



# Nudging Resisters Toward Change: Self-Persuasion Interventions for Reducing Attitude Certainty

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## Abstract

**Purpose:** To identify effective self-persuasion protocols that could easily be adapted to face-to-face clinical sessions or health-related computer applications as a first step in breaking patient resistance.

**Design:** Two self-persuasion interventions were tested against 2 controls in a between-subject randomized control experiment.

**Setting:** GuidedTrack—a web-based platform for social science experiments.

**Participants:** Six hundred seventeen adult participants recruited via Mechanical Turk.

**Intervention:** The experimental interventions prompted participants for self-referenced pro- and counterattitudinal arguments to elicit attitude-related thought (ART) and subsequent doubt about the attitude. The hypothesis was that the self-persuasion interventions would elicit larger and more frequent attitude certainty decreases than the controls. In the experimental groups, we also predicted a correlation between the amount of ART and attitude certainty decreases.

**Measures:** Changes in attitude certainty were measured by participants' pre- and post-ratio scale ratings; ART was measured by the number of words participants used to respond to the interventions.

**Analysis:** Analysis of variance (ANOVA),  $\chi^2$ , and correlation.

**Results:** A goodness-of-fit  $\chi^2$  showed that the number of participants who decreased their attitude certainty was not equally distributed between the combined experimental groups ( $n = 104$ ) and the combined control groups ( $n = 39$ ),  $\chi^2(1, n = 143) = 28.64, P < .001$ . Within each intervention, goodness-of-fit  $\chi^2$  with a Bonferroni correction ( $P = .01$  or  $.05/4$ ) indicated there were significantly more “decreasers” than “increasers” in intervention 1,  $\chi^2(1, n = 86) = 6.16, P = .01$ , but not intervention 2,  $\chi^2(1, n = 84) = 2.02, P = .16$ , the nonsense control,  $\chi^2(1, n = 42) = .22, P = .64$ , or the distraction control,  $\chi^2(1, n = 34) = .02, P = .89$ . A 1-way ANOVA revealed a significant main effect for intervention on mean certainty change ( $F_{3,613} = 4.62, P = .003$ ). Five post hoc comparisons using Tukey's honest significant difference (HSD) test indicated that the mean decrease in attitude certainty resulting from intervention 1 ( $M = -3.29$ ) was significantly larger than the mean decrease in attitude certainty resulting from the nonsense control ( $M = -0.62, t = -2.72, P = .03$ ), the distraction control ( $M = 0.11, t = 3.48, P = .003$ ), but not intervention 2 ( $M = -0.87, t = -2.54, P = .06$ ). Attitude-related thought was significantly correlated with attitude certainty change in intervention 1,  $r(158) = -.17, t = -4.28, P = .02$ , but not intervention 2,  $r(161) = -.002, t = -.03, P = .98$ .

**Conclusion:** The implication for clinical practitioners and designers of health applications is that it may be worthwhile to let patients elaborate on their personal reasons for initially forming an unhealthy attitude to increase doubt about the strongly held attitude.

## Keywords

self-persuasion, attitude change, attitude certainty, elaboration likelihood model, heuristic-systematic model, thought listings, self-referencing

## Purpose

The problem of patient resistance to prescribed lifestyle changes is well documented.<sup>1-8</sup> Some estimates put compliance to professional advice on lifestyle changes at less than 10%.<sup>9</sup> Models of change discussed in the addiction literature maintain

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that health-related behavior change must begin with patient-motivated attitude change rather than with the clinician's immediate prescriptions for behavioral change.<sup>6,9-12</sup> These models suggest a shift away from using *direct persuasion* to induce *behavioral change* toward using *self-persuasion* to induce *attitude change*.

*Direct persuasion* occurs when a communicator intentionally delivers a message that results in a voluntary change in the listener's attitudes.<sup>13</sup> For example, a doctor describes the benefits of a vitamin brand and the patient decides the brand is better than his/her current brand. Persuasion that occurs without a communicator's message is called *self-persuasion*. The message is internally generated in the form of thoughts in response to an attitude object and causes attitude change.<sup>14</sup> For example, a patient compares various vitamin brands and decides one brand is the best.

Self-persuasion is generally recognized to be a more powerful and resilient agent of attitude change than direct persuasion.<sup>14-17</sup> The relative effectiveness of self-persuasion has been attributed to the inherent credibility of the source,<sup>18</sup> the elimination of distracting cues such as the credibility and likability of the communicator,<sup>14</sup> the biased scanning of evidence,<sup>19,20</sup> the hand-tailoring of arguments to fit the individual's emotional and cognitive needs,<sup>16,21</sup> and the tendency to process self-generated arguments more deeply than others' messages.<sup>22,23</sup> The elaboration likelihood model (ELM) proposes that all effective persuasion ultimately depends on the metacognitive processes of self-persuasion.<sup>13,24-26</sup> Thinking about the thoughts triggered by internally or externally generated messages may be necessary to produce lasting attitude change.<sup>27</sup>

Using self-persuasion in clinical settings, (ie, prompting the patient to change his/her own mind) may be more efficient than tailoring direct persuasive arguments to patient groups.<sup>12,28</sup> Self-persuasion has been shown to be effective in bringing about attitude change in the health domains of smoking,<sup>29-31</sup> diet,<sup>32,33</sup> exercise,<sup>34</sup> and safe sex practices.<sup>35</sup>

