scientific reports

Check for updates

OPEN

The persuasive impact of attitudinal, behavioral, and combined message statements

Yubo Zhou[1] & Dolores Albarracín[1,2,3]✉

What makes persuasive messages effective: expressing attitudes, describing behaviors, or combining both? Across two preregistered experiments (total *N* = 1,506) and an internal meta-analysis, we compared attitudinal statements (e.g., "The car was good" or "I liked the car"), behavioral statements (e.g., "I bought the car" or "I intended to buy the car"), and combined attitudinal–behavioral statements (e.g., "The car was good, and I bought it," or "I recommended buying the car"). Participants read positive or negative social media messages about various products and reported their attitudes, perceived norms, and behavioral intentions. Mixed-effects models revealed that combined attitudinal–behavioral statements had the strongest persuasive impact, attitudinal statements had a moderate impact, and behavioral statements had the weakest impact. These effects were mediated by mental simulation of behavior, generalized across higher- and lower-value products, and were confirmed in a network meta-analysis. These findings advance theory and application in communication by showing how integrating attitudinal and behavioral content enhances persuasion.

What should a communicator say to promote favorable attitudes toward taking a vaccine or buying a product? One communicator might express an attitude (i.e., evaluation) toward the object by saying that it is good, while another might describe an actual or intended behavior (i.e., an overt action or inaction) by stating they received or intend to receive the vaccine. A third might combine both, saying "The vaccine is good, and I got it," whereas a fourth could make a direct behavioral recommendation, such as "Get vaccinated." These possibilities highlight a fundamental question about persuasive communication: Whether messages that express attitudes, describe behaviors, or combine both are most effective at influencing attitudes, perceived norms, and behavioral intentions.

This question is central for practical and theoretical concerns. Practically, understanding the optimal content of persuasive messages is critical for designing messages that successfully influence public health decisions, consumer choices, or social behavior. Theoretically, identifying what makes arguments persuasive has remained a core yet unresolved issue in communication and persuasion[1,2]. Although *actionable* messages – those that facilitate or prompt behavior – have been shown to influence intentions and behaviors[3–5], such messages often include multiple content types. In prior work[5], behavioral descriptions, behavioral attitudes, and behavioral recommendations have been treated as interchangeable, leaving unclear whether they exert distinct effects.

To address this issue, it is helpful to distinguish among several ways messages can communicate information. Messages can include (a) attitudinal information, such as evaluations of an object (e.g., "I liked the car" or "The car was good"); (b) behavioral information, such as statements about actions performed (e.g., "I bought the car") or intended (e.g., "I intended to buy the car."); or (c) combined information that includes attitudes and behavior (e.g., "The car was good, and I bought it"). Combined statements can also appear in more compact forms, such as behavioral attitude statements (e.g., "I liked buying the car") or behavioral recommendations (e.g., "I recommend buying the car") about a particular object (e.g., the car). Attitudinal information contains only a person's evaluation of a target (i.e., an object, a person, or a social issue), without alluding to behavior. In contrast, behavioral information includes only behavioral cues and no attitudinal component. Therefore, a behavioral attitude statement is classified as combined rather than as purely attitudinal (e.g., reference to only liking), or as purely behavioral (e.g., reference to only behavior). Understanding differences between these message types can clarify how persuasion operates and guide the design of more effective communications.

Existing research offers indirect evidence but not a direct comparison of the impact of these message types. Findings from the priming literature suggest that linking an evaluation to a behavior may strengthen persuasion.

[1]Department of Psychology, University of Pennsylvania, 202 S 36th Street, Philadelphia, PA 19104, USA. [2]Annenberg Public Policy Center, University of Pennsylvania, Philadelphia, USA. [3]Annenberg School for Communication, University of Pennsylvania, Philadelphia, USA. ✉email: dalba@upenn.edu

In particular, behavioral concepts have a greater influence on behavior when people hold a favorable evaluation of these concepts[6–8]. For example, priming a brand of iced tea increases the likelihood of drinking it only when participants are thirsty[7,9]. Furthermore, achievement primes promote task performance only among individuals who value achievement[10]. These findings suggest that linking an evaluation and a behavior within a message may enhance persuasion, possibly by activating a mental simulation of the behavior[11,12].

This possibility also follows from research on the attitude-behavior relation. Meta-analytic evidence demonstrates that attitudes toward a behavior predict behavioral intentions and behavior (rs ranging from 0.49 to 0.62[12–16]. Attitudes toward a behavior inherently combine an evaluative component (i.e., "good" or "bad") and a behavioral referent (e.g., "buying"), suggesting that integrating these elements within a message may directly evoke behavioral attitudes and, consequently, a greater intention to act. By contrast, messages that focus on only evaluations of objects may be less effective. Although the social influence literature also addresses communications about behavior, it has typically examined normative information at the group level rather than within individual persuasive messages. Descriptive norms (i.e., what most people do) and injunctive norms (i.e., what most people approve of) can influence decisions[17,18]. Still, these effects often rely on aggregated statistical information rather than personal expressions. Moreover, injunctive norms can either comprise attitudinal information (e.g., "A total of 73% of respondents (33% agreed and 40% strongly agreed) approved the attitude expressed by female college students that one's natural and healthy appearance is the most beautiful and needs no change."[19]; or blend attitudinal and behavioral information (e.g., "It is commonly approved that the light should be turned off when leaving a restroom"[20]), whereas descriptive norms (e.g., "More than 80% of [name of utility] customers take actions to save energy."; Bonan et al.[36]) represent behavioral information alone. Due to inconsistent measurement of injunctive norms, prior studies on normative influence have not clearly isolated the effects of attitudinal and behavioral information, or their combined effects.

Although social-norms research demonstrates the persuasive value of behavioral information, it typically relies on aggregate data rather than on what individuals say. Thus, the effect of messages about an individual's attitude or behavior remains an empirical question. Also, within the content of persuasive messages, one dimension that may affect the impact of attitudinal and behavioral information is outcome relevance. Classic persuasion models and related frameworks[1,2,21,22] suggest that the motivation and ability to process information depend on how consequential a decision is. Similarly, people may draw different inferences about someone's behavior depending on the value of the object involved. For example, hearing that someone has purchased a house (a higher-value object) may imply more positive attitudes, whereas learning that someone has bought chocolate (a lower-value object) may carry less weight. Thus, behavioral information may be more informative, and potentially more persuasive, when it concerns higher-value outcomes (for research on diagnosticity, see[23–25]).

Based on prior research on priming, the attitude–behavior relation, and social influence, we predicted that messages combining attitudinal and behavioral content would exert stronger persuasive effects than messages including only one type of information. Specifically, combined attitudinal–behavioral statements should lead to more favorable attitudes, stronger perceived norms, and greater behavioral intentions because they communicate both evaluation and action, signaling greater alignment between attitude and behavior. In contrast, purely attitudinal statements convey evaluation without evidence of enactment, and purely behavioral statements imply action without explicit evaluation. Also, we predicted that attitudinal statements would have a greater impact than behavioral statements because attitudes signal value better than behavior. Whereas an attitude unambiguously indicates positive or negative valence, information about a behavior is not evaluative, thus exerting less influence on recipients' attitudes. We therefore expected a gradient of persuasive impact: combined > attitudinal > behavioral.

In summary, our research aimed to clarify how the attitudinal and behavioral content of a message influences attitudes, perceived norms, and behavioral intentions. We had three objectives. First, we investigated the influence of attitudinal, behavioral, or combined attitudinal–behavioral statements, expecting that the combined statement would exert the strongest. Second, we investigated whether the combined content is most persuasive because it activates a mental simulation of behavior. Third, we assessed whether the financial value of the object moderates these effects. In particular, we investigated whether presenting behavioral information could enable recipients to infer the attitudes of the message source. We reasoned that those inferences could reduce the advantage of attitudinal information, whether alone or combined, particularly for higher-value objects.

Across two preregistered experiments and an internal meta-analysis, we systematically compared the impact of these message types on the outcomes of persuasion: attitudes, perceived norms, and behavioral intentions. Each experiment exposed participants to short social media–style statements that varied systematically in the type of information they conveyed. We compared statements containing attitudinal information (e.g., "The car was good" and "I liked the car"), behavioral information (descriptions or intentions such as "I bought the car" or "I intended to buy the car"), and combined attitudinal–behavioral information (e.g., "The car was good, and I bought it," "I liked buying the car," or "I recommended buying the car"). These statements could express either positive or negative valence toward different products, allowing us to test whether message content moderated persuasive effects across positive and negative valence. By directly contrasting statements that express attitudes, behaviors, or both, this work advances our understanding of the fundamental components of persuasive communication and provides practical guidance for designing effective messages across various domains, including consumer behavior and public health.

Transparency and openness

The preregistration for Studies 1 and 2 can be accessed at https://aspredicted.org/6BN_8XB and https://aspredicted.org/5665-zn74.pdf. The Supplementary Materials contain the experimental materials. We report all conditions, measures, and any deviations from the preregistration in the 'Methods' section. We conducted an internal meta-analysis to provide robust evidence across the two experiments. This meta-analysis was not

preregistered. The data and R scripts are available online: https://osf.io/at3cn/overview?view_only=f8c7a76df3d946e29311feb6dec002c6.

Study 1

Study 1 (see 'Methods' section) provided an initial test of whether combined attitudinal–behavioral statements are more persuasive than attitudinal-only or behavioral-only statements. Three hundred nationally representative participants from Prolific were presented with statements ostensibly posted by different social media users (i.e., Andy, Felix, Janet, Joshua, Laura, and Susie). The experimental design involved 6 within-subjects statement types (i.e., attitudes and behavior statement, behavioral recommendation statement, evaluative attitudinal statement, affective attitudinal statement, behavioral description statement, and behavioral intention statement) by 2 between-subjects statement valence conditions (positive vs. negative). Participants read statements about different products (i.e., bag, car, chocolate, house, laptop, and mug), and reported their attitudes, perceived norms, and behavioral intentions immediately after reading each statement. Randomized across participants, we presented either positive or negative information about each product, which was paired with one of six statement types. For examples of each statement type, see Fig. 1. All manipulations were successful and appear in the Supplementary Materials.

After viewing each statement, participants reported their attitudes toward the products using an affective attitude item, "My own attitude toward the product described in the statement would probably be…" and a behavioral attitude item, "My own attitude toward buying the [product] described in the statement would probably be…" on a 5-point scale ranging from 1 (*Extremely negative*) to 5 (*Extremely positive*). They reported their perceived injunctive norms (e.g., "Most people would probably think that the [product] described in the statement would be…") on a scale from 1 (*Extremely negative*) to 5 (*Extremely positive*) and their perceived descriptive norms (i.e., "How likely would most people be to buy the [product] described in the statement?") on a scale from 1 (*Very unlikely*) to 5 (*Very likely*). These normative items were combined into a perceived norm index. They also reported their behavioral intentions using items such as "I intend to buy the product described in the statement," rated on a 5-point scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*). The Supplementary Materials separate the two types of attitudes and the two types of norms, although the results were virtually identical.

