributes are completely redundant if the translation equivalence is known. However, the theoretical perspective of bounded rationality (Simon 1982) and supporting empirical evidence suggest that people tend to construct their preferences (Lichtenstein and Slovic 2006; Payne et al. 1988, 1993; Ungemach et al. 2011) using information about choice options at face value (e.g., the concreteness principle, Slovic 1972; or What You See Is All There Is [WYSIATI], Kahneman 2011). Bond et al. (2008) have shown that people often overlook key personal objectives when making choices because they possess a myopic mental representation of the choice. Assuming that consideration of personal objectives is beneficial to effective decision making (Keeney 1992), these findings imply that people often end up with suboptimal decision outcomes that are not fully

Figure 1. (Color online) The Current U.S. Environmental Protection Agency Fuel Economy and Environment Label for Gasoline Vehicles



aligned with personal objectives. Bond et al. (2008) have suggested that recognition of important personal objectives may be assisted through guides that describe additional features of products such as consumer reports. We propose that translated attributes play a similar role in improving choice: they allow people to recognize important personal objectives that would otherwise be overlooked. Therefore, our general hypothesis is that translated attributes have the potential to influence preferences because they serve as decision "signposts" helping people first recognize and then pursue options congruent with their personal objectives.

Previous literature has shown that partitioning a global attribute into components can increase the weight accorded to that global attribute (Dawes 1979, Fischhoff et al. 1978, Weber et al. 1988). For example, the global attribute "job security" can be split into component attributes such as "stability of the firm" and "personal job security." Although related to partitioning, the notion of translated attributes has three features that distinguish it from this earlier literature. First, translated attributes are monotone transformations of each other and highly correlated, whereas components of a global attribute described in the attribute splitting literature may not be correlated at all. Second, translated attributes differ from derived attributes used in advertising, such as a car being described as "masculine," because translated attributes all map onto actual physical properties of the object. Third, and most importantly, whereas the attribute splitting literature demonstrates the phenomenon that the sum of component attributes attracts more weight than the global attribute, we identify and test two different processes by which translated attributes affect decisions. Specifically, we distinguish the established effects of noncompensatory heuristics such as counting superiority across attributes and using the majority rule (e.g., Alba and Marmorstein 1987, Russo and Dosher 1983, Zhang et al. 2006), and our own novel explanation: activation of relevant objectives and direction toward achieving them through decision signposts.

1.1. Translated Attributes as Decision Signposts

On a roadside, a signpost has two important features: First, it indicates *the presence* of a destination that might be of personal relevance, such as a nearby town. Second, it points out *how* to reach the destination by providing the actual direction and distance to travel. Similarly, translated attributes possess both features. First, translated attributes can produce *activation* of personally relevant objectives. This implies that a translated attribute will have the most impact on those who have objectives matching those aspects highlighted by the translated attribute. Second, a decision signpost conveys *direction* toward achieving those objectives by explicitly describing the degree to which different options meet the person's objectives.

People have many objectives that can arise from different sources, such as values and goals. Values are stable dispositions that structure and guide specific beliefs, norms, and attitudes (Feather 1995, Rokeach 1973). Goals are motivational constructs directed to achieve a desirable end state (van Osselaer and Janiszewski 2012). Goals direct movement that leads to degrees of achievement allowing progress (and failure)

to be gauged (Huang et al. 2012). Goals, such as loosing 5 lbs over the summer, are typically more specific and temporary than values, such as living healthily. Values can direct which goals are considered important, and prioritized objectives can direct attention to congruent information, which in turn affects behavior (Stern and Dietz 1994). However, Bond et al. (2008) demonstrate that people often focus too narrowly and forget many objectives that they consider to be valuable, unless aided.

We argue that our proposed signpost effect is conceptually distinct from previous work on framing and priming. Traditional "framing effects" occur when behavior changes in response to different representations of information that is equivalent in basic structure and final consequences. For example, Levin et al. (1998) distinguish three types of framing effects, each relying on different cognitive mechanisms: risky choice framing, attribute framing, and goal framing. Each of these framing categories relies on changes in valance: risky choice framing contrasts options in terms of gain and loss; attribute framing contrasts object characteristics positively and negatively; goal framing contrasts positive consequences of engaging in a behavior with negative consequences of not engaging in the behavior. Our proposed translated attribute effect is distinct from these framing effects because it does not rely on such "valence shifts." Indeed, we would expect the same activation-and-direction effect regardless of positive or negative valence.

Finally, we argue that the effect of signposts is distinct from "bottom-up" priming effects, which find that a goal (e.g., becoming educated) can be activated through the subliminal presentation of means to complete that goal (e.g., study; Shah and Kruglanski 2003). First, when a translated attribute acts as decision signpost, the objective is directly presented and comprehended. Second, translated attributes, when acting as decision signposts, also provide directional information about how to choose and act, which primes do not.

1.2. Translated Attributes as Choice Architecture

Because they act as decision signposts, translated attributes represent a type of choice architecture intervention. Choice architecture refers to the application of behavioral insights to understand the influence that different ways of presenting information about choice options can have on decisions and behavior (Sunstein 2011, Thaler and Sunstein 2008, Johnson et al. 2012). Examples of application domains include personal health (e.g., Kling et al. 2012), retirement savings (e.g., O'Donoghue and Rabin 1999), and the environment (e.g., Camilleri and Larrick 2014, Larrick and Soll 2008). Choice architecture builds on insights about the effect of defaults (Johnson and Goldstein 2003), the number of alternatives presented (Payne et al. 1993), and the partitioning of options and attributes (Fox et al. 2005; for reviews, see Johnson et al. 2012 and Camilleri and Larrick 2015). These interventions, sometimes referred to as "nudges," often operate beneath conscious awareness to help improve individual and social welfare (Smith et al. 2013, Thaler and Sunstein 2008). However, this lack of awareness exposes such interventions to the criticism that they manipulate individuals by restricting their autonomy to act upon their own preferences (e.g., Hausman and Welsh 2010). As we demonstrate below, the presentation of translated attributes can be an effective and benevolent aspect of choice architecture that does not restrict individuals' autonomy. Instead, it allows people to select options that are more consistent with their personal objectives. This is also another important theoretical distinction between signposts and counting effects (such as attribute splitting effects and majority rule strategies). Whereas simply steering people to an option that is superior on multiple positive (translated) attributes is potentially a "trick," guiding people to see what they care about and to act on this preference is helpful to the individual.

In summary, our novel contribution is the idea that the presentation of translated attributes can be utilized selectively as decision signposts to help people match options with their personal objectives. Specifically, we predict that the effect of shifting preferences through the provision of translated attributes will be strongest for those who have personal objectives congruent with those highlighted by the translated attributes. When a translation is distinct enough to activate an overlooked objective, a signpost effect is expected to occur in addition to any simple counting heuristic effects, which are agnostic with regard to the type of translated attributes presented. Finally, we predict this signpost effect to occur only when the presented attributes provide *directional* information, allowing the person to identify options that are aligned with activated personal objectives.