Self-persuasion is also thought to be a better match for resistant patients than direct persuasion. The transtheoretical model proposes matching interventions to the patient's stage of readiness.<sup>11</sup> Change-resistant patients are in a stage the model calls "precontemplative." At this stage, patients are not concerned about their (smoking, eating, exercise), have no plans to change, or have tried to change before but were unsuccessful. The precontemplative patient's attitude about the unhealthy behavior is likely to be strong on several dimensions, including attitude certainty, particularly if the unhealthy behavior is long-standing.<sup>36-38</sup> At this stage, the patient is not ready for interventions aimed at immediate behavior change but may be receptive to interventions involving self-evaluation.<sup>11</sup> In fact, simply issuing directives for behavioral change is likely to increase patient resistance,<sup>9</sup> whereas asking questions about the patient's personal reasons for the current unhealthy behavior is likely to reduce resistance, increase reflection and doubt about the current attitude, and ready the patient to hear professional advice about

behavior change.<sup>7,9,12,39</sup> The model suggests that first-step interventions for resistant patients should aim to increase attitude-related thought (ART) and to decrease certainty in the (unhealthy) attitude.

### Attitude-Related Thoughts

The patient considering vitamin brands can persuade himself/herself that a specific brand is the best by using either automatic heuristics/peripheral cues or by engaging in analytical thought.<sup>40-43</sup> Using the automatic route, the patient's attitude about a vitamin brand may change based on peripheral factors (eg, convenience of purchase) or a learned heuristic (eg, "my parents' brands are the best"). Using the analytical route, the patient might systematically compare the vitamins' ingredient lists and develop his/her own argument for which brand is the best. Whether the automatic or analytic route is used depends on factors such as the motivation of the listener (personal relevance),<sup>42,44</sup> the desire for accuracy,<sup>45,46</sup> time available,<sup>44</sup> the accessibility of thoughts,<sup>47</sup> knowledge base, processing capacity,<sup>44</sup> and individual differences in cognitive style.<sup>48,49</sup> In a clinical context, where long-term attitude certainty change is desired, interventions should elicit analytic thoughts about the unhealthy attitude.

Self-persuasion interventions, designed to change attitudes via the analytical route, have involved prompting participants to actively generate thoughts about an attitude object. Interventions have prompted participants to make counterattitudinal speeches to a listener,<sup>50-52</sup> to act in a counterattitudinal manner,<sup>53</sup> to exaggerate their proattitudinal behavior,<sup>54</sup> to write proattitudinal essays,<sup>55</sup> and to express counterattitudinal arguments in a motivational interview.<sup>56</sup> Participants who generate their own pro- or counterattitudinal arguments change their attitudes more than participants who are provided with arguments by the experimenter or engage in some other control activity. Consistent with dual process theories, these findings demonstrate that participants can be self-persuaded to change attitudes if they generate pro- or counterattitudinal thoughts on a topic. There is some evidence, however, that attitude change is more likely to occur when participants are asked to make counterattitudinal arguments rather than proattitudinal arguments, perhaps because of the extra effort required to make the former type of argument.<sup>57</sup> This is particularly true when the issue is rated high rather than low in importance by the participant.<sup>58</sup>

### Number of ARTs and Effort

Both the ELM and the heuristic systematic model<sup>17,59</sup> predict that high cognitive engagement with an attitude object will produce larger and more permanent attitude change than low cognitive engagement.<sup>42,60,61</sup> Measures of cognitive engagement have included the number of ARTs that are written or verbalized by participants,<sup>62</sup> the number of message arguments

participants can recall,<sup>22,63</sup> participants' ratings of message processing effort,<sup>64</sup> and psychophysiological measures.<sup>42,65,66</sup> The most common measure of cognitive engagement is the number of thought-listing boxes filled in by participants in response to another's message about an attitude object.<sup>60,67</sup> For example, in a series of studies with college students, Barden and Petty<sup>68</sup> introduced college-relevant topics such as comprehensive examinations, presented a pro-topic message by an agent of the university, and asked students to list their thoughts about the message by listing each thought in a separate box. Attitude certainty change was greater in students showing more rather than less processing effort as measured by the number of thought boxes they filled in. Students who *perceived* that they put more rather than less effort into processing the messages presented by the university agent also showed more attitude certainty change regardless of their actual effort. Students were more likely to rate their perceived processing effort as high if their thought listings included both pro- and counterattitudinal arguments on the topic. Based on these findings, ideal clinical self-persuasion interventions would be those that elicit effortful (actual or perceived), 2-sided (pro and counter) thoughts about an attitude.

### Self-Referencing

Evidence of high cognitive engagement is more likely to be found when the topic inspires thought that includes self-references. Petty et al<sup>69</sup> found that students were more likely to engage in systematic analysis of message arguments when the topic under consideration was highly relevant to their own lives than when it was only relevant to future students. Similarly, Chaiken<sup>17</sup> found that students who expected to discuss a topic in a future interview generated more message-relevant thoughts to arguments on that topic than students who did not expect to discuss it later. Healthy eating interventions that promote self-referencing create more positive changes in attitudes about green vegetables than direct persuasion interventions.<sup>70</sup> Consumer research has found that ads containing opportunities for self-referencing may result in more cognitive elaboration than ads that do not,<sup>71</sup> particularly when message arguments are strong<sup>72</sup> or viewers are motivated to watch the ad.<sup>73</sup> Petty and colleagues propose that high issue involvement is likely to elicit complex processing of messages because of higher motivation for accuracy and better frameworks for the self than others.<sup>69</sup> These findings suggest that ideal clinical self-persuasion interventions would allow for self-referencing about an attitude.