Following our preregistration, we constructed mixed-effects models with statement type and statement valence as two fixed effects with six and two levels, respectively. We included the participants' ID (i.e., 1–300), the product (i.e., bag, car, chocolate, house, laptop, and mug), and the author (i.e., Andy, Felix, Janet, Joshua, Laura, and Susie) as random factors, and participants' attitudes, perceived norms, and behavioral intentions as the dependent measures. We obtained the main and interaction effects by conducting omnibus *F*-tests. We also contrasted the difference between positive and negative valence across each statement type (see superscripts associated with the statement valence contrasts) to better understand the relative effects of the different statement types. In addition, as exploratory analyses, we examined the effects of each statement type separately within positive and negative valence to determine which valence contributed more to the impact of these statement types.

Participants' attitudes, perceived norms, and behavioral intentions

The study results appear in Table 1. As shown by the *F*-ratios, we found significant predicted interactions between statement type and valence for all dependent measures, indicating that different statement conditions indeed had distinct effects. We also tested the relative impact of each statement type by comparing the difference

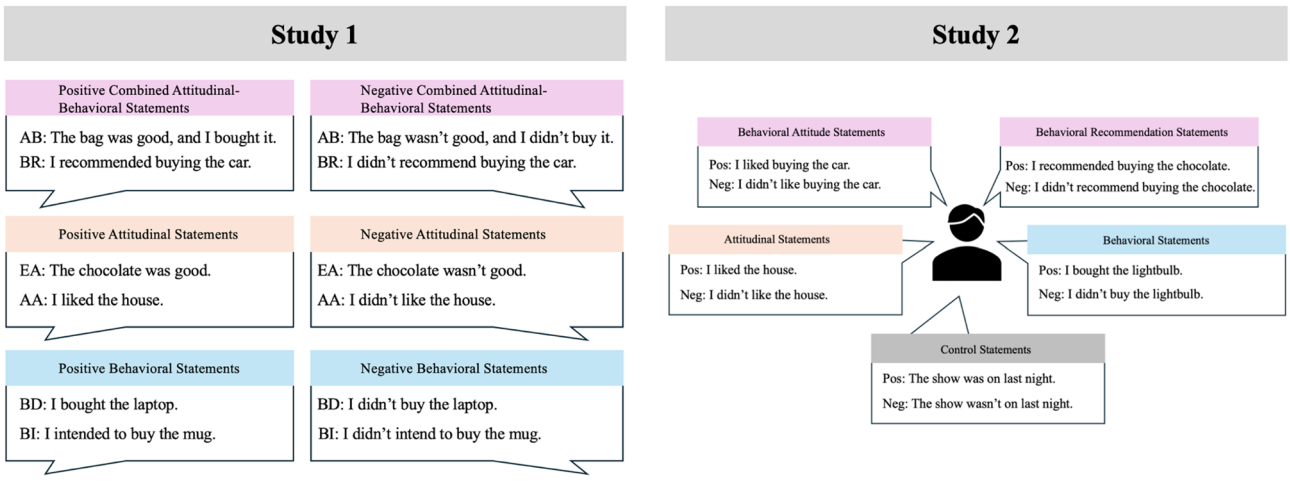

Fig. 1. Statement examples of Studies 1 and 2. AB stands for attitudes and behavior statements; BR stands for behavioral recommendation statements; EA stands for evaluative attitudinal statements; AA stands for affective attitudinal statements; BD stands for behavioral description statements; BI stands for behavioral intention statements. Pos stands for positive statement valence; Neg stands for negative statement valence.

	Statistics					
	Participants' attitudes					
	Combined attitudinal–behavioral statement		Attitudinal statement		Behavioral statement	
	Attitude and behavior statement	Behavioral recommendation statement	Evaluative attitude statement	Affective attitude statement	Behavioral description statement	Behavioral intention statement
Conditions	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	3.98 (.06)^{a}	3.90 (.07)^{ab}	3.73 (.07)^{bc}	3.82 (.07)^{ab}	3.58 (.06)^{c}	3.51 (.07)^{c}
Negative	1.82 (.07)^{a}	2.15 (.07)^{bc}	1.95 (.07)^{ac}	2.20 (.06)^{b}	2.66 (.07)^{d}	2.69 (.07)^{d}
M Differences	2.16 (.09)$_{a}^{***}$	1.74 (.09)$_{b}^{***}$	1.77 (.09)$_{b}^{***}$	1.61 (.09)$_{b}^{***}$	0.92 (.09)$_{c}^{***}$	0.81 (.09)$_{c}^{***}$
Simple effects						
F(5, 683.24) for statement type within positive valence		21.31 (.13)***				
F(5, 716.06) for statement type within negative valence		54.30 (.27)***				
Main effects and interactions						
F(5, 1484.8) main effect: statement type		8.19 (.03)***				
F(1, 1486.5) main effect: statement valence		2318.03 (.61)***				
F(5, 1780.5) interaction: statement type × statement valence		46.05 (.11)***				

	Participants' perceived norms					
	Combined attitudinal–behavioral statement		Attitudinal statement		Behavioral statement	
	Attitude and behavior statement	Behavioral recommendation statement	Evaluative attitude statement	Affective attitude statement	Behavioral description statement	Behavioral intention statement
Conditions	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	4.00 (.07)^{a}	3.92 (.07)^{ab}	3.73 (.07)^{bc}	3.82 (.07)^{ab}	3.57 (.07)^{c}	3.44 (.07)^{c}
Negative	1.76 (.07)^{a}	2.03 (.07)^{b}	1.80 (.07)^{a}	2.04 (.07)^{b}	2.42 (.07)^{c}	2.64 (.07)^{d}
M Differences	2.24 (.10)$_{a}^{***}$	1.88 (.10)$_{b}^{***}$	1.93 (.10)$_{b}^{***}$	1.79 (.10)$_{b}^{***}$	1.15 (.10)$_{c}^{***}$	0.80 (.10)$_{d}^{***}$
Simple effects						
F(5, 700.46) for statement type within positive valence		24.08 (.15)***				
F(5, 711.70) for statement type within negative valence		55.55 (.28)***				
Main effects and interactions						
F(5, 1484.5) main effect: statement type		7.17 (.02)***				
F(1, 1485.4) main effect: statement valence		3018.20 (.67)***				
F(5, 1776.4) interaction: statement type × statement valence		52.79 (.13)***				

	Participants' behavioral intentions					
	Combined attitudinal–behavioral statement		Attitudinal statement		Behavioral statement	
	Attitude and behavior statement	Behavioral recommendation statement	Evaluative attitude statement	Affective attitude statement	Behavioral description statement	Behavioral intention statement
Conditions	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	3.31 (.11)^{ac}	3.39 (.11)^{c}	3.01 (.11)^{bd}	3.10 (.11)^{ad}	2.80 (.11)^{b}	2.96 (.11)^{bd}
Negative	1.58 (.11)^{a}	1.85 (.11)^{bc}	1.66 (.11)^{ab}	1.99 (.11)^{c}	2.30 (.11)^{d}	2.27 (.11)^{d}
M Differences	1.73 (.16)$_{a}^{***}$	1.54 (.16)$_{a}^{***}$	1.35 (.16)$_{ab}^{***}$	1.11 (.16)$_{b}^{***}$	0.50 (.16)$_{c}^{***}$	0.69 (.16)$_{c}^{***}$
Simple effects						
F(5, 664.45) for statement type within positive valence		12.43 (.09)***				
F(5, 693.83) for statement type within negative valence		29.37 (.17)***				
Continued						
Main effects and interactions						

	Participants' behavioral intentions					
	Combined attitudinal–behavioral statement		Attitudinal statement		Behavioral statement	
	Attitude and behavior statement	Behavioral recommendation statement	Evaluative attitude statement	Affective attitude statement	Behavioral description statement	Behavioral intention statement
Conditions	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
F(5, 1483.8) main effect: statement type		5.93 (.02)***				
F(1, 1485.0) main effect: statement valence		996.06 (.40)***				
F(5, 1681.1) interaction: statement type × statement valence		25.20 (.07)***				
	Participants' mental simulation of behavior					
	Combined attitudinal–behavioral statement		Attitudinal statement		Behavioral statement	
	Attitude and behavior statement	Behavioral recommendation statement	Evaluative attitude statement	Affective attitude statement	Behavioral description statement	Behavioral intention statement
Conditions	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	3.52 (.09)^{a}	3.37 (.10)^{ab}	3.10 (.10)^{cd}	3.23 (.10)^{bc}	2.95 (.09)^{d}	2.95 (.10)^{d}
Negative	3.14 (.10)^{a}	2.99 (.10)^{ab}	3.02 (.10)^{ab}	2.84 (.09)^{bc}	2.68 (.10)^{c}	2.83 (.10)^{bc}
M Differences	0.37 (.09)$_{a}$***	0.38 (.09)$_{a}$***	0.08 (.09)$_{b}$	0.39 (.09)$_{a}$*	0.28 (.09)$_{a}$**	0.12 (.09)$_{b}$
Simple effects						
F(5, 657.2) for statement type within positive valence		14.82 (.10)***				
F(5, 657.81) for statement type within negative valence		10.71 (.08)***				
Main effects and interactions						
F(5, 1484.6) main effect: statement type		22.32 (.07)***				
F(1, 1485.7) main effect: statement valence		68.30 (.04)***				
F(5, 1589.0) interaction: statement type × statement valence		2.41 (.008)*				

Table 1. Effects on participants' attitudes, perceived norms, behavioral intentions, and mental simulation of behavior: Study 1 (N = 300). Significant contrasts across statement types were indicated by different subscripts within each statement valence. Significant contrasts between positive and negative valence ($p < .05$) across statement types are indicated by different subscripts. Significant contrasts between positive and negative statement valences ($p < .05$) within each statement type are indicated by an asterisk (*). The *F*-statistics are reported for each main effect and interactions, and effect sizes (η^2_p) appear in parentheses after the *F*-ratios. *** $p < .001$, ** $p < .01$, * $p < .05$..

between positive and negative valence. Significant contrasts between positive and negative statement valences are indicated by different subscripts within each statement type. As noted in the contrasts between positive and negative statement valence, the valence manipulations exerted the intended positive and negative effects on all dependent measures. Also, as hypothesized, the combined attitudinal–behavioral statements (i.e., the attitudes and behavior statement and the behavioral recommendation statement) had more influence than the attitudinal statements (i.e., the affective attitude statement and the evaluative attitude statement) and the behavioral statements (i.e., the behavioral description statement and the behavioral intention statement). However, the difference between the behavioral recommendation statement and the evaluative attitude statement was not significant for any of the dependent measures. Finally, the behavior description statement was more persuasive than the behavior intention statement. However, this difference was only present for perceived norms. We also conducted mixed-effects models and corresponding contrasts for statement types, grouped as combined attitudinal-behavioral, attitudinal, and behavioral statements, as reported in the Supplementary Materials. The results revealed significant differences between the grouped combined conditions and the grouped attitudinal conditions, as well as between the grouped attitudinal conditions and the grouped behavioral conditions. As exploratory analyses, we examined the effect of statement valence on the relative impact of three statement types. Negative statements accounted for a larger share of the effects on participants' attitudes, perceived norms, and behavioral intentions than did positive statements. Meanwhile, positive (vs. negative) statements accounted for a larger share of the effects on mental simulation of behavior. The simple effect of statement valence and the contrasts between statement types within positive and negative valence are presented in Table 1.

Mental simulation of behavior

One reason why the combined attitudinal–behavioral statements might be more persuasive is that they may activate mental simulation of behavior. For this reason, participants also rated the mental simulation of behavior of each statement with items such as: "I could visualize making a decision about the [product]," and "I could picture myself experiencing what the person described about the [product]" (see 'Methods' section). These items were used to create a mental simulation of behavior index (see the last panel of Table 1), which served as a mediator in the path analysis for Study 1.