The rest of this paper is arranged as follows: In Experiment 1, we demonstrate how translated attributes can affect preferences dependent on the congruency between the translated attribute and a person's values. In Experiment 2, we show that signpost effects cannot be explained by differences in perceived knowledge about the relation between attributes provided by one translated attribute versus another. In Experiment 3, we show how translated attributes act as decision signposts by explicitly manipulating the *activation* and *direction* features of translated attributes.

2. Experiment 1—The Signpost Effect

The purpose of Experiment 1 was to test the value activation mechanism proposed as part of the hypothesized

signpost effect. We chose to focus on the environmental domain, specifically choices between cars that differ in terms of their fuel economy, because it provides an acknowledged paradox of consumers appearing to select options that are not in their economic self-interest (National Highway Traffic Safety Administration 2010). We asked participants to choose between pairs of cars where the global attributes were price and fuel economy, which were arranged to trade off against one another. In line with our proposed translated attribute framework, we used three highly correlated translations for the car fuel economy attribute: annual fuel cost, gallons (of gas consumed) per 100 miles, and greenhouse gas rating. We assumed that annual fuel cost was likely to activate financial objectives, that gallons per 100 miles was likely to activate fuel consumption objectives, and that greenhouse gas rating was likely to activate preexisting proenvironmental values. This latter assumption was guided by the fact that greenhouse gases have been identified as the most significant driver of climate change (IPCC 2013) and the greenhouse effect (U.S. Environmental Protection Agency 2014). In addition, a significant proportion of sustainability-related product claims are based on carbon emissions (Cohen and Vandenbergh 2012), and consumers are familiar with its usage. Two advantages of focusing on the activation of proenvironmental values were that we (a) knew that such values varied in strength across the population and (b) environmental attitude could be assessed with a well-validated measure. Participants were presented either one or two of these translated fuel economy attributes. Our experimental design kept the type of translation orthogonal to the number of translated attributes presented, which allowed us to distinguish between the effect of counting heuristics and the proposed signpost mechanism.

Based on past research, we predicted that when cars were presented with more translated fuel economy attributes, participants would be more likely to prefer the more fuel-efficient car (Alba and Marmorstein 1987, Russo and Dosher 1983, Zhang et al. 2006). Congruent with our signpost effect hypothesis, we further predicted that the effect of translated attributes would be moderated, and be stronger for participants who valued the environment. Specifically, we predicted that more proenvironmental participants would be more likely to choose the fuel-efficient car when the presented translated attribute was associated with the environmental impact of fuel economy (i.e., when presented with greenhouse gas rating). This is because the environmental attribute was expected to activate preexisting environmental values and highlight the otherwise overlooked proenvironmental objective in the decision. However, this moderation was not expected to occur when the presented translated attribute was not associated with the environmental impact of fuel economy (e.g., annual fuel cost).

2.1. Method

2.1.1. Participants. Three hundred forty-one American participants (52% female; mean age = 31.8; SD = 10.1) were recruited through Amazon's Mechanical Turk (MTurk) and paid a flat fee for their participation.

2.1.2. Materials. *Choice Design.* We designed a set of nine choice problems (see Table 1). Cars were described in terms of price and either one or two different translated attributes of fuel economy. In the cases where there was one fuel economy attribute, half the participants were presented with "annual fuel cost" and the other half with "greenhouse gas rating." In the cases where there were two fuel economy attributes, half the participants were presented with "annual fuel cost" together with "greenhouse gas rating," and the other half of participants were presented with "annual fuel cost" together with "gallons per 100 miles" (GPM). Annual fuel cost, greenhouse gas rating, and gallons per 100 miles were highly correlated. Annual fuel cost was calculated assuming 15,000 miles driven annually and \$3.70 per gallon of gas (similar assumptions underlie the calculated values presented on the American

Table 1. Set of Nine Choice Problems Used in Experiments 1 and 3

	Car A (\$)		Car B (\$)		
Choice problem	Price	Annual fuel cost[a]	Price	Annual fuel cost[a]	Difference in total cost over five years (car A – B) (\$)
1	29,999	3,964	33,699	2,775	2,246
2	25,799	2,775	29,999	2,220	–1,425
3	25,799	3,964	33,699	2,775	–1,954
4	25,799	2,775	33,699	2,220	–5,125
5	29,999	3,964	33,699	2,220	5,021
6	25,799	3,964	29,999	2,220	4,521
7	25,799	3,964	33,699	2,220	821
8	29,999	2,775	33,699	2,220	–925
9	25,799	3,964	29,999	2,775	1,746

Notes. The lower price car is always car A. The ordering of the cars during the experiments was counterbalanced.
[a]The fuel cost assumes 15,000 miles driven annually for five years, costing \$3.70 for gas and no discount rate.

EPA label). Gallons per 100 miles was described as the fuel efficiency of the car in terms of how many gallons of fuel were required to travel 100 miles. Greenhouse gas rating was described as a 1-to-10 rating comparing a car's fuel economy and tailpipe carbon dioxide (CO_2) emissions to those of all other new cars, where a rating of 10 was best (i.e., fewest CO_2 emissions). The values for the different attribute levels reflected typical ranges encountered in actual car choices in a factorial design.

Environmental Values. Environmental values were measured with the New Ecological Paradigm–Revised (NEP-R) scale (Dunlap et al. 2000), which is a standard measure of attitudes toward sustainability. Participants rated 15 statements (e.g., "Humans have the right to modify the natural environment to suit their needs") on five-point scales ranging from "strongly disagree" to "strongly agree." Scores on the NEP-R scale range from 15 to 75. Higher scores indicate stronger proenvironmental values.

2.1.3. Design. We employed a 2 (number of fuel-efficiency attributes: 1 vs. 2) × 2 (environmental attribute: present vs. absent) × 9 (choice set) mixed design. The first two factors were between subjects and the third factor was within subjects. The main dependent variable was whether or not participants selected the fuel-efficient car.

2.1.4. Procedure. Participants first read an instruction screen in which they were told to assume they averaged 15,000 miles of driving each year and that they would keep the car for five years before giving it away. Participants were also shown a summary of the price and fuel-efficiency attribute definitions they would later be presented with. During the choice task, participants saw two options in a table format with price and fuel economy attributes (see Online Appendix A). The choice screens also displayed the attribute definitions.

Participants made a total of nine choices between different pairs of cars. After these choices, participants rated the extent to which they considered the environmental and the cost aspects of the cars, respectively, when making their choices. These responses were made on five-point scales ranging from "not at all" to "exclusively." Participants were then asked to judge how important a number of different car attributes (e.g., price, car type, safety rating, miles per gallon (MPG)) would be to them if making a real car purchase, on five-point scales ranging from "unimportant" to "extremely important." Finally, participants completed items relating to demographics, past driving behavior, environmental attitudes (NEP-R scale), and an attention check.