### Attitudes and Certainty

An attitude is a "summary evaluation of a concrete or abstract object of thought" (eg, birth control pills or sexual freedom).<sup>74</sup> The evaluation of the object can be affective (eg, "I'm worried the chicken pox vaccine may harm my baby"), behavioral (eg, "I'm too busy to exercise"), or

cognitive (eg, "Heavy alcohol consumption on weekends is a societal norm")<sup>75,76</sup> and can vary on the dimensions of valence and strength. An attitude has positive valence when it is favorable toward the object and negative when it is unfavorable. An attitude is strong if it is *knowledge based*, easily *accessible*, held with confidence (*certain*), is very positive or very negative (*extreme*), and deemed *important*.<sup>77,78</sup> Although the dimensions of attitude strength are correlated, they are theoretically and empirically distinct.<sup>79</sup> For example, an attitude can be extreme (eg, "I am very worried about my obesity") but uncertain (eg, "My weight may cause health problems, but my overweight mother lived a long life").<sup>80</sup> Attitudes that are certain are more predictive of behavior,<sup>81-83</sup> more enduring,<sup>84</sup> and more resistant to persuasive attack<sup>85,86</sup> than attitudes that are less certain.

Attitudes can change in valence and strength. These changes can be fleeting or durable. For example, a smoker may have a prosmoking (valence) attitude that is certain (strength). The attitude can change to (1) an uncertain prosmoking attitude, (2) an uncertain antismoking attitude, or (3) a certain antismoking attitude. For resistant patients, change is thought to occur through a series of gradual stages making the first option, a reduction in attitude certainty, but not a change in valence, a likely but difficult first step.<sup>11</sup> Tormala has proposed that fostering uncertainty is likely to increase future message processing and a desire for information.<sup>80</sup> In addition to influencing downstream information processing of messages, reduced attitude certainty may also lead to changes in behavior.<sup>87</sup>

### Rationale

The current study will test 2 short, easy-to-administer self-persuasion interventions, designed to reduce certainty about strongly held attitudes, against 2 control interventions. The goal was to identify effective self-persuasion protocols that could easily be adapted to face-to-face clinical sessions or health-related computer applications as a first step in breaking patient resistance. To test the interventions against attitudes that are strong and change resistant,<sup>85-86</sup> participants were asked to describe a self-held attitude that met 3 strength criteria (extremity, importance, and certainty). The interventions were not designed to change attitude valence or behavior but to elicit ARTs that would lead to decreased attitude certainty. Based on dual process theories of analytical attitude change, the 2 experimental interventions attempted to elicit ART that was effortful and self-referenced. Participants were prompted for pro- and counterattitudinal thoughts about their attitude and were encouraged to include self-references in their responses. Generating counter arguments is thought to make *actual* effortful thought more likely,<sup>49</sup> and generating both pro- and counter-arguments is thought to increase *perceived* effortful thought.<sup>68</sup> Self-referencing was invited by asking about personal attitude precursors ("How was your attitude formed?") or consequences ("What are the benefits to your attitude?") to elicit high

**Table 1.** Number of Participants (n = 617) in Gender, Age, Employment, Education, and Residence Categories.

Age	Gender	Employment	Highest Level of Education	Residence
18-22	69 (11%) Male	261 (42%) Homemaker	25 (4%) High school or GED*	64 (10%) United States
23-27	176 (29%) Female	356 (58%) Student	66 (11%) Some college	166 (27%)
28-32	121 (20%)	Employed	339 (55%) AA** or AS***	58 (9%)
33-37	97 (15%)	Out of work, looking for work	43 (7%) BA or BS	239 (39%)
38-42	46 (7%)	Out of work, not looking for work	7 (1%) MA or MS	58 (9%)
43-47	23 (4%)	Retired	17 (3%) MD or PhD	6 (1%)
48-52	32 (5%)	Self-employed	111 (18%) Vocational certificate	26 (4%)
53-57	29 (5%)	Unable to work	9 (1%)	
58-62	14 (2%)			
63-67	8 (1%)			
68-73	2 (.3%)			
63-67	8 (1%)			
68-73	2 (.3%)			

\*General Equivalency Diploma.

\*\*Associate of Arts.

\*\*\*Associate of Science.

cognitive engagement.<sup>17,69</sup> As in previous studies, the length of participants' responses was used as the measure of cognitive engagement.<sup>60,67,68</sup> However, the current study used the number of words rather than the number of thought boxes completed to better simulate conversational responses that might be elicited in a clinical setting. In the 2 control interventions, participants were prompted for thoughts that were either unrelated to the self-held attitude or related in a nonsensical way. Pre- and postintervention attitude certainty was compared to assess the effectiveness of the interventions compared to the controls. It was predicted that the experimental interventions would cause larger and more frequent attitude certainty decreases than the controls. It was also predicted that the length of responses to the prompts would be correlated with attitude certainty changes in the experimental conditions.

## Methods

### Design

Two self-persuasion interventions were tested against 2 controls in a between-subject randomized control experiment with a pretest and posttest design.

### Sample

Eleven hundred ninety adult participants were recruited on Mechanical Turk. However, only 617 participants were included in the statistical analysis after eliminating participants who did not meet a priori criteria. Of the 573 participants eliminated, 399 withdrew before the intervention was randomly assigned. After random assignment, participants were eliminated for the following reasons: 109 for inattention (ie, failing to pass one or both attention check questions), 47 for not

**Table 2.** Number of Participants Selecting Each Attitude Category.

Attitude Categories	n (%)
Health or medicine	60 (10%)
Philosophy	115 (19%)
Politics	117 (19%)
Professional life	27 (4%)
Relationships or families	50 (8%)
Science or technology	69 (11%)
Society or culture	112 (18%)
The arts or entertainment	53 (9%)
Other	14 (2%)
Grand total	617

meeting the high certainty criteria ( $\geq 70\%$ ), 15 for not completing the interventions, and 3 for rushing (ie, completing the intervention in less than 3 minutes).