As shown in Table 1, mental simulation of behavior was primarily a function of statement type and valence. Therefore, if different statements activate different mental simulations of behavior, we should observe that the interaction between statement types and valence is mediated by the interaction between positive behavioral presentations and statement valence. The path model examines this possibility. The model also examined the other critical interactions and effects, which are fully reported in the Supplementary Materials. A simplified representation of the model appears in Fig. 2. We treated the behavioral intention statement as the baseline and represented statement type using a set of effect-coding indicator variables (±0.5) designed to capture deviations from this baseline. Specifically, for each statement type, we created a new variable coded as 0.5 for the target statement type, −0.5 when the statement was a behavioral intention statement, and 0 otherwise. The model had a good fit and revealed a significant moderated mediation index. As shown in Fig. 2, the two combined attitudinal–behavioral statements elicited greater mental simulation of behavior, the two attitudinal statements were in the middle, and the behavioral description statement elicited lesser mental simulation of behavior. Then, mental simulation of behavior, in interaction with statement valence, mediated the effect of the statement type × valence interaction on participants' attitudes and perceived norms, which in turn predicted their behavioral intentions.

In sum, this experiment showed that combined attitudinal–behavioral statements are most persuasive, and that mental simulation of behavior mediate this effect. This is reassuring given the diversity of products in the study, which included both higher- and lower-value items. However, higher- and lower-value objects have considerable ecological and theoretical importance. Therefore, we conducted an exploratory analysis of the interactive effect of statement type, statement valence, and the financial value of the products (higher vs. lower). For this analysis, we categorized certain products (i.e., car, house, and laptop) as having higher financial value, and others (i.e., bag, chocolate, and mug) as having lower financial value. The results are presented in the Supplementary Materials and were suggestive, though not significant. Additionally, we preregistered and studied financial value in Study 2.

Study 2

Study 2 (see 'Methods' section) was designed to examine whether the findings from Study 1 replicated and to investigate possible differences between higher- and lower-value products, as well as how different products affect attitudinal and behavioral inferences. Study 2 (N = 1,206 participants from Prolific) established the robustness of the findings from Study 1. We increased the sample size and replaced the attitudes and behavior statement (e.g.,

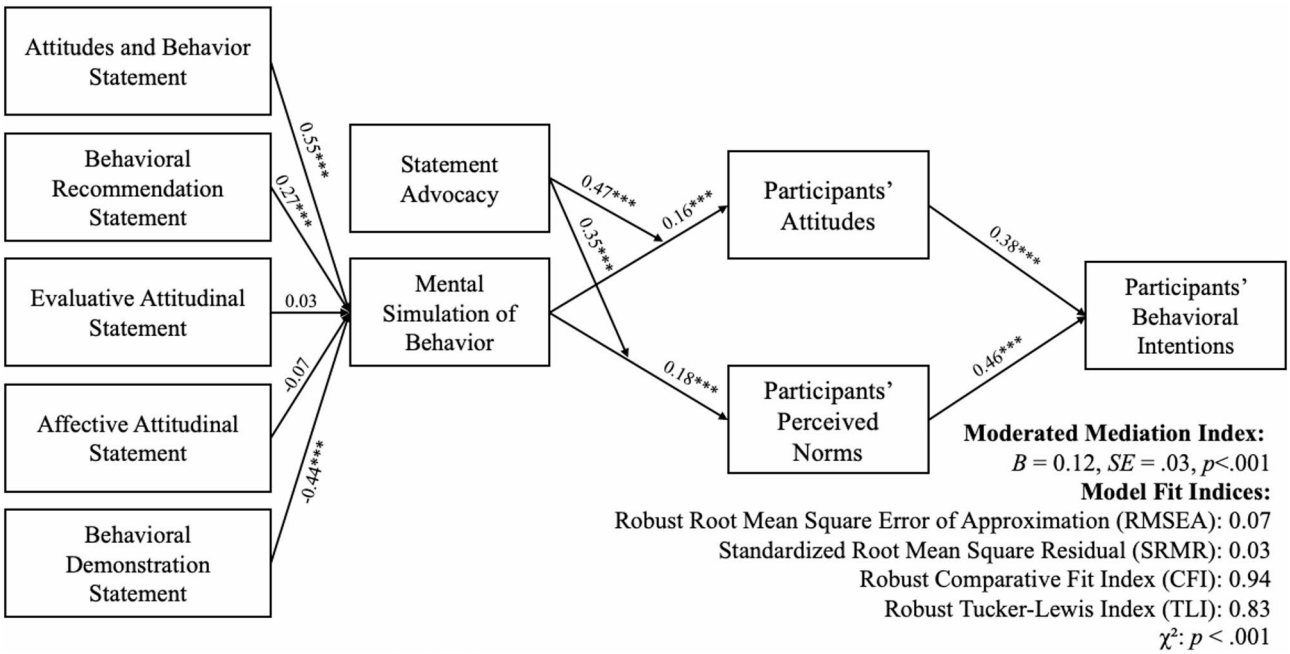

Fig. 2. Moderated Mediation Model: Study 1 (N = 300). This model examined the influence of statement type and the interaction of statement type and statement valence on participants' attitudes and perceived norms. This figure presents a simplified representation. The coefficients and significance levels of these paths are presented in the Supplementary Materials. *** p <.001, ** p <.01, * p <.05.

"The car was good, and I bought it."), which was effectively two propositions, with a behavioral attitude statement (e.g., "I like buying the car"), which integrates attitudinal and behavioral information to keep the number of propositions constant across all experimental conditions. Thus, the combined attitudinal–behavioral statements in this study included the behavioral attitude statement and the behavioral recommendation statement. The study included three additional conditions comprising an attitudinal statement, a behavioral statement, and a control statement. As in Study 1, different products (i.e., car, chocolate, house, lightbulbs, and show) and authors (i.e., Andy, Felix, Janet, Joshua, and Susie) were paired with statement type and valence conditions. For examples of each statement, see Fig. 1. In this analysis, products were also included as a fixed factor, with car and house categorized as higher-value products, and chocolate, lightbulbs, and show as lower-value products. All manipulation checks supported the success of our manipulations and appear in the Supplementary Materials.

To ensure that the effects of the statements persisted beyond the exposure time, we introduced distractor items (e.g., "The statements were grammatical," rated from 1 = *Strongly disagree* to 5 = *Strongly agree*) between participants' exposure to the messages and the dependent measures. As in Study 1, the dependent measures included participants' attitudes, perceived norms, and behavioral intentions. Moreover, participants completed two items about the attitudes they inferred the statements' authors had (e.g., "[Name]'s attitude toward the car is…") using scales from 1 (*Extremely negative*) to 5 (*Extremely positive*). They also reported their inferences about the statement authors' behaviors, by rating the item, "How likely would [Name] be to buy the car?" on a scale from 1 (*Very unlikely*) to 5 (*Very likely*).

As mentioned, the experimental design involved 5 within-subjects statement type conditions (i.e., behavioral attitude statement, behavioral recommendation statement, attitudinal statement, behavioral statement, and control statement) by 2 between-subjects statement valence conditions (i.e., positive vs. negative) by 2 within-subjects financial value conditions (i.e., higher- vs. lower value). We constructed a mixed-effects model that included statement type, statement valence, and financial value as fixed effects. We included participants' IDs (1–1206), the target (i.e., car, chocolate, house, lightbulb, and show), and statement author names (i.e., Andy, Felix, Janet, Joshua, and Susie) as random factors.

We examined the preregistered hypotheses already tested in Study 1, as well as the preregistered analysis of the interaction between statement type, statement valence, and financial value. The results from these analyses are presented in Table 2, which includes descriptive statistics, omnibus effects, simple effects, and contrasts for both positive and negative levels of statement valence, across all levels of financial value. The table also presents contrasts comparing the differences between positive and negative statement valence for each statement type across higher- and lower-value conditions, illustrating the three-way interaction.

Participants' attitudes, perceived norms, and behavioral intentions

We first examined attitudes, perceived norms, and behavioral intentions as a function of statement type (behavioral attitude, behavioral recommendation, attitudinal, behavioral, or control statement), statement valence (positive vs. negative), and financial value (higher vs. lower value). As in Study 1, the statement valence manipulation exerted powerful effects across the board. Also, we predicted, the combined attitudinal–behavioral statements (i.e., behavioral attitude and behavioral recommendation statements) had more influence on each of these measures than the attitudinal statements, followed next by the behavioral statements and last by the control ones. Thus, Study 2 successfully replicated the findings of Study 1. However, two exceptions showed directional but nonsignificant differences: behavioral recommendation statements versus attitudinal statements for participants' attitudes and behavioral statements versus control statements for participants' behavioral intentions (see Table 2).

With respect to the three-way interaction between statement type, statement valence, and financial value, this interaction was significant only for perceived norms. As shown in Table 2, the differences in differences across higher- and lower-value conditions indicated that, as preregistered, the behavioral information had greater normative influence for higher-value products. In contrast, the attitudinal information had greater influence on lower-value products. However, these patterns, although similar in direction, were not significant for either participants' attitudes or behavioral intentions. The internal meta-analysis revisited this issue.

Inferred authors' attitudes and inferred authors' behaviors We also examined inferred authors' attitudes and behaviors as a function of statement type (behavioral attitude, behavioral recommendation, attitudinal, behavioral, and control statement), statement valence (positive vs. negative), and financial value (higher vs. lower value). As displayed in the fourth panel of Table 2, the inferred attitudes showed significant interactions between statement type and valence. These interactions supported the notion that the attitudinal statements were properly interpreted as concerning the attitudes of the statements' authors (see also the manipulation checks in the 'Methods' section). The effects of the statement valence on inferred attitudes were stronger in the combined attitudinal–behavioral statement condition than in the other conditions. Moreover, as predicted, the higher-order interaction between statement type, statement valence, and financial value was significant. As hypothesized, this was largely due to the stronger effect of the behavioral statement for the higher-value products (vs. lower-value products). Specifically, when participants learned about the purchase of a higher-value item (e.g., a car), they inferred that the authors liked the item more than when they learned about the purchase of a lower-value item (e.g., a lightbulb). As a result, the influence of the combined statements was smaller in the higher-value conditions than in the lower-value conditions.