2.2. Results

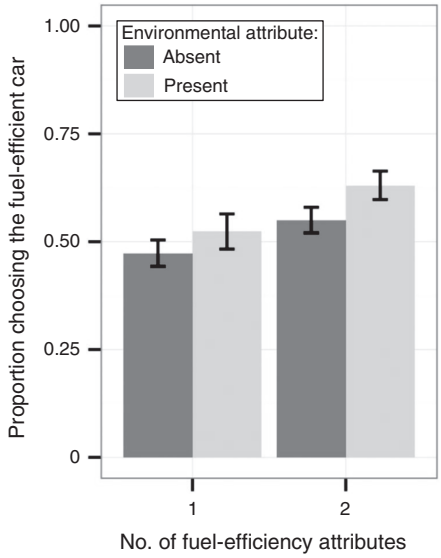
Twenty-one participants incorrectly answered the attention check question and were removed from the subsequent analysis, leaving 320 participants. However, as described below, all conclusions remain unchanged if we include these data in the analysis.

2.2.1. Activation of Environmental Values. To assess whether our manipulation was successful in activating environmental values, we checked the effect of presenting the greenhouse gas rating attribute on the self-rating of considering the environmental and cost aspects of the cars in participants' decisions. As expected, participants reported considering the environmental aspect to a greater extent when the GGR was present (mean = 2.95, SD = 1.12) than when it was absent (mean = 1.81, SD = 1.00, $t(312.16) = -9.553$, $p < 0.0001$). Conversely, in conditions with the GGR rating present, the cost aspect was considered to a lesser extent (mean = 3.78, SD = 0.85) than in conditions without the GGR rating (mean = 4.20, SD = 0.75), $t(312.94) = 4.836$, $p < 0.0001$).

2.2.2. Preferences. Figure 2 shows the observed proportions of fuel-efficient car choices in the four experimental groups collapsed across choice sets. On average, participants chose the fuel-efficient option 54% of the time (SD = 31%). In line with a counting explanation, participants made more fuel-efficient choices when fuel economy was expressed via two translated attributes (right pair of bars) than one (left pair of bars).

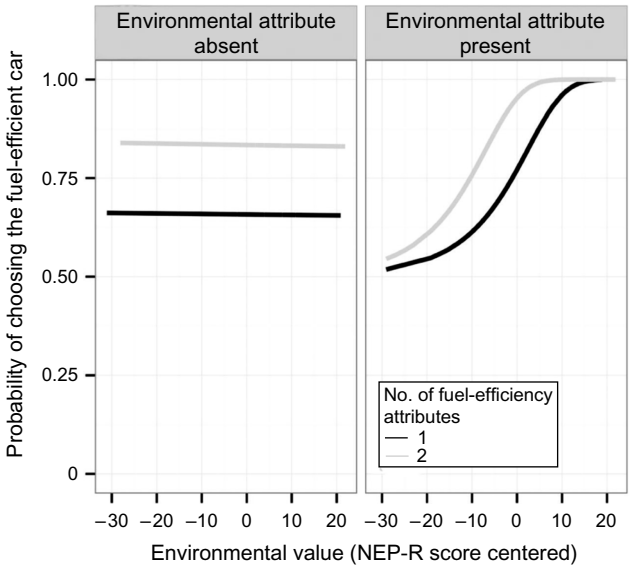
To investigate the signpost effect, we examined the relationship between the observed likelihood of choosing the environmental option across participants' environmental attitudes as indicated by their NEP-R scores (see Figure 3). As predicted, the probability of choosing

Figure 2. Proportion of Choices for the Fuel-Efficient Option in Experiment 1 as a Function of the Number of Fuel-Efficiency Attributes and Whether an Environmental Attribute Was Presented or Not



Note. Error bars are the standard error of the mean (SEM).

Figure 3. Probability of Choosing the Fuel-Efficient Car in Experiment 1 Modeled as a Function of Environmental Values, Number of Fuel-Efficiency Attributes, and Whether an Environmental Attribute Was Presented or Not



the fuel-efficient car increased with increasing NEP-R scores when the GGR attribute was present (right panel). However, this relationship was not observed in the conditions without the GGR attribute (left panel).

To test that this effect was statistically significant, we compared several nested multilevel logistic regression models with selection of the fuel-efficient car as the dependent variable. All models contained random intercepts for participants and choice problems. For the main hypotheses, we included simple fixed effects for the number of attributes presented, a dummy variable indicating the presence of the GGR attribute, and the two-way $GGR_{present} \times$ NEP-R interaction to test the signpost effect. The model confirmed that participants were more likely to select the fuel-efficient option when fuel efficiency was expressed by two translated attributes compared to one ($\chi^2(1) = 9.16$, $p < 0.01$). In addition, and in line with our prediction, the relationship between environmental attitudes and the probability of choosing the fuel-efficient car was moderated by the presence of the GGR attribute, as indicated by a significant $GGR_{present} \times$ NEP-R interaction ($\chi^2(1) = 12.2$, $p < 0.001$).[1] Finally, a comparison with a model that also included a number of attributes × NEP-R interaction showed that the relationship between environmental attitudes and the probability of choosing the fuel-efficient car was not moderated by the number of attributes presented (i.e., number of attribute × NEP-R interaction, $\chi^2(1) = 0.62$, $p > 0.05$).

2.3. Discussion

The observations made in Experiment 1 illustrate that both the number of attributes and the type of attributes independently influence people's preferences. First, presenting more translated fuel economy attributes increased the likelihood of choosing the more fuel-efficient car, regardless of the type of attributes. Second, and in line with our hypothesized signpost effect, the presentation of an environmental translated attribute increased the likelihood of choosing the more fuel-efficient car, regardless of the number of total presented attributes. Importantly, the increase in fuel-efficient choices was driven by those with higher proenvironmental values and cannot be explained by a simple counting heuristic. Rather, it appears that the presence of the environmental translated attribute activated respondents' preexisting but latent proenvironmental value, and subsequently aligned choices with personal values.

An alternative explanation for our observations is that participants may have received different information when presented with one attribute combination compared to another. Therefore, the purpose of Experiment 2 was to contrast our activation-and-direction account with this potential informational account.

3. Experiment 2—Effects of Information

According to our value-activation-and-direction account, translated attributes serve as decision-signposts: They activate a person's preexisting objectives and then help the person to identify which option best aligns with their activated objective. According to the informational account, a person might fail to realize that certain attributes are translations of one another and, as a result of this oversight, have a different knowledge base with relation to one attribute combination compared to another. Moreover, a person might gain different information about the relation between attributes throughout the experiment depending on the experimental manipulation they were assigned to. For example, participants presented with a greenhouse gas rating might find it easier to learn the relation between environmental impact and annual fuel cost compared to participants presented with gallons per 100 miles and annual fuel cost.

To rule out this informational account, we replicated Experiment 1 while manipulating whether knowledge about the relation between translated attributes was measured before versus after the choice task. If the informational account were true, we would expect that knowledge regarding the relation between translated attributes would be different before versus after the choice task, or as a function of which attributes were presented during the choice task.