The results of a demographic survey administered at the beginning of the study are summarized in Table 1. The participants were US residents. Fifty-eight percent were female and 42% were male. Participants ranged in age from 18 to 73, but the majority (64%) were between 23 and 37 years old ( $M = 33$ ; median = 30). Most were employed (55%) or self-employed (18%) and had at least some college education (27%), AA or AS degrees (9%), or BA or BS degrees (39%).

### Measures

The demographic survey, the interventions, and the dependent measures used in this study were constructed using GuidedTrack—a web-based platform for creating social science experiments. The entire procedure can be viewed from the participants' perspective at this address: <https://www.guided-track.com/programs/tz7a6bx/run>. The GuidedTrack code for

**Table 3.** Preintervention Attitude Certainty.

Frequency of certainty level ratings	High (70%-79%)	74 (12%)
	Very high (80%-89%)	158 (26%)
	Extremely high (90%-100%)	385 (62%)
	Total	617 (100%)
Measures of central tendency and variability	Mean certainty	89.52%
	Median certainty	90%
	Mode certainty	90%
	Standard deviation	8.90%

the procedure can be viewed by creating a free GuidedTrack account at <https://www.guidedtrack.com/programs/850/edit>. The directions, interventions, and measures were tested and refined in prior pilot studies.

**Attitude statement.** After completing the demographic survey, participants were asked to select a strong self-held attitude to review. Suggested attitude categories were philosophy, politics, society/culture, professional life, relationships/family, science/technology, entertainment/arts, health/medicine, or others (Table 2). Specific attitude topics were selected by the participants, rather than the experimenter, to ensure that the interventions were tested against strongly held attitudes and against a range of different attitude topics. Examples of specific topics are doctors, prescription medicine, alternative medicine, climate change, the death penalty, gun control, torture, racism, personal computers, work, creationism, conservation of natural resources, and god. Participants confirmed that their attitude met the definition of *attitude* rather than *fact* (eg, “the sun rises in the east”) or *preference* (eg, “Manchester United is my favorite football team”). They also confirmed that their attitude met 2 strength criteria: *importance* (ie, “it should be something important to you”) and *extremity* (ie, “it should be something many people disagree with you about”). After confirming that their selected attitude was strong, participants were asked to write a statement describing the attitude.

**Pretest attitude certainty.** Participants were asked to rate their confidence in the selected attitude on a ratio scale from 0% to 100%, with 0% meaning certainty the attitude is false and 100% meaning certainty the attitude is true. Participants rating their certainty as 70% or higher were included in the analyses. The average certainty rating was 89.5%, and the median and the mode were both 90% (Table 3).

#### Interventions.

Participants were randomly assigned to 1 of 4 interventions using GuidedTrack’s JavaScript-based random number generator. Depending on the random assignment, participants responded to one of the following prompt sets:

**Prompt set 1.** Participants were asked for both pro- and counterattitudinal arguments (Appendix A). The proattitudinal

prompt invited self-referencing (P1: “How was your attitude formed originally?”).

**Prompt set 2.** Participants were asked for both pro- and counterattitudinal arguments. Self-referencing was invited in the proattitudinal prompt (P1: “What are the specific benefits of holding your attitude?”) and in one of the counterattitudinal prompts (P3: “What would you have to experience for you to change your mind about this attitude?”).

**Nonsense control.** Participants were prompted for nonsense sentences using words from their attitude statement. For example, they were asked for words that rhymed with the last word of their essay, every other word of their statement, and their favorite word from their essay.

**Distraction control.** Participants were prompted for irrelevant topics including what they had for breakfast, a future goal, and the contents of the room they occupied.

The control prompt sets were designed to take approximately the same length of time as the experimental sets and to create similar expectations about the possibility of attitude change but did not ask for pro- or counterarguments or include anything to influence the direction of attitude change. In all conditions, participants were asked to respond to the prompts in writing because it enabled us to measure the length of their responses. All responses were saved and presented in summaries as participants moved through the prompts because it has been demonstrated that thoughts are more persuasive when written down and saved than when they are written down and thrown away.<sup>88</sup>

**Posttest attitude certainty.** After completing the prompts, participants were reminded of their initial attitude certainty rating and asked to rate their attitude confidence a second time using the same ratio scale from 0% to 100%.

**Posttest ART.** We measured ART quantitatively by counting (1) the number of words in the attitude statement, (2) the number of words used to respond to the total prompt set, and (3) the number of words used to respond to each question in the prompt set. The attitude statement was written preintervention and was measured only to ensure that the intervention and control participants were comparable in their readiness to engage with the computer application.

#### Analysis

Analysis of variance (ANOVA),  $\chi^2$ , and correlation were used to analyze data.

## Results

### Change in Attitude Certainty

Of the 617 participants, 246 (40%) changed their attitude certainty (increase or decrease) and 371 (60%) did not change their attitude certainty following the interventions (Table 4).