Inferred authors' behaviors were also significantly influenced by the interaction between statement type and valence (see Table 2). As shown by this two-way interaction, the effects of statement valence on inferred behavior were stronger for the combined attitudinal–behavioral statements and the behavioral statements than for the attitudinal statements. However, there was also a three-way interaction between statement type, statement valence, and financial value. When participants learned that the author liked a lower-value product (e.g., a

Conditions	Statistics				
	Participants' attitudes				
	Combined attitudinal–behavioral statement		Attitudinal statement	Behavioral statement	Control statement
	Behavioral attitude statement	Behavioral recommendation statement			
	Positive vs. negative valence				
	M (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	3.67 (.08)^{a}	3.53 (.08)^{b}	3.56 (.08)^{ab}	3.45 (.08)^{bc}	3.36 (.08)^{c}
Negative	2.86 (.08)^{ab}	2.75 (.08)^{b}	2.89 (.08)^{a}	3.05 (.08)^{c}	3.13 (.08)^{c}
M differences	0.82 (.05)$_{a}$***	0.78 (.05)$_{ab}$***	0.67 (.05)$_{b}$***	0.40 (.05)$_{c}$***	0.23 (.05)$_{d}$***
Simple effects					
F(4, 2333.7) for statement type within positive valence		20.02 (.03)***			
F(4, 2256.0) for statement type within negative valence		21.12 (.04)***			
	Higher vs. lower financial value				
Higher value					
Positive	3.59 (.13)	3.43 (.10)	3.46 (.13)	3.36 (.13)	3.35 (.13)
Negative	2.67 (.13)	2.61 (.10)	2.85 (.13)	2.83 (.13)	3.08 (.13)
M differences	0.92 (.07)$_{a}$***	0.82 (.07)$_{a}$***	0.60 (.07)$_{b}$***	0.53 (.07)$_{b}$***	0.27 (.07)$_{c}$***
Lower value					
Positive	3.73 (.10)	3.60 (.10)	3.63 (.10)	3.52 (.10)	3.37 (.10)
Negative	2.99 (.10)	2.85 (.10)	2.92 (.10)	3.19 (.10)	3.16 (.10)
M differences	0.75 (.06)$_{a}$***	0.75 (.06)$_{a}$***	0.71 (.06)$_{a}$***	0.32 (.06)$_{b}$***	0.21 (.06)$_{b}$***
	Higher financial value (mean difference$_{\text{Positive—Negative}}$) – lower financial value (mean difference $_{\text{Positive—Negative}}$)				
M differences in differences	0.17 (.09)$_{a}$	0.08 (.09)$_{ab}$	− 0.11 (.09)$_{b}$	0.21 (.09)$_{a}$*	0.06 (.09)$_{a}$
Simple effects					
F(4, 2005.6) for statement type within higher financial value		2.95 (.006)*			
F(4, 2978.6) for statement type within lower financial value		4.42 (.006)**			
Main effects and interactions					
F(4, 4858.5) main effect: statement type		5.27 (.004)***			
F(1, 5070.1) main effect: statement valence		874.58 (.15)***			
F(1, 3.0) main effect: financial value		1.33 (.31)			
F(4, 5822.9) interaction: statement type × statement valence		28.97 (.02)***			
F(4, 5866.6) interaction: statement type × financial value		3.16 (.002)*			
F(1, 5851.2) interaction: statement valence × financial value		3.86 (.001)*			
F(4, 5661.3) interaction: statement valence × statement valence × financial value		1.74 (.001)			
	Participants' perceived norms				
	Behavioral attitude statement	Behavioral recommendation statement	Attitudinal statement	Behavioral statement	Control statement
	Positive vs. negative valence				
Conditions	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	3.70 (.08)^{a}	3.61 (.08)^{ab}	3.60 (.08)^{ab}	3.53 (.08)^{b}	3.37 (.07)^{c}
Negative	2.76 (.08)^{ab}	2.66 (.08)^{a}	2.87 (.08)^{bc}	2.98 (.08)^{cd}	3.10 (.08)^{d}
M differences	0.94 (.11)$_{a}$***	0.95 (.11)$_{a}$***	0.73 (.11)$_{b}$***	0.55 (.11)$_{c}$***	0.27 (.11)$_{d}$***
Simple effects					
F(4, 2271.2) for statement type within positive valence		23.74 (.04)***			
F(4, 2201.9) for statement type within negative valence		28.60 (.05)***			
	Higher vs. lower financial value				
Higher value					
Continued					

Conditions	Participants' perceived norms				
	Behavioral attitude statement	Behavioral recommendation statement	Attitudinal statement	Behavioral statement	Control statement
	Positive vs. negative valence				
	M (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	3.57 (.11)	3.46 (.11)	3.46 (.11)	3.45 (.11)	3.35 (.11)
Negative	2.63 (.11)	2.59 (.11)	2.87 (.11)	2.76 (.11)	3.01 (.11)
M differences	$0.94\ (.15)_{a}^{***}$	$0.88\ (.15)_{ac}^{***}$	$0.59\ (.15)_{b}^{***}$	$0.69\ (.15)_{c}^{***}$	$0.35\ (.15)_{d}^{***}$
Lower value					
Positive	3.79 (.09)	3.72 (.09)	3.69 (.09)	3.58 (.09)	3.38 (.09)
Negative	2.85 (.09)	2.71 (.09)	2.87 (.09)	3.12 (.09)	3.16 (.09)
M differences	$0.94\ (.13)_{a}^{***}$	$1.01\ (.13)_{b}^{***}$	$0.82\ (.13)_{a}^{***}$	$0.47\ (.13)_{c}^{***}$	$0.22\ (.13)_{d}^{***}$
	Higher financial value (mean difference$_{\text{Positive—Negative}}$) – lower financial value (mean difference$_{\text{Positive—Negative}}$)				
M differences in differences	$-.00\ (.09)_{ab}$	$-0.13\ (.09)_{a}$	$-0.24\ (.09)_{a}^{*}$	$0.22\ (.09)_{b}^{*}$	$0.12\ (.09)_{b}$
Simple effects					
F(4, 1960.6) for statement type within higher financial value		2.60 (.005)*			
F(4, 3028.6) for statement type within lower financial value		3.27 (.004)*			
Main effects and interactions					
F(4, 4856.9) main effect: statement type		4.30 (.003)**			
F(1, 5062.7) main effect: statement valence		1168.85 (.19)***			
F(1, 3.0) main effect: financial value		1.96 (.40)			
F(4, 5803.9) interaction: statement type × statement valence		34.32 (.02)***			
F(4, 5845.7) interaction: statement type × financial value		2.02 (.001)			
F(1, 5831.5) interaction: statement valence × financial value		0.01 (<.001)			
F(4, 5636.9) interaction: statement valence × statement valence × financial value		3.94 (.003)**			

Conditions	Participants' behavioral intentions				
	Behavioral attitude statement	Behavioral recommendation statement	Attitudinal statement	Behavioral statement	Control statement
	Positive vs. negative valence				
	M (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	$3.40\ (.14)^{a}$	$3.25\ (.14)^{ab}$	$3.24\ (.14)^{b}$	$3.15\ (.14)^{b}$	$3.11\ (.14)^{b}$
Negative	$2.63\ (.14)^{a}$	$2.46\ (.14)^{b}$	$2.63\ (.14)^{ac}$	$2.79\ (.14)^{c}$	$2.88\ (.14)^{c}$
M differences	$0.77\ (.19)_{a}^{***}$	$0.79\ (.19)_{a}^{***}$	$0.61\ (.19)_{b}^{***}$	$0.36\ (.19)_{c}^{***}$	$0.23\ (.19)_{c}^{***}$
Simple effects					
F(4, 2320.3) for statement type within positive valence		10.36 (.02)***			
F(4, 2321.3) for statement type within negative valence		17.31 (.03)***			
	Higher vs. lower financial value				
Higher value					
Positive	3.03 (.14)	2.92 (.13)	2.94 (.13)	2.83 (.14)	2.86 (.13)
Negative	2.34 (.13)	2.26 (.13)	2.45 (.14)	2.41 (.14)	2.70 (.14)
M differences	$0.70\ (.19)_{a}^{***}$	$0.66\ (.19)_{a}^{***}$	$0.49\ (.19)_{ab}^{***}$	$0.42\ (.19)_{b}^{***}$	$0.16\ (.19)_{c}^{***}$
Lower value					
Positive	3.63 (.11)	3.47 (.11)	3.44 (.11)	3.37 (.11)	3.27 (.11)
Negative	2.82 (.11)	2.59 (.11)	2.76 (.11)	3.05 (.11)	2.99 (.11)
M differences	$0.81\ (.16)_{a}^{***}$	$0.88\ (.16)_{a}^{***}$	$0.69\ (.16)_{a}^{***}$	$0.32\ (.15)_{b}^{***}$	$0.27\ (.16)_{b}^{***}$
	Higher financial value (mean difference$_{\text{Positive—Negative}}$) – lower financial value (mean difference$_{\text{Positive—Negative}}$)				
M differences in differences	$-0.12\ (.11)_{ab}$	$-0.22\ (.11)_{a}$	$-0.19\ (.11)_{ab}$	$0.10\ (.11)_{b}$	$-.11\ (.11)_{ab}$
Continued					
Simple effects					

	Participants' behavioral intentions				
	Behavioral attitude statement	Behavioral recommendation statement	Attitudinal statement	Behavioral statement	Control statement
	Positive vs. negative valence				
Conditions	***M* (*SE*)**	***M* (*SE*)**	***M* (*SE*)**	***M* (*SE*)**	***M* (*SE*)**
F(4, 1829.0) for statement type within higher financial value		2.23 (.005)			
F(4, 2933.6) for statement type within lower financial value		5.58 (.008)***			
Main effects and interactions					
F(4, 4849.9) main effect: statement type		5.06 (.004)***			
F(1, 5033.1) main effect: statement valence		499.98 (.09)***			
F(1, 3.0) main effect: financial value		9.03 (.75)			
F(4, 5724.1) interaction: statement type × statement valence		17.88 (.01)***			
F(4, 5762.0) interaction: statement type × financial value		2.91 (.002)*			
F(1, 5746.4) interaction: statement valence × financial value		4.49 (.001)*			
F(4, 5549.4) interaction: statement valence × statement valence × financial value		1.24 (.001)			
	Inferred authors' attitudes				
	Behavioral attitude statement	**Behavioral recommendation statement**	**Attitudinal statement**	**Behavioral statement**	**Control statement**
	Positive vs. negative valence				
Conditions	***M* (*SE*)**	***M* (*SE*)**	***M* (*SE*)**	***M* (*SE*)**	***M* (*SE*)**
Positive	4.03 (.05)^{a}	3.97 (.05)^{ab}	3.85 (.05)^{b}	3.62 (.05)^{c}	3.43 (.05)^{c}
Negative	2.46 (.05)^{a}	2.48 (.05)^{a}	2.55 (.05)^{a}	2.80 (.05)^{b}	2.91 (.05)^{b}
M differences	1.57 (.06)$_{a}$***	1.49 (.06)$_{a}$***	1.30 (.06)$_{b}$***	0.82 (.06)$_{c}$***	0.52 (.06)$_{d}$***
Simple effects					
F(4, 2357.7) for statement type within positive valence		70.40 (.11)***			
F(4, 2233.4) for statement type within negative valence		26.35 (.05)***			
	Higher vs. lower financial value				
Higher value					
Positive	4.02 (.09)	3.91 (.08)	3.79 (.08)	3.67 (.09)	3.48 (.08)
Negative	2.33 (.08)	2.46 (.08)	2.58 (.09)	2.60 (.09)	2.84 (.09)
M differences	1.68 (.09)$_{a}$***	1.44 (.09)$_{a}$***	1.21 (.09)$_{ab}$***	1.07 (.09)$_{b}$***	0.64 (.09)$_{c}$***
Lower value					
Positive	4.05 (.07)	4.02 (.07)	3.90 (.07)	3.59 (.07)	3.40 (.07)
Negative	2.55 (.07)	2.49 (.07)	2.54 (.07)	2.93 (.07)	2.96 (.07)
M differences	1.49 (.07)$_{a}$***	1.53 (.07)$_{a}$***	1.37 (.07)$_{a}$***	0.66 (.07)$_{b}$***	0.44 (.07)$_{c}$***
	Higher financial value (mean difference$_{\text{Positive—Negative}}$) – lower financial value (mean difference$_{\text{Positive—Negative}}$)				
M differences in differences	0.19 (.11)$_{a}$	− 0.08 (.11)$_{b}$	− 0.16 (.11)$_{b}$	0.41 (.11)$_{a}$***	0.20 (.11)$_{a}$
Simple effects					
F(4, 2114.7) for statement type within higher financial value		0.34 (.001)			
F(4, 3198.9) for statement type within lower financial value		1.57 (.002)			
Main effects and interactions					
F(4, 4871.4) main effect: statement type		0.93 (.001)			
F(1, 5124.2) main effect: statement valence		2213.56 (.30)***			
F(1, 3.0) main effect: financial value		0.92 (.23)			
F(4, 5923.1) interaction: statement type × statement valence		60.62 (.04)***			
F(4, 5967.2) interaction: statement type × financial value		0.71 (<.001)			
F(1, 5958.3) interaction: statement valence × financial value		4.76 (.001)*			
F(4, 5799.3) interaction: statement valence × statement valence × financial value		4.24 (.003)**			