3.1. Methods

3.1.1. Participants. Seven hundred ninety-nine American participants (44% female; mean age = 31; SD = 11.2) were recruited through MTurk and paid a flat fee for their participation.

3.1.2. Design. The design was a simplified version of Experiment 1. Specially, we used a 2 (translated attribute: GPM vs. GGR) × 2 (knowledge measure: before vs. after choice task) between-subjects design. For each car, participants were presented with price, AFC, and one of the translated attribute variables (i.e., GPM or GGR). To limit opportunities to learn about the correlation between the translated attributes, participants were presented with a single choice scenario in this experiment (Problem 2 from Experiment 1; see Table 1).

3.1.3. Materials. We measured knowledge of the relation between AFC and GGR in two ways. First, we used a general "relatedness" measure that asked participants how related the two metrics were on a 10-point scale from "not at all related" to "completely related." On this same page and using the same scale, we also asked how related AFC and engine longevity were, and how related GGR and crash safety rating were (see Online Appendix B). These two additional questions measured comparisons with unrelated variables and were expected to produce very low relatedness scores, thereby allowing us to evaluate the validity of our relatedness scale. Second, we used directional questions that presented the participant with a list of AFC values ($3,800, $2,900, $2,150, $1,650) in random order, for which matching scores had to be identified within a list of GGR values ranging from 1 to 10 (the answers were 2, 4, 6, and 8, respectively). This question allowed us to determine whether participants correctly identified the (negative) direction of the relation between AFC and GGR.

3.1.4. Procedure. Participants for whom knowledge was to be measured prior to choice were presented with the current U.S. fuel economy label (see Figure 1), together with definitions of AFC and GGR, and answered the three relatedness questions. On the next page, participants answered the four directional questions. They then completed the choice task, which was followed by two attention check questions. Finally, we asked participants to complete the NEP-R scale and demographic questions. Participants for whom knowledge was to be measured after choice had a similar experience; however, the choice task was presented first.

3.2. Results

Thirty-eight participants incorrectly answered both attention check questions and were removed from the subsequent analysis, leaving 761 participants. However, as described below, the conclusions remain the same even when these excluded data are included in the analysis.

3.2.1. Knowledge. We first contrasted the three relatedness questions to lend support to the use of relatedness as a valid measure. The mean relatedness score between AFC and GGR was 6.4 out of 10 (SD = 2.4). The mean relatedness score between AFC and engine longevity was 4.2 out of 10 (SD = 2.6). The mean relatedness score between GGR and crash safety rating was 2.1 out of 10 (SD = 1.9). The mean relatedness score between AFC and GGR was significantly higher than the related scores between the other two comparisons (both p's < 0.001), suggesting that the relatedness measure was valid.

We next examined whether participants' response to the relatedness between AFC and GGR varied as a function of experimental group. An inspection of the means, which ranged between 6.2 and 6.6, suggested little variance between groups. An analysis of variance with translated attribute (GPM vs. GGR) and knowledge measure timing (before vs. after choice task) entered as independent variables and relatedness entered as the dependent variable revealed no effect of translated attribute ($F(1, 760) = 1.54$, $p = 0.21$), no effect of knowledge measure timing ($F(1, 760) = 0.51$, $p = 0.48$), and no interaction between these two variables ($F(1, 760) = 0.03$, $p = 0.84$).[2] Moreover, the distribution of responses to the relatedness question was not significantly different between those who answered the knowledge questions before versus after the choice task (two-sample Kolmogorov–Smirnov test, $D_{\text{Max}} = 0.04$, $p = 0.94$). Analyses using the data collected from the four directional questions produced similarly null results (see the electronic companion). In summary, there was no evidence for a difference in knowledge regarding the relation between AFC and GGR as a function of which label was presented or whether the knowledge questions were asked before or after the choice task.

3.2.2. Choice. As can be seen in Figure 4, the proportion of participants choosing the fuel-efficient car was higher when the environmental attribute GGR was present compared to when it was absent (i.e., when GPM was presented). Moreover, this difference appears to hold regardless of when the knowledge measure was administered. To statistically confirm this interpretation, we ran a logistical regression with translated attribute (GPM vs. GGR) and knowledge measure timing (before vs. after choice task) entered as independent variables, and choice as the dependent variable. The analysis revealed a main effect of translated attribute ($\chi^2(1, N = 761) = 48.32$, $p < 0.001$), no effect of knowledge measure timing ($\chi^2(1, N = 761) = 1.36$, $p = 0.24$), and no interaction between these two variables ($\chi^2(1, N = 761) = 1.41$, $p = 0.24$).[3] In other words, participants were significantly more likely to prefer the efficient car when presented with AFC and GGR compared to AFC and GPM, irrespective of the timing of the knowledge question.

To demonstrate a signpost effect for Experiment 2, we ran a second logistic regression, this time also

Figure 4. Proportion of Choices for the Fuel-Efficient Option in Experiment 2 as a Function of the Timing of the Knowledge Measure and Whether an Environmental Attribute Was Absent or Present

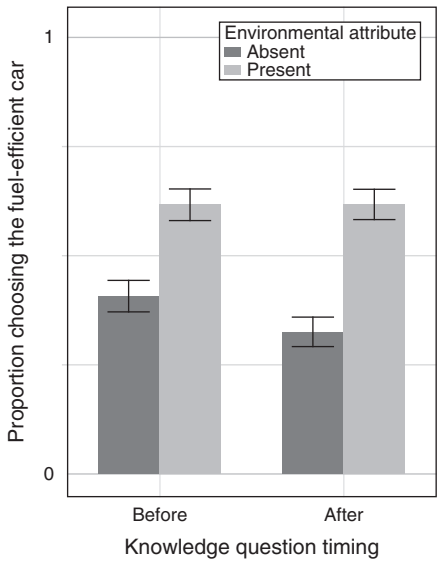
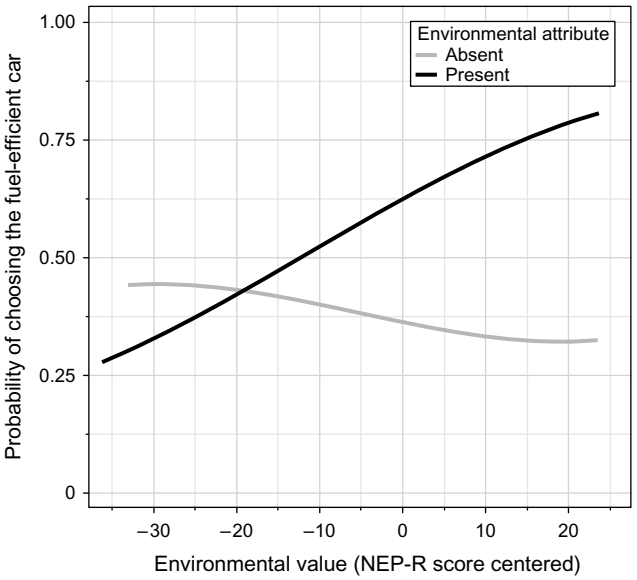