**Table 4.** Number of Participants Showing Attitude Certainty Changes by Intervention.

Type of Attitude Change	Prompt Set 1	Prompt Set 2	Nonsense Control	Distraction Control	Total
Decrease	55 (34%)	49 (30%)	23 (16%)	16 (11%)	143 (23%)
Increase	31 (19%)	35 (21%)	19 (13%)	18 (12%)	103 (17%)
No change	74 (46%)	79 (48%)	104 (71%)	114 (77%)	371 (60%)
Total	160	163	146	148	617

An omnibus  $2 \times 4$  (change [yes, no]  $\times$  intervention)  $\chi^2$  was significant,  $\chi^2(3, n = 617) = 47.24, P < .001, \phi_c = 0.28$ , indicating that the likelihood of change and intervention were related. A series of 6 post hoc  $2 \times 2$   $\chi^2$  tests (change [yes, no]  $\times$  intervention) with Bonferroni-adjusted  $\alpha$  levels of 0.008 per test (0.05/6) showed there were significantly more attitude certainty changes in set 1 than the nonsense control,  $\chi^2(1, n = 306) = 18.57, P < .001, \phi_c = 0.25$ , and the distraction control,  $\chi^2(1, n = 308) = 29.34, P < .001, \phi_c = 0.32$ . There was also a significantly more attitude certainty changes in set 2 than the nonsense control,  $\chi^2(1, n = 309) = 15.6, P < .001, \phi_c = 0.23$ , and the distraction control,  $\chi^2(1, n = 311) = 25.57, P < .001, \phi_c = 0.29$ . There was not a significant difference in the frequency of attitude certainty changes in the 2 experimental interventions,  $\chi^2(1, n = 323) = 0.08, P = .78, \phi_c = .02$ , or the 2 controls,  $\chi^2(1, n = 294) = 1, P = .32, \phi_c = .07$ . These results indicate that the experimental interventions caused more participants to change their attitude certainty (increase or decrease) than either of the controls.

### Direction of Change in Attitude Certainty

Of the 246 participants who changed their attitude certainty, a goodness-of-fit  $\chi^2$  was performed to determine whether the percentage of “increasers” and “decreasers” overall was different than expected (50% and 50%) under the null hypothesis (Table 4). Regardless of intervention, significantly more participants decreased their certainty,  $n = 143$ , than increased their certainty,  $n = 103, \chi^2(1, n = 246) = 6.18, P = .01$ . Two goodness-of-fit  $\chi^2$  with a Bonferroni correction,  $P = .025$  or  $.05/2$  showed that the number of decreasers,  $\chi^2(1, n = 143) = 28.64, P < .001$ , was not equally distributed between the experimental ( $n = 104$ ) and control interventions ( $n = 39$ ) as expected under the null hypothesis (50% and 50%). The distribution of “increasers” between the experimental ( $n = 66$ ) and control interventions ( $n = 37$ ),  $\chi^2(1, n = 103) = 7.62, P = .005$ , also differed from chance. Within each intervention, goodness-of-fit  $\chi^2$  with a Bonferroni correction ( $P = .01$  or  $.05/4$ ) indicated there were significantly more decreasers than increasers in set 1,  $\chi^2(1, n = 86) = 6.16, P = .01$ , but not set 2,  $\chi^2(1, n = 84) = 2.02, P = .16$ , the nonsense control,  $\chi^2(1, n = 42) = 0.22, P = .64$ , or the distraction control,  $\chi^2(1, n = 34) = 0.02, P = .89$ . Although both experimental interventions caused more attitude certainty changes than the controls, the

**Table 5.** Mean Change in Attitude Certainty by Intervention.

	Mean	Cohen <i>d</i>	95% CI	SD	<i>n</i>
Set 1	-3.29	-0.38	-3.20 to 3.40	12.02	160
Set 2	-.87	-0.15	-0.80 to 0.94	8.58	163
Nonsense Control	-0.62	-0.12	-0.55 to 0.69	7.74	146
Distraction Control	0.11	0	0.14 to 0.08	3.43	148

Abbreviations: CI, confidence interval; SD, standard deviation.

results indicate that set 1 was the only experimental intervention that was effective in causing more attitude certainty decreases than increases.

### Size of Change in Attitude Certainty

The size of the change in attitude certainty was calculated by subtracting the postintervention certainty ratings from the pre-intervention certainty ratings. The resulting difference scores ranged from a 75-point decrease in attitude certainty to a 30-point increase in attitude certainty. The overall average was a 1.2-point decrease in certainty. The average attitude certainty change for each group in shown in Table 5.

A 1-way ANOVA revealed a significant main effect for intervention on mean certainty change,  $F_{3,613} = 4.62, P = .003$ . Five post hoc comparisons using the Tukey's honest significant difference (HSD) test indicated that the mean decrease in attitude certainty resulting from set 1 ( $M = -3.29$ ) was significantly larger than the mean decrease in attitude certainty resulting from the nonsense control ( $M = -0.62, t = -2.72, P = .03$ ), the distraction control ( $M = 0.11, t = 3.48, P = .003$ ), but not set 2 ( $M = -.87, t = -2.54, P = .06$ ). The mean attitude certainty decreases, resulting from set 2 did not differ significantly from the nonsense control or the distraction control. These results indicate that only set 1 resulted in significantly larger attitude certainty decreases than the controls.

### Attitude-Related Thought

The attitude statement was written before the intervention and was not expected to differ by group. The mean number of words in the statement was 29.92 in set 1, 26.66 in set 2, 25.66 in the nonsense control, and 28.34 in the distraction control. A 1-way ANOVA confirmed no group differences in ART prior to the interventions ( $F_{3,613} = 0.57, P = .68$ ).

The total number of words written in response to set 1 and set 2 differed significantly, which is not surprising because set 1 contains 4 questions ( $M = 86.01$ ) and set 2 contains 3 questions,  $M = 68.27, t(321) = 3.90, P < .001$  (Table 6). However, more importantly, the average number of words written *per prompt* in set 1 ( $M = 21.50$ ) and set 2 ( $M = 22.76$ ) did not differ,  $t(321) = -0.96, P = .34$ .