Conditions	Inferred authors' behaviors				
	Behavioral attitude statement	Behavioral recommendation statement	Attitudinal statement	Behavioral statement	Control statement
	Positive vs. negative valence				
	M (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Positive	4.10 (.06)^{a}	3.99 (.06)^{ab}	3.91 (.06)^{b}	3.86 (.06)^{b}	3.51 (.06)^{c}
Negative	2.59 (.06)^{a}	2.40 (.06)^{ab}	2.55 (.06)^{ab}	2.58 (.06)^{b}	2.94 (.06)^{c}
M differences	1.51 (.06)$_{ab}$***	1.58 (.06)$_{b}$***	1.36 (.06)$_{ac}$***	1.28 (.06)$_{c}$***	0.57 (.06)$_{d}$***
Simple effects					
F(4, 2349.1) for statement type within positive valence		46.29 (.07)***			
F(4, 2260.1) for statement type within negative valence		19.83 (.03)***			
	Higher vs. lower financial value				
Higher value					
Positive	4.08 (.08)	3.82 (.08)	3.79 (.08)	3.85 (.08)	3.45 (.08)
Negative	2.52 (.08)	2.33 (.08)	2.57 (.08)	2.33 (.08)	2.88 (.08)
M differences	1.56 (.10)$_{a}$***	1.49 (.10)$_{a}$***	1.22 (.10)$_{b}$***	1.51 (.10)$_{a}$***	0.57 (.10)$_{c}$***
Lower value					
Positive	4.12 (.07)	4.10 (.07)	3.99 (.07)	3.87 (.07)	3.56 (.07)
Negative	2.63 (.07)	2.45 (.07)	2.54 (.07)	2.74 (.07)	2.98 (.07)
M differences	1.49 (.08)$_{a}$***	1.65 (.08)$_{a}$***	1.45 (.08)$_{a}$***	1.13 (.08)$_{b}$***	0.57 (.08)$_{c}$***
	Higher financial value (mean difference$_{\text{Positive—Negative}}$) − lower financial value (mean difference$_{\text{Positive—Negative}}$)				
M differences in differences	0.07 (.13)$_{ab}$	− 0.15 (.13)$_{a}$	− 0.23 (.13)$_{a}$	0.39 (.13)$_{b}$**	− 0.00 (.13)$_{a}$
Simple effects					
F(4, 2138.3) for statement type within higher financial value		2.00 (.004)			
F(4, 3608.7) for statement type within lower financial value		1.40 (.002)			
Main effects and interactions					
F(4, 4871.4) main effect: statement type		0.93 (.003)			
F(1, 5124.2) main effect: statement valence		2213.56 (.29)***			
F(1, 3.0) main effect: financial value		0.92 (.62)			
F(4, 5923.1) interaction: statement type × statement valence		60.62 (.03)***			
F(4, 5967.2) interaction: statement type × financial value		0.71 (<.001)			
F(1, 5958.3) interaction: statement valence × financial value		4.76 (<.001)*			
F(4, 5799.3) interaction: statement valence × statement valence × financial value		4.24 (.002)**			

Table 2. Effects on participants' attitudes, perceived norms, behavioral intentions and inferred author's attitudes and behaviors: Study 2 (N = 1,206). Significant contrasts across statement types were indicated by different subscripts within each statement valence in the "Positive vs. Negative Valence" panel. Significant contrasts between positive and negative valence ($p < .05$) across statement types are indicated by different subscripts. Significant contrasts between positive and negative statement valences ($p < .05$) within each statement type are indicated by an asterisk (*). The *F*-statistics are reported for each main effect and interactions, and effect sizes (η^2_p) appear in parentheses after the *F*-ratios.*** $p < .001$, ** $p < .01$, * $p < .05$..

lightbulb), they also inferred that the author would purchase it more often than they did when they learned that the author liked a higher-value product (e.g., a house).

In summary, even though the advantage of combined attitudinal–behavioral statements was generally present across higher- and lower-value products, the inference measures suggested a hydraulic pattern. As predicted, behavioral statements led to inferences of consistent attitudes for products of higher value, whereas attitudinal statements led to inferences of consistent behavior for products of lower value. This was also reflected in perceived norms, which appeared to have been based on those inferences, with norms about higher-value products being more influenced by the behavioral statement. In fact, an exploratory mediation analysis suggested that this was the case (see the Supplementary Materials). Similar to Study 1, the "Positive vs. Negative Valence" panel of Table 2 shows that negative statements accounted for a larger share of the effects on participants' attitudes,

perceived norms, and behavioral intentions. In contrast, positive (vs. negative) statements accounted for a larger share of the effects for inferred authors' attitudes and behaviors.

Meta-analysis of Studies 1 and 2

Studies 1 and 2 (see 'Methods' section) demonstrated that among the three types of statements we tested, combined attitudinal–behavioral statements had the strongest impact, followed by attitudinal statements, followed by behavioral statements. However, a closer examination of the subtypes of combined attitudinal–behavioral statements and attitudinal statements revealed a less clear pattern. Specifically, behavioral recommendation statements, which are a form of combined attitudinal–behavioral statements, did not consistently differ from attitudinal statements. For instance, in Study 1, behavioral recommendation statements were significantly stronger than affective attitudinal statements but did not differ from evaluative attitudinal statements for any of our dependent measures. Also, in Study 2, behavioral recommendation statements did not differ from attitudinal statements for recipients' attitudes.

Given slight variability across the studies, to better estimate the relative impact of attitudinal, behavioral, and combined attitudinal–behavioral statements, we conducted a non-preregistered network meta-analysis. This analysis compared attitudinal statements (i.e., affective and evaluative attitudinal statements), behavioral statements (i.e., behavioral description and behavioral intention statements), and combined attitudinal–behavioral statements (i.e., attitudes and behavior, behavioral attitude and behavioral recommendation statements) using the data from Studies 1 and 2. This meta-analysis separated the higher- and lower-value conditions from Study 1, for which we had no preregistered hypotheses.

Table 3 presents the meta-analytic effects for participants' attitudes, perceived norms, and behavioral intentions. As shown in Table 3, the Bayesian fixed-effects meta-analytic model (see 'Methods' section) revealed that combined attitudinal-behavioral statements were the most impactful, followed by attitudinal statements, with behavioral statements last. We then conducted sensitivity analyses to examine whether the observed relative impact of the three types of statements was consistent across higher- and lower-value products. As shown in the bottom panel of Table 3, the combined attitudinal–behavioral statements were consistently stronger than the attitudinal statements, which in turn were stronger than the behavioral statements for each dependent measure and across levels of product value. The effect sizes were small to moderate, which is typical of persuasion studies[26].

We also examined whether financial value moderated the effects of combined attitudinal and behavioral statements, attitudinal statements, and behavioral statements, using attitudinal statements as the reference statement type. As shown in Table 4, attitudinal statements exerted a credibly stronger impact than behavioral statements on participants' attitudes, perceived norms, and behavioral intentions for lower- (vs. higher-) financial-value products. In contrast, behavioral statements exerted a credibly stronger impact on perceived norms for higher- (vs. lower) financial-value products. A similar pattern emerged in which behavioral information showed a stronger effect for higher (vs. lower) financial-value products on participants' attitudes and behavioral intentions. However, the corresponding credible intervals included zero, suggesting no statistically reliable difference. Financial value did not credibly moderate the relative impact of combined attitudinal and behavioral statements compared with attitudinal statements.

General discussion

Across two preregistered experiments and an internal meta-analysis, we found consistent evidence that messages combining attitudinal and behavioral content are more persuasive than those expressing only one type of information. This effect emerged not only when attitudinal statements and behavioral statements were

Fixed-effects model	Estimates			
Relative effects	***g***	**95%*CrI***	**Effective *N***	$\hat{R}$
	Participants' attitudes ($k = 24$)			
Attitudinal vs. behavioral	0.30	[0.23, 0.36]	1407	1
Combined vs. attitudinal	0.09	[0.04, 0.15]	1188	1.01
lp_	− 49.05	[− 51.81, − 48.06]	1202	1
	Participants' perceived norms ($k = 24$)			
Attitudinal vs. behavioral	0.28	[0.21, 0.35]	1353	1
Combined vs. attitudinal	0.11	[0.05, 0.17]	1420	1
lp_	− 56.35	[− 59.07, − 55.38]	1162	1
	Participants' behavioral intentions ($k = 24$)			
Attitudinal vs. behavioral	0.20	[0.13, 0.26]	1700	1
Combined vs. attitudinal	0.11	[0.05, 0.16]	1647	1
lp_	− 23.72	[− 26.25, − 22.75]	1488	1

Table 3. Network meta-analysis of the pooled effects comparing attitudinal, behavioral, and combined attitudinal–behavioral statements. *g* stands for Hedges' *g*, which is the small sample corrected version of *d*. *k* stands for the number of comparisons. *Crl* stands for the credible interval. $\hat{R}$ stands for the potential scale reduction factor, also known as the Gelman-Rubin convergence diagnostic. Effective *N* stands for effective sample size. lp stands for log posterior density.