Figure 5. Probability of Choosing the Fuel-Efficient Car in Experiment 2 as a Function of Environmental Values and Whether an Environmental Attribute Was Present or Not



adding the mean-centered NEP-R scores as an independent variable, which was also crossed with the other independent variables. Again, the analysis revealed an effect of translated attribute ($\chi^2(1, N = 761) = 48.14$, $p < 0.0001$), no effect of knowledge measure timing ($\chi^2(1, N = 761) = 2.31$, $p = 0.13$), and no interaction between these two variables ($\chi^2(1, N = 761) = 1.55$, $p = 0.21$). Moreover, there was a significant effect of NEP-R scores ($\chi^2(1, N = 761) = 4.52$, $p = 0.03$). Importantly, and as predicted, there was a significant interaction between translated attribute and NEP-R scores ($\chi^2(1, N = 761) = 15.01$, $p = 0.0002$),[4] indicating that participants were significantly more likely to prefer the efficient car when presented with AFC and GGR compared to AFC and GPM, and this was especially true for those who had a relatively high NEP-R score. This pattern is illustrated in Figure 5.

Finally, there was no correlation between choice and relatedness (Spearman's $\rho = 0.01$, $p = 0.73$), which suggests that choices were not influenced by the knowledge that participants possessed regarding the relation between AFC and GGR.

3.3. Discussion

The observations made in Experiment 2 replicated the signpost effect found in Experiment 1: Participants tended to have a stronger preference for the fuel-efficient car when presented with AFC and GGR compared to AFC and GPM, especially for those with higher proenvironmental attitudes. Importantly, this effect cannot be explained by a knowledge account because understanding of the relationship between AFC and GGR did not differ before versus after participating in the choice task, and regardless of which translated attribute was presented. In addition, we observed the signpost effect within a single choice trial, ruling out a learnt knowledge account. Moreover, the tendency to choose the efficient car was not determined by the participants' perceived relationship between AFC and GGR. Therefore, these observations lend further support to our value-activation-and-direction account of the data: individuals possess a collection of knowledge and values, and different translated attributes can activate and direct otherwise dormant objectives, which only then impact upon choices.

4. Experiment 3—Boundary Conditions for Signposts

In our conceptual framework, the signpost effect operates by the following two processes: (1) a translated attribute *activates* some latent objective of the person (e.g., a value, goal, etc.), and (2) the translated attribute *directs* the people to the option that is most congruent with the activated objective. This conceptualization predicts several conditions under which a translated attribute should *not* cause a signpost effect. First, the effect should not occur if the objective associated with the translated attributes is already activated. Recall that we expect that presenting the greenhouse gas rating attribute will cause participants with preexisting proenvironmental values to weight environmental information more heavily during choice. However, we would not expect this if, for some reason, the participants were already thinking about how much they value the environment.

The second process would not operate if the option most congruent with the activated objective were already known. This could be possible if participants were explicitly taught the relationship between attributes and, more importantly, the direction of the relationship such that they could independently make the translation. For example, participants who have proenvironmental objectives and understand that a high annual fuel cost implies high greenhouse gas emissions could use the first attribute to infer the second and thus act on their objectives in spite of the incongruence between the presented translated attribute (i.e., annual fuel cost) and their activated objectives (i.e., proenvironmental behavior).

In Experiment 3, we tested the extent to which both of these mechanisms underlie the signpost effect using the car choice paradigm introduced in Experiments 1 and 2. We activated participants' environmental values (or not) prior to choice by having them fill out an environmental value questionnaire before (vs. after) choosing between the cars. In addition, we educated the participants (or not) about the direction of the relationship between the annual fuel cost and environmental impact prior to the choice phase through a tutorial.

We predicted that in situations where participants were not reminded of their environmental values or not educated about the direction of the relationship between annual fuel cost and the environmental impact, we would replicate the original signpost effect: participants' likelihood of choosing the fuel-efficient car would be aligned with their environmental values when presented with the greenhouse gas rating attribute but not when presented with the annual fuel cost attribute. In contrast, we predicted that when participants were reminded of their environmental values or educated about the direction of the relationship between annual fuel cost and the environmental impact prior to choice, then the signpost effect would not be observed: participants' likelihood of choosing the fuel-efficient car would be aligned with their environmental values regardless of which attribute was presented.

Finally, the measurement of environmental attitudes before and after the presentation of the translated attributes as part of the design also allowed us to test an alternative explanation for the signpost effect observed in Experiments 1 and 2, namely, that the translated attribute created new environmental values that the participant originally did not possess. If our manipulation of presenting environmental attribute translations did indeed create new values, then we would expect the distribution of environmental values to differ between experimental groups and expect higher environmental attitude scores after the decision tasks involving the greenhouse ratings. However, if environmental attribute translations serve only as signposts for existing values, as predicted by our own account, we would expect the distribution of environmental attitudes to be similar across experimental groups and stages of the experiment.

4.1. Methods

4.1.1. Participants. Six hundred six American participants (58% female; mean age = 31.6; SD = 10.8) were recruited through MTurk and paid a flat fee for their participation.

4.1.2. Design. We employed a 2 (translation: annual fuel cost vs. greenhouse gas rating) × 2 (tutorial: present vs. absent) × 2 (order of NEP-R scale: before choice vs. after choice) mixed design. The main dependent variable was whether or not the participant selected the fuel-efficient car.

4.1.3. Materials and Procedure. Participants were randomly assigned to one of the eight conditions and presented with the same nine car choices used in Experiment 1. For each choice pair, participants viewed the price of the car and one fuel-efficiency translation (see Online Appendix C). Half of the participants were presented with the annual fuel cost, and the other half with the greenhouse gas rating. Half of the participants completed the NEP-R scale before the choice task, and the other half completed it after the choice task. In addition, half of the participants watched a brief animation explicitly describing the direction of the relationship between the annual fuel cost and the greenhouse gas emissions before the choice task and after the NEP-R scale (see Online Appendix D). To complete the tutorial, participants had to correctly answer a question regarding the positive relationship between the two variables. After the nine choices, all participants had to answer two manipulation check questions to evaluate whether they had understood the relationship between annual fuel cost and the greenhouse gas emissions of the car. The first question asked participants to rate how strong the relationship between the annual fuel cost and the greenhouse gas emissions of a car is on a five-point scale ("unrelated" to "completely related"). The second question asked participants to select the car with the fewest greenhouse gas emissions out of a set of four cars described only by their annual fuel cost. Finally, participants provided basic demographic information. As there were no attention check questions, the data from all 606 participants were used for the subsequent analysis.