The prompts within each set did elicit responses of different lengths, however (Table 7). In set 1, a 1-way ANOVA for

**Table 6.** Total Number of Words Per Set and Average Number of Words Per Prompt.

	Total Number of Words to Set 1 (4 Prompts)	Total Number of Words to Set 2 (3 Prompts)	Average Number of Words Per Prompt in Set 1	Average Number of Words Per Prompt in Set 2
Mean	86.01 (n = 160)	68.28 (n = 163)	21.50 (n = 160)	22.76 (n = 163)
Median	81	59	20.25	19.33
SD	44.01	37.43	11	12.58
Range	15-253	20-301	3.75-63.25	6.67-100.33

Abbreviation: SD, standard deviation.

correlated samples found a significant effect for prompt on the number of words used in the response ( $F_{1,321} = 163.57$ ,  $df = 3$ ,  $P < .001$ ). Post hoc Tukey HSD tests showed that the mean number of words in response to prompt 1 was significantly greater than the mean number of words to prompt 2, 3, and 4 ( $P = .01$ , critical difference 5.81). In set 2, a 1-way ANOVA for correlated samples also found a significant effect for prompt ( $F_{1,321} = 30.61$ ,  $P < .001$ ). Post hoc Tukey HSD comparisons showed that the mean number of words used in response to prompt 1 was significantly larger than the mean number of words used in response to prompt 2 and 3 ( $P = .01$ , critical difference = 3.77). The first prompt in each set, both of which invited self-references, elicited the longest responses. Prompt 1 in set 1 elicited significantly more words than prompt 1 in set 2,  $t(321) = 6.14$ ,  $P < .001$ .

### Attitude Related Thought and Change in Attitude Certainty

The correlation matrices show the correlation between the postintervention measures of ART and the raw attitude certainty change scores (Tables 8 and 9). As would be expected, the number of words used to respond to each prompt was significantly correlated with the number of words used in every other prompt within a set. The mean number of words used per prompt was significantly correlated with attitude certainty change in set 1,  $r(158) = -.17$ ,  $t = -4.28$ ,  $P = .02$ , but not set 2,  $r(161) = -.002$ ,  $t = -.03$ ,  $P = .98$ . In set 1, the more words that were used to respond to the prompts, the more attitude certainty decreased. Also in set 1, there were significant correlations between the size of the attitude certainty decrease and the number of words used to respond to prompt 1,  $r(158) = -.15$ ,  $t = -1.91$ ,  $P = .03$ , and 3,  $r(158) = -.16$ ,  $t = -2.04$ ,  $P = .02$ . More ART following these prompts was associated with less attitude certainty.

A simultaneous entry method multiple regression analysis was used to determine whether the amount of ART and

intervention type significantly predict attitude certainty change. The overall model was significant ( $R^2 = .25$ ,  $F_{2,322} = 4.29$ ,  $P = .019$ ), however, neither ART,  $\beta = -0.03$ ,  $t(322) = -1.90$ ,  $P = .06$ , nor intervention,  $\beta = 1.96$ ,  $t(322) = 1.65$ ,  $P = .10$ , significantly predicted attitude certainty change. In set 1, a regression analysis showed that ART did significantly predict attitude change,  $R^2 = .029$ ,  $F_{1,159} = 4.77$ ,  $P = .03$ ,  $\beta = -0.05$ ,  $t(159) = -2.19$ ,  $P = .30$ . In set 2, ART did not significantly predict attitude change,  $R^2 = .00$ ,  $F_{1,162} = 8.58 \times 10^{-4}$ ,  $P = .98$ ,  $\beta = -.001$ ,  $t(159) = -0.03$ ,  $P = .98$ .

### Discussion

The focus of this study was on developing self-persuasion interventions to reduce participants' certainty in strongly held attitudes. Prior to receiving the interventions, it was confirmed that the participants held attitudes that were strong on the dimension of certainty, extremity, and importance. Participants selected an attitude that was important to them and maintained despite others feeling very differently. More than half of the participants included in the analyses were 90% or more certain of their self-held attitude. The participants' high attitude strength provided a very stringent test of the self-persuasion interventions. We deemed this challenge necessary to increase the generalizability of our findings to settings where patients hold strong attitudes about health-related issues.

The hypothesis that the experimental interventions would lead to more frequent attitude certainty decreases than the controls was partially supported. The experimental interventions lead more participants to increase and decrease their attitude certainty than the control interventions. However, only set 1 led more participants to decrease than increase their attitude certainty. Perhaps not surprisingly, given the known resilience of highly certain attitudes,<sup>84-86</sup> only 34% of the participants receiving set 1 decreased their attitude certainty. Further, 19% of participants in set 1 increased their attitude certainty. The latter finding might be due to the actual or perceived length of the interventions or thought confidence issues for these participants. Clarkson and colleagues found that shorter thought intervals can lead to attitude polarization (ie, increases in certainty) and longer thought intervals can lead to thought confidence decreases and attitude depolarization.<sup>89,90</sup> More thinking time (300 vs 180 or 60 seconds) is thought to lead to attitude certainty decreases because the inability to continue to generate new attitude-consistent thoughts leads to a lack of confidence in one's thoughts. Also, fear of having incorrect thoughts has been shown to lead to more attitude-inconsistent thoughts during thinking time. The level of confidence in these thoughts then determines whether thinking leads to polarization or depolarization of attitudes.<sup>90</sup> The thought intervals in this study were self-regulated. Participants could spend as much or as little time thinking about each prompt as desired before continuing to the next prompt. A post hoc