Moderators	g [95%CrI]	Credibility of the effect	Effective *N*	R̂
	Participants' attitudes			
Financial value				
Higher = 1				
Behavioral vs. attitudinal	0.12 [− 0.02, 0.26]		2753	1
Combined vs. attitudinal	0.08 [− 0.04, 0.20]		2730	1
Lower = 0				
Behavioral vs. attitudinal	− 0.35 [− 0.44, − 0.26]	*	3450	1
Combined vs. attitudinal	0.06 [− 0.02, 0.14]		3205	1
lp_	− 48.42 [− 51.92, − 46.61]		1913	1
	Participants' perceived norms			
Financial value				
Higher = 1				
Behavioral vs. attitudinal	0.18 [0.05, 0.32]	*	2815	1
Combined vs. attitudinal	0.07 [− 0.05, 0.19]		2464	1
Lower = 0				
Behavioral vs. attitudinal	− 0.36 [− 0.44, − 0.28]	*	3204	1
Combined vs. attitudinal	0.08 [0.00, 0.16]	*	3377	1
lp_	− 53.55 [− 56.94, − 51.78]		2109	1
	Participants' behavioral intentions			
Financial value				
Higher = 1				
Behavioral vs. attitudinal	0.08 [− 0.05, 0.22]		2838	1
Combined vs. attitudinal	− 0.01 [− 0.14, 0.10]		2943	1
Lower = 0				
Behavioral vs. attitudinal	− 0.23 [− 0.32, − 0.14]	*	3361	1
Combined vs. attitudinal	0.11 [0.04, 0.19]	*	3589	1
lp_	− 23.34 [− 26.82, − 21.56]		1967	1

Table 4. Moderation analysis on participants' attitudes, perceived norms, and behavioral intentions. Behavioral stands for behavioral statements. Attitudinal stands for attitudinal statements. Combined stands for combined attitudinal-behavioral statements. *g* stands for Hedges' *g*, which is the small sample corrected version of *d*. *CrI* stands for the credible interval. lp stands for the log posterior density that represents the natural logarithm of the posterior probability density of the model parameters given the observed data. Effective *N* is the effective sample size in Bayesian MCMC sampling. R̂ stands for the potential scale reduction factor, also known as the Gelman-Rubin convergence diagnostic. * indicates that the effect is credibly different from zero (similar to statistical significance within a frequentist framework).

juxtaposed (e.g., "I liked the car, and I bought it.") but also when they were integrated into a single proposition, as in behavioral attitudes (e.g., "I liked buying the car.") or behavioral recommendations (e.g., "I recommended buying the car."). The pattern was also robust across measures of attitudes, perceived norms, and behavioral intentions. A potential confound in Experiment 1 was that the combined attitudinal and behavioral conditions each comprised two statements, whereas the attitudinal statements and behavioral conditions included a single statement. This concern was addressed in Experiment 2, which showed that a single statement with dual meaning still produced stronger effects than solely attitudinal or solely behavioral statements, indicating that the number of components did not drive the earlier effect. However, combined information is essentially multifaceted even in its compact forms. Thus, future research should determine what combined meanings produce these effects. For example, one could investigate the conditions under which complex information that expresses affective and evaluative attitudes has more influence than simple information.

We also found that combined attitudinal-behavioral statements exerted stronger effects than attitudinal or behavioral statements because they better promoted a mental simulation of behavior (See Fig. 2). Another possible mechanism underlying the superior impact of combined statements could be greater attitude strength, defined as greater confidence and certainty in one's evaluation[27]. These statements may convey not only an evaluative position but also stronger signals of commitment and stability, shaping recipients' inferences about the communicator's attitude or behavior.

The advantage of combining attitudinal and behavioral information was observed for both higher and lower-value objects (see Study 2 and meta-analysis). However, Study 2 revealed that behavioral information had more influence on perceived norms when the target objects had higher financial value. This finding was replicated in the meta-analysis, which showed that financial value moderated the relative impact of attitudinal and behavioral statements: behavioral statements were more impactful than attitudinal statements when the financial value was higher (vs. lower; Study 2). These patterns suggest that recipients use message content to infer

the source's attitudes, depending on the object's value. For higher-value objects, people appear to infer attitudes from behavioral statements, resembling injunctive inferences about what behaviors indicate approval[18]. For lower-value objects, attitudes alone may be sufficient to imply behavior, reducing the added impact of behavioral content. Meanwhile, purchases of higher-value objects like a house tend to occur infrequently, and when they do occur, they may be more salient and more likely to prompt attitudinal inferences from behavior. In contrast, expressing a positive attitude toward a higher-value object is relatively common (e.g., praising a BMW as very good), which may attract less attention and elicit fewer behavioral inferences.

This inference process was further supported by exploratory results showing that participants inferred behavior from attitudes for lower-value objects. For example, when participants learned that someone liked chocolate, they inferred that the person also bought and ate chocolate, effectively eliminating the difference between combined attitudinal–behavioral statements and attitudinal information alone. Although this hypothesis was not preregistered, these findings highlight the importance of attributional reasoning in persuasion: people use communicators' statements to infer both what they like and what they do, with the weight of each inference depending on value. Future research should investigate when these inferences about the authors' behaviors affect the decisions of message recipients.

Both Studies 1 and 2 used within-subjects designs. Although we randomized the order of statement type, statement valence, target product, and author, we cannot fully rule out the possibility that exposure to multiple statement types might differ from exposure to a single message. However, our design approximates common real-world contexts in which individuals are exposed to multiple forms of information rather than a single message.

We also found that statement valence may shape the relative impact of the statement types. Negative statements accounted for a larger share of the effects on participants' attitudes, perceived norms, and behavioral intentions. We interpret this pattern as reflecting greater attentional capture and greater impact of negative (vs. positive) information, consistent with prior work on negativity bias (e.g[28,29]). At the same time, this pattern does not emerge consistently across all statement types and both studies. Accordingly, we report these findings in an exploratory manner and offer only limited discussion. Conducting systematic research on how our effects operate for positive and negative valence will be an important future direction.

Identifying which types of messages –attitudinal, behavioral, or combined- most influence recipients' attitudes, perceived norms, and behavioral intentions advances our understanding of persuasive communication. Across two studies and an internal meta-analysis, we demonstrated that statements integrating both attitudinal and behavioral information are more influential than those containing only one type of information, and that attitudinal statements alone generally outperform behavioral statements alone. Future research should continue examining these contingencies, particularly the role of attributions in shaping persuasive outcomes. Such work can inform message design across domains from health communication to consumer marketing, where aligning attitudes and behaviors may be key to influencing beliefs and behavior.

Methods

All experiments involving human participants were approved by the Institutional Review Board of the University of Pennsylvania. All procedures were carried out in accordance with relevant guidelines and regulations and adhered to the principles of the Declaration of Helsinki. Informed consent was obtained from all participants prior to their participation in the experiments.

Study 1

Participants and design

To ensure that our samples accurately represented the demographic characteristics of the general United States population, we recruited 300 U.S. nationally representative samples from Prolific Academic. Our final sample included 302 participants. Per our preregistered criteria, 2 participants were excluded from analyses due to failing attention checks, resulting in a final sample of 300 participants (146 males, 150 females, 4 others; age: $M = 45.18$ years, $SD = 15.53$ years; 60.7% White, 13.3% Black, 6.3% Asian, 8.3% Multiracial/ethnic, and 11.3% were categorized as Others.). The study design involved a 6 within-subjects statement type condition (i.e., attitudinal–behavioral, behavioral recommendation, evaluative attitudinal, affective attitudinal, behavioral description, and behavioral intention statement) by 2 between-subjects statement valence conditions (i.e., positive vs. negative), with six products and six authors paired with each statement type. The attitudinal–behavioral statements included (a) an attitudes and behavior statement and (b) a behavioral recommendation statement. The attitudinal statements included (c) an affective attitudinal statement and (d) an evaluative attitudinal statement. The behavioral statements included (e) a behavioral description statement and (f) a behavioral intention statement. We fully randomized six consumer products (i.e., bag, car, chocolate, house, laptop, and mug) and names of the post authors (i.e., Andy, Felix, Janet, Joshua, Laura, and Susie) to each of the six statement-type conditions. Participants were paid $1.87 for approximately 14 min of participation.

Procedure

In this study, participants were told that the research concerned how humans process information. Then, they read six statements presented as social media posts, ostensibly written by six social media users. For example, a positive attitudes and behavior statement was "Susie posts: The laptop was good, and I bought it." (vs. negative valence: "The car wasn't good, and I didn't buy it."). A positive behavioral recommendation statement was "Susie posts: I recommended buying the car." (vs. negative valence: "I didn't recommend buying the car."). A positive evaluative attitude statement was "Susie posts: The car was good." (vs. negative valence: "The car wasn't good."). A positive affective attitude statement was "Susie posts: I liked the laptop." (vs. negative valence: "I didn't like the car."). A positive behavior description statement was "Susie posts: I bought the laptop." (vs. negative valence: "I

didn't buy the car."). A positive behavioral intention statement was "I intended to buy the laptop." (vs. negative valence: "I didn't intend to buy the car."). We fully randomized the order of statement presentation and the products (i.e., bag, car, chocolate, house, laptop, and mug) so that each statement type and each product appeared only once per participant. Among the six statements, three conveyed a positive valence, and three conveyed a negative valence, all presented in a random order. Each statement was displayed for at least 3 s, but participants could read it for as long as they wanted.

Participants reported their attitudes, perceived norms, behavioral intentions, and manipulation check measures immediately after reading each statement. Specifically, after reading each statement, participants moved to the next page, where the statement was no longer visible. Once participants had completed all the measures and demographic questions, they were thanked and compensated for their participation. The Supplementary Materials contain the study materials.

Dependent measures and other methodological issues

We measured participants' attitudes, perceived norms, and behavioral intentions toward the products described in the statements. The correlations among these variables appear in the Supplementary Materials.

Participants' attitudes Participants reported their attitudes toward the products with two items (i.e., "My own attitude toward the product described in the statement would probably be…" and "My own attitude toward buying the product described in the statement would probably be…") on a 5-point scale ranging from 1 (*Extremely negative*) to 5 (*Extremely positive*). The average of these two items formed an index of attitudes (r =.95).

Participants' perceived norms Participants reported their perceived injunctive norms (i.e., "Most people would probably think that the [product] described in the statement would be…"; "Most people would probably think that buying the [product] described in the statement would be…") on a scale from 1 (*Extremely negative*) to 5 (*Extremely positive*). We also assessed perceived descriptive norms (i.e., "How likely would most people be to buy the [product] described in the statement?") on a scale from 1 (*Very unlikely*) to 5 (*Very likely*). The three items were averaged as an index of perceived norms ($\alpha = 0.94$).

Participants' behavioral intentions We assessed participants' behavioral intentions concerning the products described in the posts using two items, "I intend to buy the product described in the statement," rated on a 5-point scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*) and "How likely would you be to buy the product described in the statement?" rated on a 5-point scale from 1 (*Very unlikely*) to 5 (*Very likely*). The internal consistency was high (r =.91), and we averaged the two items to form an index of behavioral intentions.

Participants' mental simulation of behavior Participants rated the mental simulation of behavior of each statement using five items, such as: "I could visualize making a decision about the [product];" "This statement allowed me to imagine whether or not I would buy the [product];" "This statement painted a story or situation clearly in my mind about the [product];" "I could picture myself experiencing what the person described about the [product];" and "I can imagine myself buying the [product] described in the statement." Responses were given on a scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*). The internal consistency of these items was high ($\alpha = 0.86$).

Manipulation checks, other measures, and checks for experimental demand effects Participants reported (a) perceived behavioral content (i.e., "This statement describes specific actions with respect to the [product];" "This statement describes what this person would like to do or not do with the [product];" "This statement is a clear behavioral recommendation about the [product]."); (b) perceived attitudinal content (i.e., "This statement describes specific evaluations with respect to the [product];" and "This statement tells the person's likes or dislikes."); and (c) valence (e.g., This statement opposes or supports the [product]?) on scales from 1 (*Strongly disagree*) to 5 (*Strongly agree*).