4.2. Results

4.2.1. Manipulation Check. To assess whether our tutorial manipulation was successful in explaining the relationship between annual fuel cost and the greenhouse gas emissions of a car, we analyzed the perceived relationship strength between these attributes across

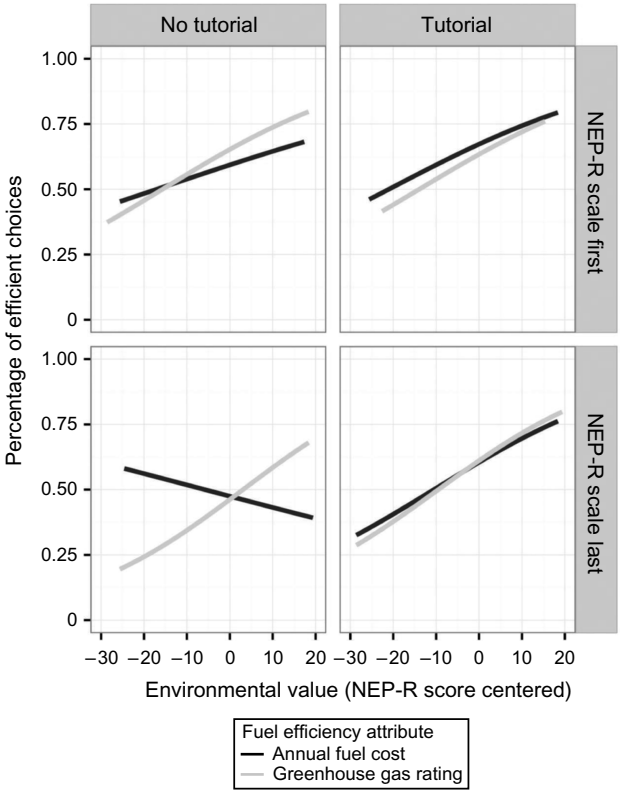
the tutorial conditions. As expected, participants who went through the tutorial reported a stronger relationship between a car's annual fuel cost and its greenhouse gas emissions (mean = 3.94, SD = 0.86) than participants who did not go through the tutorial (mean = 3.49, SD = 0.84, $t(601.6) = -6.47$, $p < 0.001$). Participants who went through the tutorial were also more likely to correctly identify the car with the lowest emissions (85%) than participants who did not (78%, $\chi^2(1, N = 604) = 10.52$, $p < 0.01$).

We also tested whether the tutorial affected participant's environmental values by comparing NEP-R scores between conditions. We found no significant differences between NEP-R scores of participants who went through the tutorial (mean = 53.31, SD = 9.73) and participants who did not (mean = 53.92, SD = 9.59, $t(603.73) = 0.77$, $p = 0.44$). Similarly, there was no difference between the NEP-R scores of participants who answered the NEP-R questions before (mean = 53.64, SD = 9.41) and after the choice task (mean = 53.60, SD = 9.91, $t(602.37) = 0.05$, $p = 0.963$). Finally, there was no difference between the NEP-R scores of participants who had seen the greenhouse gas rating (mean = 54.03, SD = 9.61) and participants who had seen the annual fuel cost (mean = 53.21, SD = 9.70, $t(603.99) = -1.04$, $p = 0.3$). Thus, there was no evidence for the creation of environmental values as a result of our experimental manipulations.

4.2.2. Preferences. To investigate whether the signpost effect was observed across the different experimental conditions, we examined again the observed likelihood of choosing the environmental option across participants' environmental attitudes. This relationship is visualized in Figure 6, where we see a signpost effect replicated only in the lower left panel: a strong positive relationship between NEP-R scores and the proportion of fuel-efficient car choices was observed for participants presented with the greenhouse gas rating (gray line). In contrast, for participants presented with the same information as annual fuel cost (black line), we observed no (or a slightly negative) relationship between the NEP-R scores and the proportion of fuel-efficient choices.

Comparing the lower left panel with the other panels, we see that this signpost effect was not observed in the remaining panels. Participants made choices related to their environmental preferences regardless of whether GGR was present or absent when (1) the tutorial explained the relationship between annual fuel cost and the greenhouse gas emissions (right panels, Figure 6) or (2) the NEP-R scale was presented before choice (top panels, Figure 6). When participants were reminded of their environmental values or how to use fuel cost as a proxy for environmental outcomes, they did not need a signpost; the signpost effect was observed only when there was no tutorial and the NEP-R scale was presented after choice.

Figure 6. Percentage of Fuel-Efficient Car Choices in Experiment 3 as a Function of Environmental Values (Centered NEP-R Scores), Type of Fuel-Efficiency Attribute, Whether the NEP-R Scale Was Presented First or Last, and Whether a Tutorial Was Presented or Not



This observed effect of our manipulations and their interactions with the relationship between environmental values and choice was confirmed using multilevel logistic regression models with the selection of the fuel-efficient car as the dependent variable, random intercepts for participants and choice problems and fixed effects for the type of attribute presented (AFC vs. GGR), the presence of the tutorial (present vs. absent), the order of the NEP-R scale (first vs. last), and centered NEP-R scores. To examine the effects of the manipulations on the interaction between type of attribute and NEP-R scores (the signpost effect), we also included the higher order interactions between the independent variables.

In line with the proposed mechanisms underlying the signpost effect, the model indicated that the effect of NEP-R scores on the probability of choosing the environmental option depended on the type of attribute presented and was moderated by the presence of the tutorial and the order of the NEP-R question: the four-way interaction (tutorial × NEP-R order × $GGR_{present}$ × NEP-R score) was significant ($\chi^2(11) = 32.5$, $p < 0.001$).

Next, we broke down the higher order interaction to examine the ability of the GGR attribute to align choices with personal values by running separate models for the different attribute groups. When the same model was run only for the group of participants who saw the AFC attribute, the three-way interaction indicated that the effect of NEP-R scores on choosing the efficient car depended on the presence of the tutorial and the order of the NEP-R score (tutorial × NEP-R order × NEP-R score interaction; $\chi^2(4) = 14.0$, $p < 0.01$). However, when the same model was run only for the group of participants who saw the GGR attribute, there was no significant three-way interaction: $\chi^2(4) = 6.32$, $p > 0.05$. This is in line with our assumption that the effect of the NEP-R score on choice was facilitated by the presence of the signpost itself (GGR attribute) and observed regardless of the presence of the tutorial ($\chi^2(1) = 0.02$, $p = 0.9$) or the order of the NEP-R score ($\chi^2(1) = 0.16$, $p = 0.69$) or their interaction ($\chi^2(4) = 6.32$, $p = 0.18$).

4.3. Discussion

In Experiment 3, we replicated the signpost effect introduced in Experiments 1 and 2. In addition, we showed that the signpost effect was only observed under conditions in line with our proposed mechanism. Specifically, we demonstrated that when participants were not taught the direction of the relationship between annual fuel cost and the environmental impact (i.e., no tutorial) and their environmental values were not activated (i.e., NEP-R scale after choice), the environmental GGR attribute acted as a signpost providing both activation and direction. As a result, we replicated the original signpost effect: participants' likelihood of choosing the fuel-efficient car was aligned with their environmental values when presented with the GGR attribute but not when presented with the AFC attribute.