**Table 7.** Number of Words Used to Respond to Each Prompt Within 2 Sets.

	Prompt Set 1 (n = 160)				Prompt Set 2 (n = 163)		
	Counterarguments				Proargument With Opportunity for Self-Reference	Counterarguments With Opportunity for Self-Reference	
	P1	P2	P3	P4	P1	P2	P3
	How Was Your Current Attitude Formed?	What Is a Piece of Evidence Against Your Current Attitude?	What Is a Second Piece of Evidence Against Your Current Attitude?	What Is a third Piece of Evidence Against Your Current Attitude?	What Are the Benefits of Your Current Attitude?	What Is the Strongest Argument Against Your Current Attitude?	What Evidence Would You Have to Encounter to Change Your Current Attitude?
Mean	46.58	15.04	12.49	11.9	28.45	18.93	20.90
SD	32.19	10.75	10.09	7.49	19.46	13.37	13.48
Range	2-178	1-58	1-65	1-38	4-128	3-98	0-75

Abbreviation: SD, standard deviation.

**Table 8.** Correlations for the Number of Words Per Prompt, Per Set, and Attitude Certainty Change for Set 1.<sup>a</sup>

Prompt Set 1						
	Q1	Q2	Q3	Q4	Mean (Q1-Q4)	Certainty Change
Q1	1	0.19	0.16	0.33	0.87	-0.15 <sup>b</sup>
Q2		1	0.36	0.47	0.55	-0.08 (NS)
Q3			1	0.52	0.52	-0.16 <sup>c</sup>
Q4				1	0.65	-0.02 (NS)
Mean (Q1-Q4)					1	-0.17 <sup>d</sup>
Certainty Change						1

Abbreviation: NS, not significant.

<sup>a</sup>All correlations are significant except where noted (NS); *t* values are reported for notable correlations only.

<sup>b</sup>*t*(158) = -1.91, *P* = .03.

<sup>c</sup>*t*(158) = -2.04, *P* = .02.

<sup>d</sup>*t*(158) = -4.28, *P* = .02.

*t* test confirmed that the participants receiving set 1 who decreased their attitude certainty spent significantly more time (*M* = 17.52 minutes) answering the prompts than participants who increased their attitude certainty (*M* = 12.66 minutes; *t* = 2.86, *df* = 79.89, *P* < .001). Perhaps finding ways to stretch the thinking time out for participants who do not meet a minimum thinking time would ensure more certainty decreases with this or other self-persuasion interventions. It should be noted also that some participants in the control groups decreased their attitude certainty (11% and 16%) perhaps due to a “mere thought” effect that operated despite the distraction of the control prompts. Alternately, the expectation for change created in the control groups may have influenced some participants to decrease their attitude certainty ratings regardless of whether they thought about their attitude during the control exercises (ie, placebo effect).

**Table 9.** Correlations for the Number of Words Per Prompt, Per Set, and Attitude Certainty Change for Set 2.<sup>a</sup>

Prompt Set 2						
	Q1	Q2	Q3	Mean (Q1-Q3)	Certainty Change	
Q1	1	0.56	0.36	0.84	0.083 (NS)	
Q2		1	0.54	0.84	-0.074 (NS)	
Q3			1	0.74	-0.053 (NS)	
Mean (Q1-Q3)				1	-0.002 (NS)	
Certainty Change					1	

Abbreviation: NS, not significant.

<sup>a</sup>All correlations are significant except where noted (NS).

The hypothesis that the experimental interventions would lead to larger attitude certainty decreases was also partially supported. For set 1, but not set 2, the mean decrease in attitude certainty was larger than the mean decrease in the control groups. The relative effectiveness of set 1 is likely due to the higher level of ART it elicited. Although both prompt sets elicited roughly the same mean number of words per prompt, the mean number of words elicited by the attitude formation prompt in set 1 was significantly larger than the mean number of words elicited by the attitude benefit prompt in set 2. Memory for the concrete events surrounding the formation of an attitude may be more accessible than memory for abstract benefits of an attitude.<sup>91</sup> The ease of accessing the memory and the availability of details may have led to more cognitive engagement reflected by longer responses, which in turn led to more doubt about the attitude.

The hypothesis that the length of responses to the prompts would be correlated with attitude certainty changes in the experimental interventions was also partially supported. In set



1 only, there were significant, but small negative correlations between attitude certainty change and the number of words elicited by prompt 1 and 3 and the average number of words elicited by the entire set. The prompt “How was your attitude formed originally?” in set 1 may activate deeper attitude structures than the prompt “What are the benefits of your attitude?” in set 2 because the former requires accessing long-term memory for information.<sup>69</sup> Rather than polarizing the current attitude, the activation of long-term memories may have triggered a memory of the time before the current attitude was formed. Memories of the pre-event attitude, which likely had different valence and strength attributes, may have created doubt about the current attitude. Another possible interpretation is that the longer time spent thinking in set 1 may have caused a lack of confidence in the participants’ attitude formation arguments, which in turn caused the decrease in attitude certainty.<sup>89</sup> The predictive power of question 3 in the same set, “What is a second piece of evidence against your attitude?” over questions 2 and 4, which are very similar, is difficult to explain. In the transtheoretical model of behavior change, self-induced doubt or uncertainty may increase future receptivity to counterattitudinal messages. Perhaps in reviewing their personal reasons for forming the attitude, participants realized the basis for the attitude was not entirely rational, doubt was induced, and receptivity to their own counterarguments increased particularly when they could easily think of a second counterargument.