We thus checked our manipulations by analyzing these measures. As expected, all statement type conditions containing behavior ($M = 3.44$, $SE = 0.06$) were perceived as having greater behavioral content than the two conditions containing only attitudinal information ($M = 3.08$, $SE = 0.06$), $F(1, 1495.5) = 66.47$, $p < .001$, $\eta^2_p = 0.04$. This was true for each condition that included behavior: attitudes and behavior statements ($M = 3.92$, $SE = 0.08$), behavioral recommendation statements ($M = 3.36$, $SE = 0.08$), behavioral description statements ($M = 3.58$, $SE = 0.08$), and behavioral intention statements ($M = 3.38$, $SE = 0.08$) versus evaluative attitudinal statements ($M = 2.88$, $SE = 0.08$) and affective attitudinal statements ($M = 2.94$, $SE = 0.08$). Also, as expected, all statement type conditions that included attitudinal content ($M = 3.51$, $SE = 0.07$) were perceived as having significantly greater attitudinal content than the two conditions that included only behavioral content ($M = 3.17$, $SE = 0.06$), $F(1, 1495.2) = 58.09$, $p < .001$, $\eta^2_p = 0.04$. This pattern held true for each specific condition containing attitudinal information: attitudes and behavior statements ($M = 3.72$, $SE = 0.08$), behavioral recommendation statements ($M = 3.34$, $SE = 0.08$), evaluative attitudinal statements ($M = 3.50$, $SE = 0.08$), and affective attitudinal statements ($M = 3.52$, $SE = 0.08$), compared to behavioral description statements ($M = 2.76$, $SE = 0.08$) and behavioral intention statements ($M = 2.86$, $SE = 0.08$). Lastly, participants perceived the information in favor of a product as more supportive ($M = 4.18$, $SE = 0.04$) than the information opposing it ($M = 1.91$, $SE = 0.04$), $F(1, 1794.8) = 3{,}027.9$, $p < .001$, $\eta^2_p = 0.63$.

We also asked participants to report the degree to which they mentally represented the behavior (i.e., "I could visualize making a decision about the [product];" "The statement about the [product] allowed me to imagine whether or not I would buy the laptop;" "This statement painted a story or situation clearly in my head about the

[product];" "I could picture myself living what the person described about the [product];" and "I can imagine myself buying the [product] described in the statement." on scales from 1 (*Strongly disagree*) to 5 (*Strongly agree*).

We included a funnel debriefing asking participants to report their experience (i.e., "Was there something in this study that surprised you in any way?") and their understanding of the study's goal (i.e., "What do you think was the hypothesis in this study?"). An analysis of these items indicated that no participant guessed the study hypothesis, thus ruling out possible demand effects. Participants also completed demographic questions (i.e., gender, age, race, education, and whether English was their first language). For detailed information about the demographic questions, refer to the Supplementary Materials.

Deviations from preregistration

There were no deviations from the preregistration.

Statistical analyses

Following our preregistration, we constructed a mixed-effects model with statement type and statement valence as two fixed effects with six and two levels, respectively. We also added the participants' ID (i.e., 1–300), the product (i.e., bag, car, chocolate, house, laptop, and mug), and the author (i.e., Andy, Felix, Janet, Joshua, Laura, and Susie) as random factors, and participants' attitudes, perceived norms, and behavioral intentions as the dependent measures. We obtained the main and interaction effects by conducting omnibus *F*-tests. The results appear in Table 1 and the Supplementary Materials. We used the R packages *lme4*[30] and *emmeans*[31] for mixed-effects model analyses and corresponding contrasts, and the *lavaan* package[32] for structural equation modeling.

Study 2

Study 1 compared the influence of combining attitudinal and behavioral information with presenting either attitudinal or behavioral information alone. Study 2 extended Study 1 in four ways. First, Study 2 presented all five statements together and created a delay by inserting distractor questions between this presentation and our dependent measures. Second, although Study 1 showed that behavioral statements were the least impactful of the three statement types, including a baseline is desirable. Thus, Study 2 included control statements for comparison with the three types of statements.

Participants and design

We preregistered a target sample of 600 participants for a first wave on Prolific Academic participants and ended with 604 participants. After observing a directional effect that suggested insufficient statistical power, as preregistered, we recruited an additional 602 participants. In line with our preregistered criteria, one participant was excluded, leaving 1,206 participants for the final analyses (576 males, 614 females, 16 others; age: $M = 41.39$ years, $SD = 13.95$; 70.2% White, 11.3% Black, 7.1% Asian, 7.0% Multiracial/ethnic, and 4.4% were categorized as "Others"). We manipulated five statement types (i.e., behavioral attitude, behavioral recommendation, attitudinal, behavioral, and control statement) within-subjects, attributing each to a randomly assigned author (i.e., Andy, Susie, Janet, Felix, and Joshua). Participants were randomized to receive a particular level of statement valence (positive vs. negative) within a specific statement condition, thus constituting an incomplete design. We fully randomized the products (i.e., car, chocolate, house, lightbulbs, and show) and the statement author names (i.e., Andy, Felix, Janet, Joshua, and Susie). Car and house were higher-value products. In contrast, chocolate, show, and lightbulbs were lower-value products. All participants provided informed consent. They were paid $2 for approximately 15 min of participation.

Procedure

We followed the same procedure as in Study 1, except for the inclusion of additional statement types and the post-delay timing of participants' responses to the dependent measures. In Study 2, participants read five ostensible social media message statements, each supposedly from a different author. For example, a positive behavioral attitude statement was "Susie posts: I liked buying the car." (vs. negative: "I didn't like buying the car."). A positive behavioral recommendation statement was "Susie posts: I recommended buying the car." (vs. negative: "I didn't recommend buying the car."). A positive attitudinal statement was "Susie posts: I liked the car." (vs. negative: "I didn't like the car."). A positive behavioral statement was "Susie posts: I bought the car." (vs. negative: "I didn't buy the car."). A positive control statement was "Susie posts: The car was red." (vs. negative: "The car wasn't red."). We fully randomized the order of the statements (i.e., behavioral attitude, behavioral recommendation, attitudinal, behavioral, and control statements), the products (i.e., car, chocolate, house, lightbulb, and show), and the author names (i.e., Andy, Felix, Janet, Joshua, and Susie). Each statement type was presented only once with either the positive or the negative valence. As in Study 1, each statement was displayed for at least 3 s, with participants deciding when to advance to the next page.

After reading all five manipulated statements and one filler statement, formatted similarly to the manipulated statements, participants answered four distractor items unrelated to the targeted products or our main measures (e.g., "The statements were grammatical."). They then completed measures of attitude, perceived norm, and behavioral intention for each product. Items were grouped by construct but presented in a randomized order. Participants were thanked and compensated after completing the dependent measures and demographic questions. The Supplementary Materials contain the full study materials.

Dependent measures and other methodological issues

As in Study 1, we examined participants' attitudes, perceived norms, and behavioral intentions concerning the products as the primary dependent measures. We also measured inferences about the authors' attitudes and behaviors.

Participants' attitudes Participants reported their attitudes toward the products (i.e., "My own attitude toward the [product] described in the statement would probably be…"; and "My own attitude toward buying the [product] described in the statement would probably be…") on a 5-point scale ranging from 1 (*Extremely negative*) to 5 (*Extremely positive*). The average of these two items formed an index of participants' attitudes (r =.91).

Participants' perceived norms Similar as Study 1, we assessed both participants' perceived injunctive norms (i.e., "Most people would probably think that the [product] described in the statement would be…"; and "Most people would probably think that buying the [product]/watching the show described in the statement would be…") on a scale from 1 (*Extremely negative*) to 5 (*Extremely positive*). We also assessed perceived descriptive norms (i.e., "How likely would most people be to buy the [product]/watch the show described in the statement?") on a scale from 1 (*Very unlikely*) to 5 (*Very likely*). The three items were averaged as an index of perceived norms ($\alpha = 0.93$).

Participants' behavioral intentions Participants also rated behavioral intentions with the item "How likely would you be to buy the [product]/watch the show described in the statement?" Responses were provided from 1 (*Very unlikely*) to 5 (*Very likely*).

Inferred authors' attitudes We assessed participants' inferences about the statement authors' attitudes toward the products mentioned by asking, for example: "[Name]'s attitude toward the car is…" and "[Name]'s attitude toward buying the [product]/watching the show is…" Responses were recorded on a scale from 1 (*Extremely negative*) to 5 (*Extremely positive*). The internal consistency of these items was high (r =.97).

Inferred authors' behaviors Participants reported their inferences about the statement authors' behaviors by responding to the item, "How likely would [Name] be to buy the [product]?" Responses were given on a scale from 1 (*Very unlikely*) to 5 (*Very likely*).

Manipulation checks We included three manipulation check measures. The item checking the attitudinal content of the statement was "The item describes [Name]'s like or dislike." The item checking the behavioral content of the statement was "The item described a behavior that [Name] does or does not perform." Each of the two items was rated on a scale from 1(*Not at all*) to 5 (*Very much so*). We also included an item to verify whether participants perceived the financial values of the products in the statements as intended. Participants responded to the item, "Buying a [product]/Watching a show can have financial consequences," on a scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*).

We then analyzed these items as a function of our experimental conditions. Behavioral statements ($M = 4.22$, $SE = 0.06$) were perceived as containing the most behavioral content, followed by behavioral attitude statements ($M = 3.78$, $SE = 0.06$), behavioral recommendation statements ($M = 3.32$, $SE = 0.06$), and attitudinal statements ($M = 2.39$, $SE = 0.06$), with control statements perceived as having the least behavioral content ($M = 1.66$, $SE = 0.06$). Pairwise comparisons revealed that all statements differed in perceived behavioral content from each other ($ps < 0.001$).

Meanwhile, attitudinal statements ($M = 4.53$, $SE = 0.04$) were perceived as containing the most attitudinal content, followed by behavioral attitude statements ($M = 4.40$, $SE = 0.04$), behavioral recommendation statements ($M = 3.70$, $SE = 0.04$), and behavioral statements ($M = 2.15$, $SE = 0.04$), with control statements perceived as containing the least attitudinal content ($M = 1.74$, $SE = 0.04$). Pairwise comparisons again revealed that each statement differed from the others in perceived attitudinal content ($ps < 0.01$).

Also, we found that products manipulated as having higher financial value ($M = 4.83$, $SE = 0.23$) were perceived as having significantly greater financial consequences than those manipulated as having lower financial value ($M = 2.43$, $SE = 0.19$), $F(1, 3.00) = 64.35$, p =.004. Overall, all manipulations worked as intended.

Deviation from preregistration

We preregistered analyses of mediators related to the financial value of the products, referred to as "Value" in the preregistration. These included four measures of the effort and thought required for each decision, as well as self-image consequences, and whether people only buy the products they like. However, these measures serve as a check on our manipulation and thus received no further attention; interested readers can find them in the Supplementary Materials. Also, Study 2 included a measure of inferred post-behavior evaluation, which largely overlapped with inferred behavior and is thus reported in the Supplementary Materials.

Statistical analyses

To test our hypotheses, we constructed a mixed-effects model that included statement type (i.e., attitudinal vs. behavioral vs. control vs. control statements), statement valence (i.e., positive vs. negative), and financial value (higher vs. lower). Table 2 presents the omnibus effects and the contrasts for the positive and negative levels of statement valence across the board and for each level of financial value. The table also compares the impact of the statement valence across the higher- and lower-value panels, which represent differences in the difference between positive and negative statement valence, subtracting that difference in the lower-value condition from the difference in the higher-value condition. Similar to Study 1, we used the R packages *lme4*, and *emmeans* for the analyses[30,31,33].