In contrast, when participants were taught the direction of the relationship between annual fuel cost and the environmental impact prior to choice (i.e., via the tutorial) or reminded of their environmental values (i.e., by answering the NEP-R scale before choice), activation and direction were already provided without the aid of the signpost. As a result, we observed choices aligned with personal environmental values regardless of the attribute presented (i.e., GGR or AFC). Thus, we showed that activation of congruent values and communication of information regarding the relationship between the attribute and the objective could be achieved either via reflection on dormant values and a tutorial or via the presentation of a translated attribute that could act as a signpost.

In addition, our finding of similar NEP-R score distributions across experimental groups demonstrated that the observed signpost effects cannot be explained through the creation of environmental values as a result of our experimental manipulations. Furthermore, the signpost effect was observed despite an equal number of attributes presented to all participants, which rules out the use of a counting heuristic as an explanation in these observations.

5. General Discussion

In this paper, we examined the impact of presenting translated attributes on choices. Translated attributes refer to information that is, in principle, already available by a simple transformation via a change in scale of other, known information. However, given that people tend to construct preferences on the fly based on available information (e.g., Lichtenstein and Slovic 2006; Payne et al. 1988, 1993; Ungemach et al. 2011), and often without considering all the objectives they care about (Bond et al. 2008), we hypothesized and then observed that choices were indeed influenced by the presentation of different translated attributes that provided opportunities to consider and pursue important but initially neglected objectives.

5.1. Summary of Experiments

In three experiments, we have presented evidence highlighting how translated attributes can affect the decisions that people make. In Experiment 1, we demonstrated how translated attributes could serve as decision signposts. A signpost is a translated attribute that helps people choose in line with their personal objectives. We found that value activation through the presentation of translated attributes was moderated by congruent preexisting proenvironmental values: Participants' likelihood of selecting the fuel-efficient car increased with proenvironmental value strength, but only when an environmental translated attribute was presented. Importantly, we showed that the effects of translated attributes on choice were caused by both the number of attributes presented and the type of attributes presented. More important for our contribution, the signpost effect in this experiment was driven by the presence of an environmental attribute, which highlights the *activation* feature of translated attributes.

In Experiment 2, we replicated the signpost effect, this time showing that the signpost effect could not be explained by differences regarding the understanding and learning of the relationship between different translated attributes. Finally, in Experiment 3, we demonstrated that the signpost effect was produced by two separate mechanisms by explicitly turning on and off the *activation* and *direction* features of translated attributes. We also ruled out the possibility that proenvironmental values were created through the simple presentation of environmental attributes.

5.2. Theoretical Implications

In this paper we have introduced the concept of a "translated attribute" and repeatedly demonstrated

how the presentation of translated attributes can influence choice by serving as a decision "signpost." A decision signpost has two important features that are theoretically important. First, a decision signpost can help people make a decision by reminding them of a personally held objective. This is the *activation* feature of translated attributes. In our experiments, objectives that translated attributes could signpost included personal values and goals. The activation effect of signposts is related to the finding that subliminally presented primes about goal achievement means (e.g., "study") can activate the associated goal (e.g., "learning"; Shah and Kruglanski 2003). Our work shows that such bottom-up activation is also possible via explicitly stated product attributes.

Moreover, our observation of an interaction between translated attributes and personal attitudes implies that the mechanism only affects the preferences of individuals who hold relevant objectives, which is clearly distinct from the effects of a pure counting heuristic. Just as primes can activate different associations in different people (e.g., Wheeler and Berger 2007), so too can attributes activate different objectives. Thus, translated attributes have an ability to help overcome shortcomings in the generation process (Bond et al. 2008) by aiding the recognition of existing objectives.

Second, a decision signpost can help point out the option that is better aligned with this activated objective. This is the *directional* feature of translated attributes. For example, a person attempting to act upon a proenvironmental value but presented only with annual fuel cost information may fail to appreciate which option is most value congruent. The translated attribute "greenhouse gas rating" could eliminate such confusion. This point marks another clear and vital distinction between primes and signposts: The former is limited to merely nonconsciously activating an objective, whereas the latter additionally and explicitly reveals the information necessary to achieve the objective.

We have proposed that translated attributes operate by reminding decision makers of goals they wish to achieve and directing them to how to achieve them. The activation of different sets of knowledge is similar to many other constructs in judgment and decision making research. For example, Levin et al. (1998) have discussed framing in three contexts—risk, choice, and attributes—by building on a large literature in judgment and decision making (e.g., Kahneman and Tversky 1984, Tversky and Kahneman 1981). Levin et al. (1998) argue that judgments involving fundamentally identical quantitative outcomes yield different behaviors depending on whether the outcomes are described as gains or losses. This work on attribute framing, however, focuses narrowly on valence. The idea of framing has received a broader treatment in other literatures, such as political psychology, which describes how competing issue frames in politics emphasize different facts, values, and relationships for complex problems (see Nelson 2011). For example, automobile speed limits could be framed as a "public health" issue (lower speed would save lives and reduce health care costs) or as a "free choice" issue (speed limits impede free choice). Framing research in judgment and decision making focuses on holding constant the key quantitative information across frames; framing research in political psychology, on the other hand, recognizes that frames often change beliefs and preferences because they add new information (e.g., on casualties caused by accidents) and omit other information (e.g., added hours spent driving). We believe that the psychology of translated attributes falls in an area between many of the traditional framing effects studied in judgment and decision making, which often rely on changes in valence for identical outcomes (Levin et al. 1998), and the more expansive notion of framing in political psychology, which often assumes the introduction of novel facts. For example, the fact that car fuel economy affects driving costs and the environment is not surprising to most consumers. However, the salience of those dimensions when evaluating alternatives and their precise magnitude can both be neglected during choice.

Alternatively, it could be argued that the choice architects' selection of attributes might leak information beyond the literal content indicating the architect's own preferences or implicit recommendation to the decision maker (e.g., McKenzie and Nelson 2003, Sher and MacKenzie 2006). For example, assuming that leakage can come from any source, including policy makers (e.g., McKenzie et al. 2006), the inclusion of greenhouse gas rating on national fuel economy labels could be interpreted as evidence that policy makers want consumers to choose more environmental cars. This is a plausible account, but it would require additional assumptions to make clear predictions consistent with the signpost effect. For example, including GPM or GGR on a label would leak similar information about the choice architect's preferences. However, in Experiment 2 only GGR changed behavior in a value-consistent way (Figure 4). Moreover, without further assumptions, information leakage does not explain the observed interaction between the translated attribute and individual differences in latent values. Future research can try to disentangle whether a simple activation-and-direction account is sufficient to explain this behavior or whether an information leakage account is necessary. For example, one strategy for teasing them apart would be to vary the description of the process by which the presented attributes are generated, such as whether the attributes were chosen

by a designer or randomly drawn from a large pool of attributes varying in importance.