Not only did set 1 cause more frequent and larger attitude certainty decreases than the controls, it was also the only experimental set that evidenced a predictive relationship between cognitive engagement and attitude certainty decreases. The relative effectiveness of set 1 over set 2, which appears to be due to “formation” question in set 1, was unexpected, given that set 2 had 2 opportunities for self-referencing. It seems that the level of engagement elicited by a single prompt about a stored personal memory is greater ( $M_{\text{number of words}} = 46.58$ ) than either a prompt about current events ( $M_{\text{number of words}} = 28.45$ ) or a prompt about a hypothetical future event ( $M_{\text{number of words}} = 20.90$ ). This is surprising because imagining a future event has been found to increase confidence that the event will happen.<sup>92-93</sup> It should be noted that word counts are a relatively superficial proxy for cognitive engagement and are used here as a starting point for studying the role of ARTs in attitude change. Future studies should also measure the qualitative aspects of participants’ responses such as the use of words indicating doubt or change.

The implication for clinical practitioners and health-related computer applications is that it may be worthwhile to let patients elaborate on their personal reasons for initially forming for an unhealthy attitude (eg, “I need to drink to relax” or “Smoking is cool”). For example, a question about the circumstances surrounding the

development of the attitude could be added to existing protocols such as the one developed by Rollnick and colleagues<sup>12</sup> that targets smoking. Instead of simply asking for the patient’s proarguments for smoking, a question that directs thoughts to a time before the behavior developed might be helpful in eliciting doubt. Allowing patients plenty of time to respond to questions and encouraging extra time for those who rush through their answers are also recommended.

Although the correlations between ART and attitude certainty decreases in this study were small, continued investigations of self-persuasion prompts with strong self-referencing features is warranted. Future studies could improve on the limitations of the current study by recruiting participants with strong attitudes specific to the health domain only, specifying the attitude to be changed, testing other methods of eliciting self-referenced pro- and counterarguments, analyzing ART’s qualitatively as well as quantitatively, and including follow-up measures of receptivity to clinician’s prescriptions for behavior change.

## So What?

### *What is already known on this topic?*

Since the 1950s, academic psychologists have known that it is possible to induce self-persuaded attitude change. In the intervening 70 years, the field has accumulated empirical evidence on the “how,” “when,” and for “whom” self-persuasion is likely to occur. Practitioners of motivational interviewing have begun to capitalize on the “how” data by prompting clients to *actively think of objections* to their addictive behaviors as a first step in bringing about lifestyle changes. However, more clinically oriented research is needed to test the applicability of academic knowledge to clinical goals.

### *What does this article add?*

The current study manipulates self-referencing, another academic “how” variable, with participants presenting strong attitudes, a “whom” variable, using prompts that could be easily adapted to clinical interviews or health technology applications.

### *What are the implications for health promotion practice or research?*

Prompting for memories about how a strong attitude was formed may be a productive way to induce lifestyle changes in patients.

## Appendix A

### Prompt Set 1 With Participant Response Examples

Procedure Sequence	Response: Example 1	Response: Example 2
Attitude statement: Describe your attitude.	Obesity is a problem of self-control and motivation.	I think all natural medicine is not something that works as a whole. I think the only thing it does is to give the person some sort of placebo effect that makes them think they're getting better.
Attitude certainty pretest: Enter your attitude confidence percentage (0%-100%).	90%	99%
Q1-Proargument with self-reference: Describe the way you formed your attitude originally.	After attending a biomechanics lecture on weight change, I was leaning toward the idea that even though obesity can be genetic, there is still an amount of control one has over their body. After looking more into the issue, I found other viewpoints that were similar to mine and they contained statistics and evidence that made sense to me.	I had trouble sleeping and tried one of those over-the-counter medicines that are supposed to help you produce a certain chemical in your body to help you sleep. It did not work for me at all even though I wanted to believe it would.
Q2-Counterargument: What's the first piece of evidence against this attitude?	Many people who are obese have other medical problems.	That it has helped some people.
Q3-Counterargument: What's the second piece of evidence against this attitude?	Unhealthy food is cheaper than healthy food.	It does have some sort of effect.
Q4-Counterargument: What's the third piece of evidence against this attitude?	People could have other biological problems that cause them to not exercise.	It has been proven to possibly help certain people.
Attitude certainty posttest: Enter your new confidence percentage in this attitude between 0% and 100%.	70%	90%

### Prompt Set 2 With Participant Response Examples

Procedure Sequence	Response: Example 1	Response: Example 2
Attitude statement: Describe your attitude.	People should stop relying so much on medicine to fix their health problems.	I believe prescription drugs are too easily prescribed and make you reliant on that product. They make people feel a certain way rather than actually curing them. A short-term relief effort, and buying these drugs can cost hundreds of dollars.
Attitude certainty pretest: Enter your attitude confidence percentage (0%-100%).	80%	90%
Q1-Proargument with self-reference: Are there any specific benefits you get from holding this attitude?	Feeling superior to others, especially people who can change their lives for the better if they exercised a bit more.	Psychological benefits. I do not want to take legal drugs that alter my chemical body balance. I don't want to rely on pills.
Q2-Counterargument: What do you think the best or strongest argument against this attitude is?	Western medicine has come a long way and exercise can make some conditions worse.	They can help you live longer.
Q3-Counterargument with self-reference: What would you have to experience for you to change your mind about this attitude?	Exercise doesn't actually help most people who use medicine to treat their illnesses.	Be put in a situation where I'm relying on prescriptions to keep me alive. I would rather find a homeopathic way.

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