Meta-analysis of Studies 1 and 2

Studies 1 and 2 found that attitudinal statements had a significantly stronger impact than behavioral statements on recipients' attitudes, perceived norms, and behavioral intentions. However, the relative impact between

attitudinal statements and combined attitudinal–behavioral statements, especially behavioral recommendation statements, was not always consistent. Therefore, we conducted a meta-analysis to examine the relative impact of attitudinal, behavioral, and combined attitudinal–behavioral statements on recipients' attitudes, perceived norms, and behavioral intentions.

Internal meta-analysis

We conducted an internal meta-analysis to examine the relative impact of attitudinal, behavioral, and combined attitudinal–behavioral statements and to test whether financial value moderated the impact of attitudinal versus behavioral statements. To achieve these objectives, we calculated the standardized mean difference (Cohen's *d*) for recipients' attitudes, perceived norms, and behavioral intentions across each statement type and valence condition using the means, standard deviations, and sample sizes from Studies 1 and 2. Following standard meta-analytic conventions, we applied Hedges and Olkin's[34] correction factor to all effect sizes to adjust for small-sample bias. Accordingly, all effect size estimates reported in our results are expressed as Hedges' *g*.

We adopted a Bayesian network meta-analysis using a fixed-effects model, as Studies 1 and 2 were highly comparable in multiple aspects (e.g., experimental design, procedure, participant population, and measurement methods), and our goal was to estimate their overall pooled effect. We set attitudinal information as the reference group, as its effect size appeared to fall between behavioral information and combined attitudinal–behavioral information. All analyses were conducted using the R package, *multinma*[35].

Averaging statement types

We compared the relative impact of attitudinal, behavioral, and combined attitudinal–behavioral statements on participants' attitudes, perceived norms, and behavioral intentions. Thus, we averaged across subtypes within each category. Specifically, in Study 1, we averaged the two types of attitudinal statements (affective and evaluative attitudinal statements) and the two types of behavioral statements (behavioral description and behavioral intention statements). We also averaged the two kinds of combined attitudinal–behavioral statements (attitudes and behavior statements and behavioral recommendation statements) in Study 1 and the two types of combined attitudinal–behavioral statements (behavioral attitude statements and behavioral recommendation statements) in Study 2. Since the direction of the effect differs for positive and negative statements, requiring reverse coding, and we tested our effects across financial-value levels, we coded each effect size separately by statement valence (positive vs. negative) and financial value (higher vs. lower). Thus, the two studies generated 24 effect sizes for each dependent variable (i.e., participants' attitudes, perceived norms, and behavioral intentions), resulting from the combinations of 2 studies × 2 statement valence conditions × 2 financial value conditions × 3 dependent measures.

Moderation analysis by financial value

One goal of this meta-analysis was to examine whether financial value moderates the impact of attitudinal versus behavioral statements. Specifically, we conducted a moderation analysis using Bayesian network meta-regression with a fixed-effects model. The network meta-regression analyses examined the moderating effect of financial value (higher vs. lower) on the relative impact of combined attitudinal and behavioral statements, attitudinal statements, and behavioral statements, using attitudinal statements as the reference, on participants' attitudes, perceived norms, and behavioral intentions.

Data availability

All data relevant to the studies are reported in the article or the Supplementary Materials. The data and R scripts are available online at: https://osf.io/at3cn/overview?view_only=f8c7a76df3d946e29311feb6dec002c6.

Received: 1 December 2025; Accepted: 16 March 2026
Published online: 25 March 2026

References

1. Johnson, B. T., Wolf, L. J., Maio, G. R. & Smith-McLallen, A. Communication-induced persuasion or resistance: Processes and effects of who says what to whom. In *The Handbook of Attitudes*, 45 (Routledge, 2018).
2. Petty, R. E. & Cacioppo, J. T. The elaboration likelihood model of persuasion. In *Advances in Experimental Social Psychology*, 123–205 (Elsevier, 1986).
3. Albarracín, D., Sunderrajan, A. & Dai, W. Action, inaction, and actionability: Definitions and implications for communications and interventions to change behaviors. In *Nebraska Symposium on Motivation*, 75–99 (Springer International Publishing, 2018).
4. Albarracín, D., Sunderrajan, A., Dai, W. & White, B. X. The social creation of action and inaction: From concepts to goals to behaviors. In *Advances in Experimental Social Psychology,* 223–271. (Elsevier, 2019).
5. Chan, M.-P. et al. Living health-promotion campaigns for communities in the United States: Decentralized content extraction and sharing through AI. *PNAS Nexus* **4**(6), pgaf171 (2025).
6. Albarracín, D. & Dai, W. Chapter Three - The impact of the environment on behavior. In *Advances in Experimental Social Psychology* (ed Gawronski, B.) Vol. 69, 151–201 (Academic Press, 2024).
7. Strahan, E. J., Spencer, S. J. & Zanna, M. P. Subliminal priming and persuasion: Striking while the iron is hot. *J. Exp. Soc. Psychol.* **38** (6), 556–568 (2002).
8. Weingarten, E. et al. From primed concepts to action: A meta-analysis of the behavioral effects of incidentally presented words. *Psychol. Bull.* **142**(5), 472–497 (2016).
9. Veltkamp, M., Custers, R. & Aarts, H. Motivating consumer behavior by subliminal conditioning in the absence of basic needs: Striking even while the iron is cold. *J. Consum. Psychol.* **21**(1), 49–56 (2011).
10. Hart, W. & Albarracín, D. The effects of chronic achievement motivation and achievement primes on the activation of achievement and fun goals. *J. Pers. Soc. Psychol.* **97**(6), 1129–1141 (2009).
11. Gregory, W. L., Cialdini, R. B. & Carpenter, K. M. Self-relevant scenarios as mediators of likelihood estimates and compliance: Does imagining make it so?. *J. Pers. Soc. Psychol.* **43**(1), 89–99. https://doi.org/10.1037/0022-3514.43.1.89 (1982).

12. Hagger, M. S. & Chatzisarantis, N. L. D. Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *Br. J. Health Psychol.* **14**(2), 275–302 (2009).
13. Albarracín, D., Johnson, B. T., Fishbein, M. & Muellerleile, P. A. Theories of reasoned action and planned behavior as models of condom use: A meta-analysis. *Psychol. Bull.* **127**(1), 142–161 (2001).
14. Cooke, R., Dahdah, M., Norman, P. & French, D. P. How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health Psychol. Rev.* **10** (2), 148–167 (2016).
15. Fishbein, M. & Ajzen, I. Belief, attitude, intention and behaviour: An introduction to theory and research, Vol. 27 (1975).
16. Starfelt Sutton, L. C. & White, K. M. Predicting sun-protective intentions and behaviours using the theory of planned behaviour: A systematic review and meta-analysis. *Psychol. Health* **31**(11), 1272–1292 (2016).
17. Cialdini, R. B. et al. Managing social norms for persuasive impact. *Soc. Influ.* **1**(1), 3–15 (2006).
18. Cialdini, R. B., Kallgren, C. A. & Reno, R. R. A Focus theory of normative conduct: a theoretical refinement and reevaluation of the role of norms in human behavior. In *Advances in Experimental Social Psychology* Vol. 24 (ed. Zanna, M. P.) 201–234 (Academic, 1991).
19. Li, R. Effects of Social Norms on Women's Body Satisfaction [社会规范对女性身体满意度的影响] [Southwestern University]. https://cnki.huanghuai.edu.cn/KCMS/detail/detail.aspx?filename=1022668703.nh&dbcode=CMFD&dbname=CMFD2022 (2022).
20. Leoniak, K. J. & Cwalina, W. The role of normative prompts and norm support cues in promoting light-switching behavior: A field study. *J. Environ. Psychol.* **64**, 1–11 (2019).
21. Albarracín, D. Cognition in persuasion: An analysis of information processing in response to persuasive communications. In *Advances in Experimental Social Psychology*, 61–130 (Elsevier, 2002).
22. Chaiken, S. Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *J. Pers. Soc. Psychol.* **39**(5), 752–766. https://doi.org/10.1037/0022-3514.39.5.752 (1980).
23. Jones, E. E. & Davis, K. E. From acts to dispositions: The attribution process in person perception. In *Advances in Experimental Social Psychology* (ed Berkowitz, L.) Vol. 2, 219–266 (Academic Press, 1965).
24. Kelley, H. H. The processes of causal attribution. *Am. Psychol.* **28**(2), 107–128. https://doi.org/10.1037/h0034225 (1973).
25. Van Wallendael, L. R. & Guignard, Y. Diagnosticity, confidence, and the need for information. *J. Behav. Decis. Mak.* **5**(1), 25–37 (1992).
26. Albarracín, D., Fayaz-Farkhad, B. & Granados Samayoa, J. A. Determinants of behaviour and their efficacy as targets of behavioural change interventions. *Nat. Rev. Psychol.* **3**(6), 377–392 (2024).
27. Krosnick, J. A. & Petty, R. E. *Attitude Strength: An Overview* (Psychology Press, 2014).
28. Baumeister, R. F., Bratslavsky, E., Finkenauer, C. & Vohs, K. D. Bad is stronger than good. *Rev. Gen. Psychol.* **5**(4), 323–370 (2001).
29. Rozin, P. & Royzman, E. B. Negativity bias, negativity dominance, and contagion. *Pers. Soc. Psychol. Rev.* **5**(4), 296–320 (2001).
30. Bates, D., Mächler, M., Bolker, B. & Walker, S. Fitting linear mixed-effects models using lme4. *J. Stat. Softw.* **67**(1), 1–48 (2015).
31. Lenth, R. V. et al. Estimated Marginal Means, aka Least-Squares Means. https://cran.r-project.org/web/packages/emmeans/index.html (2025).
32. Rosseel, Y. Lavaan: An R package for structural equation modeling. *J. Stat. Softw.* **48**(2), 1–36 (2012).
33. Searle, S. R., Speed, F. M. & Milliken, G. A. Population marginal means in the linear model: An alternative to least squares means. *Am. Stat.* **34**(4), 216–221 (1980).
34. Hedges, L. & Olkin, I. *Statistical Methods in Meta-Analysis*, Vol. 20 (1985).
35. Phillippo, D. M. multinma: An R package for Bayesian network meta-analysis of individual and aggregate data. In *Abstract from Evidence Synthesis and Meta-Analysis in R Conference 2021* https://dmphillippo.github.io/ESMARConf2021_multinma/ (2021).
36. Bonan, J., Cattaneo, C., d'Adda, G. & Tavoni, M. The interaction of descriptive and injunctive social norms in promoting energy conservation. *Nat. Energy.* **5** (11), 900–909 (2020).

Acknowledgements

The authors acknowledge Zihan Yang for assisting the first author in preparing the experimental materials and for contributions that exceeded what is typical for an undergraduate research assistant.

Author contributions

Y.Z. conducted the studies and performed the corresponding statistical analyses. Y.Z. drafted the original manuscript. D.A. provided critical feedback and contributed to the final version. Both Y.Z. and D.A. approved the manuscript.

Funding

This article was funded by the Annenberg Communication Science Division Endowment. National Institutes of Health, MSM Grant R01 MH114847-01A1. National Institutes of Health, Avant-Garde Award DP1 DA048570-01. National Institutes of Health, Modeling Grant R01AI147487-01R01, R01 MH132415, NSF 2031972, P30AI045008, U24HD113146.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1038/s41598-026-44897-4.

Correspondence and requests for materials should be addressed to D.A.