We argue that translated attributes represent a new type of choice architecture intervention. Some examples of choice architecture can be described as psychological "tricks" by capitalizing on common cognitive biases. For example, in Experiment 1, we showed that provision of translated attributes could shift preferences in a predicable direction by simply adding more translations. Such an outcome capitalizes on people's tendency to rely on counting heuristics, that is, favoring options that appear to have more superior characteristics. However, across all of our experiments, we also showed that provision of translated attributes could shift preferences in a direction contingent on the person's unique objectives. Instead of steering people into choices irrespective of their personal objectives, translated attributes that work as signposts guide people in the direction they want to go. Therefore, translated attributes could potentially point different people in different directions. For example, in our experiments, the presentation of the greenhouse gas rating highlighted the environmental aspect of fuel efficiency, which mainly influenced those with more proenvironmental attitudes. Similarly, individual differences in concern for future financial costs (e.g., Lynch et al. 2010) might predict preferences for fuel-efficient cars most strongly when future cost attributes are present and weakly when they are absent. Thus, instead of restricting an individuals' autonomy and ability to act upon her own preferences—a criticism sometimes used against choice architecture (e.g., Hausman and Welsh 2010)—signposts epitomize a new class of choice architecture that is concerned with the alignment of behavior with existing objectives. While much of the popular discussion of choice architecture surrounds nudging, this discussion neglects the primary role of choice architecture: helping people make better choices for themselves. Signposts represent a tool consistent with this purpose.

5.3. Practical Implications

Apart from the psychological insights gained by identifying two separate mechanisms of translated attributes—activation and direction—there are also important practical implications for the design of potential choice interventions using translated attributes as appropriate choice architecture. Clearly, the possibility of activating preexisting objectives that are aligned with societal goals makes signposts an interesting choice architecture tool for policy makers. For example, the U.S. EPA fuel economy and environment label for new cars provides seven translated attributes for fuel economy, including miles per gallon, annual fuel cost, and a greenhouse gas rating, all of which are highly correlated with each other but highlight different objectives related to fuel economy (Figure 1). Many other product labels include multiple translated attributes. For example, food labels describe nutrients in terms of amount per serving (55 mg of sodium) as well as a percentage (2%) of recommended daily values. Home appliances, such as air conditioning (AC) units, state estimated yearly electricity use in kilowatt hours as well as estimated yearly operating cost in dollars. Indeed, we have also replicated our results in other domains that did not involve cars, including choices between AC units and food options. For example, in one study involving choices between AC units, participants made decisions that were much more aligned with their personal environmental values when we replaced the technical labels "Seasonal Energy Efficiency Rating" and "BTU/Wattage" with "Environmental Rating." Therefore, merely changing the label of a metric while keeping the actual attribute value constant appears to be sufficient to produce a signpost effect.

An initial concern when contemplating the value of translated attributes is the potential liability of overloading people with information (e.g., Jacoby 1984, Lee and Lee 2004). Our work shows that the presentation of translated attributes actually facilitates decision making by better aligning objectives and choices. Nonetheless, there remains a question of coverage: How many translations to provide while not overloading people with information? We propose that the optimal design would provide the minimum information needed to cover most important key objectives that vary within the target population. We have not explicitly studied a label with as many attributes as are present on the current EPA label and, therefore, cannot say whether all of the information on the label is useful in decision making. However, one possibility is that the presentation of a large number of different translated attributes causes an individual to selectively seek out the attributes that seem most relevant to addressing his or her own personal objectives. If that were the case, then we would expect the presentation of many translated attributes to have no negative consequences on decision making beyond the additional effort required to identify personally relevant attributes. Nevertheless, the selection of successful signposts requires careful consideration of the specific population segment being targeted, the objectives that are important to this segment, and matching attributes that have the potential to *activate* and *direct* those objectives.

More generally, translated attributes could be used as signposts in many other contexts, including online customization. For example, the website http://www.fueleconomy.gov allows a person to compare the fuel economy of different vehicles. The information is presented under different tabs, which the user is free to click on. One tab of information includes fuel-efficiency attributes such as gallons of fuel per 100

miles, MPG, and annual fuel cost. A second tab of information includes greenhouse gas emissions per mile and annual barrels of gasoline consumed. Although all of these pieces of information are translated attributes, the website user has some control over what information is presented. We can easily imagine a more customizable interface that enables the presentation of tailored information to specific users or user segments.

Obviously, the effectiveness of translated attributes is conditional on an appropriate presentation of the information. Potential benefits of translated attributes might not be realized in designs that impede the detection of the critical attributes because of the amount or format of the presented information. An important prerequisite for successful application of a signpost strategy is the identification of specific attributes that are most effective at reminding people of the important objectives they care about.

Finally, signpost effects are not necessarily limited to attribute translation. Other design features or presentation formats might be used to highlight relevant aspects and guide choice in a similar way. For example, research on food labeling has shown the benefit of using simple color schemes to indicate better (green) and worse (red) levels of an attribute, such as saturated fat, to help people quickly assess which food options are healthy and which are not (Hawley et al. 2013).

5.4. Conclusion

In summary, we have introduced the new concept of translated attributes as decision signposts—related attributes derived from a global dimension by simple transformations that can overcome shortcomings in the generation of choice objectives and align preferences with existing objectives. The effect of decision signposts on choice is robust in part because two separate psychological mechanisms support it independently: activation of inherent objectives such as values and goals, and provision of directional information for the individual to act upon. The utilization of translated attributes as decision signposts offers a new type of choice architecture and will be useful for both policy makers and managers alike as they strive to effectively communicate and guide informed choices.

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Endnotes

[1] Similar results were observed when also including the data of participants who failed the attention check. Participants were more likely to select the fuel-efficient option when fuel efficiency was expressed by two translated attributes compared to one ($\chi^2(1) = 8.78$, $p < 0.005$), and the relationship between environmental attitudes and the probability of choosing the fuel-efficient car was moderated by the presence of the GGR attribute, as indicated by a significant $GGR_{present} \times$ NEP-R interaction ($\chi^2(1) = 15.68$, $p < 0.001$).

[2] The same analysis, this time including all of the data, also revealed no effect of translated attribute ($F(1, 798) = 1.11$, $p = 0.29$), no effect of knowledge measure ($F(1, 798) = 0.58$, $p = 0.44$), and no interaction between these two variables ($F(1, 798) = 0.00$, $p = 0.99$).

[3] The same analysis, this time including all of the data, also revealed a main effect of translated attribute ($\chi^2(1, N = 799) = 52.01$, $p < 0.001$), no effect of knowledge measure ($\chi^2(1, N = 799) = 1.97$, $p = 0.16$), and no interaction between these two variables ($\chi^2(1, N = 799) = 1.33$, $p = 0.25$).

[4] The same analysis, this time including all of the data, also revealed a significant interaction between translated attribute and NEP-R scores ($\chi^2(1, N = 799) = 14.25$, $p = 0.0002$).

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