Pitch as a Recipient, Channel, and Context Factor Affecting Thought Reliance and Persuasion

Joshua J. Guyer, PhD[1]
Pablo Briñol, PhD[2]
Thomas I. Vaughan-Johnston, PhD[3]
Leandre R. Fabrigar, PhD[4]
Lorena Moreno, PhD[2]
Borja Paredes, PhD[2]
Richard E. Petty, PhD[5]

[1] IE University, Department of Human Science and Technology
[2] Universidad Autónoma de Madrid; Department of Social Psychology and Methodology
[3] Durham University, Department of Psychology
[4] Queen's University; Department of Psychology
[5] The Ohio State University; Department of Psychology

Orcid of first author (JJG): 0000-0002-3932-4956
Contact information:
JJG: jguyer@faculty.ie.edu, ORCID = 0000-0002-3932-4956
PB: pablo.brinnol@uam.es, ORCID = 0000-0002-0327-5865
TVJ: cnzw72@durham.ac.uk, ORCID = 0000-0002-4682-481X
LRF: fabrigar@queensu.ca,
LM: lorena.moreno@uam.es. ORCID = 0000-0003-4829-7280
BP: borja.paredes@uam.es, ORCID = 0000-0002-2418-3337
REP: petty.1@osu.edu, ORCID = 0000-0002-2870-8575

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Pablo Briñol declares that he has no conflict of interest
Thomas Vaughan-Johnston declares that he has no conflict of interest
Leandre R. Fabrigar declares that he has no conflict of interest
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Abstract

Three experiments tested how low versus high pitch generated from sources beyond a message communicator can affect reliance on thoughts and influence recipients' attitudes. First, participants wrote positive or negative thoughts about an exam proposal (Experiments 1, 2), or their academic abilities (Experiment 3). Then, pitch from the message recipient (Experiment 1), channel (Experiment 2), or context (Experiment 3) was manipulated to be high or low. Experiment 1 showed that when participants vocally expressed their thoughts using low (vs. high) pitch, thoughts had a greater effect on attitudes toward exams. Experiment 2 revealed low (vs. high) pitch sounds from the keyboard participants used to write their thoughts produced the same effect on thought usage. Experiment 3 demonstrated that thoughts influenced attitudes more when listed while background music was low (vs. high) pitch. Pitch can influence attitudes through a meta-cognitive thought reliance process whether emerging from the recipient, channel, or context.

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Considerable prior research has focused on the question of how acoustic features of a speaker's voice influence message recipients' attitudes (Brooke & Hung Ng, 1986; Chattopadhyay et al., 2003; Chebat et al., 2007; Gelinas-Chebat & Chebat, 1992; Guyer et al., 2018a; Hall, 1980; Mehrabian & Ferris, 1967; Mehrabian & Williams, 1969; Miller et al., 1976; Van Zant & Berger, 2020; Wang et al., 2021). Such characteristics of voice include speech rate (i.e., slow versus fast speech), volume (i.e., soft, or loud speech), pitch (i.e., the frequency of vocal fold vibrations, with higher frequency indicating high pitch), and intonation (sentences ending with rising or falling pitch). Despite the well-documented evidence that message recipient's attitudes are influenced by these features of the communicator's voice (speaker), it remains unclear whether recipients' attitudes can be shaped by acoustic features generated from a source other than the communicator. Therefore, the present research examined whether pitch emerging from origins other than the message-source can influence attitudes. Instead of focusing on the pitch of the communicator, we tested whether pitch coming from the message recipient, the channel, and the context can affect persuasion.

Furthermore, research investigating the processes by which vocal qualities of the speaker influence attitudes has focused exclusively on different processes of primary cognition by the message recipient (e.g., affecting the valence of thoughts; Guyer et al., 2018a, and the amount of thinking; Guyer et al., 2018b; Guyer et al., 2018c). To our knowledge, research has not tested whether vocal qualities can influence attitudes by processes of secondary cognition focused on using those thoughts more (vs. less) when forming attitudes. Instead of examining how pitch affects attitudes by changing thoughts, the present work focuses on how pitch can influence judgments by affecting thought usage. Taken together, the present research examined for the first time whether pitch emerging from origins beyond the message-source can influence attitudes and do so by affecting the extent to which people rely on their thoughts rather than by changing thoughts.

Acoustic Cues can Affect Primary Cognition

Primary cognition refers to thoughts that occur at a direct level and involves initial associations of some object with some attribute (e.g., my professor sounds calm). A wealth of research has shown that primary cognitions can be shaped by vocal qualities of the speaker delivering a message. For example, based on vocal features, people make inferences about a speaker's traits (Burgoon et al., 1990; Guyer et al., 2018, 2020; Klofstad et al., 2012, 2015; Miller et al., 1976; Pisanski & Bryant, 2019), social intentions (Fraccaro et al., 2011; Hughes et al., 2010, 2014; Leongómez et al., 2014; Pisanski et al., 2018), indicators of power, such as authority (Sorokowski et al., 2019), physical size, dominance, strength (e.g., Klofstad et al., 2015; Pisanski & Bryant, 2019; Puts et al., 2006), and social rank (Cheng et al., 2016). In addition, vocal features of the speaker are used to make inferences about the appraisal of situations and objects (Chattopadhyay et al., 2003; Chebat et al., 2007; Gelinas-Chebat, & Chebat, 1992; Gregory & Webster, 1996; Mehrabian & Ferris, 1967; Puts et al., 2006) attitudes (e.g., Pittam & Gallois, 1987; Scherer, 1988), and the perceived persuasiveness of the speaker (Brooke & Hung Ng, 1986; Hall, 1980; Mehrabian & Williams, 1969; Van Zant & Berger, 2020; Wang et al., 2021).

Research indicates that pitch is one of the most perceptually salient vocal properties of a speaker (e.g., Titze, 1994). Pitch refers to the variation in the "highness" or "lowness" of voice resulting from differences in the fundamental vibration frequency (F_0, measured in Hertz) caused by the length, tension, and cross-sectional area of the vocal folds in the larynx (Lieberman & Blumstein, 1988; Titze, 1994). Although many characteristics of the voice of a speaker could

plausibly influence persuasive communication, a growing body of research suggests one characteristic that should play an important role is the extent to which a speaker sounds confident (Brennan & Williams, 1995; Brown et al., 1985; Kimble & Seidel, 1991; Scherer et al., 1973; Smith & Clark, 1993). In that literature, confidence refers to the extent to which an audience believes that the speaker is certain or sure of the message he/she is conveying. Prior research has produced converging evidence demonstrating that lower-pitched voices are recognized by listeners as indicating speaker confidence (Guyer et al., 2018a; Guyer et al., 2020; Jiang & Pell, 2014; Van Zant & Berger, 2020).

In a previous example of how speakers' pitch can increase persuasion by affecting processes of primary cognition in the recipients, Guyer et al. (2018) presented participants with an audio passage that discussed the benefits of using phosphate-based laundry detergent. In an audio recording, the pitch of the speaker was digitally manipulated to be low versus high relative to their natural baseline. This manipulation of speaker pitch was designed to vary how confident participants attributed the communicator to be. The researchers also manipulated participants' motivation and ability to think about the message by either increasing both factors (i.e., high-thinking condition), or decreasing both factors (i.e., low-thinking condition). After listening to the recording, participants reported their attitudes toward the topic, evaluated the level of confidence perceived in the speaker's voice, then listed their thoughts toward the topic. As predicted, low pitch affected ratings of speakers' confidence and increased persuasion compared to high pitch. In accord with the elaboration likelihood model of persuasion (Petty & Cacioppo, 1986), the persuasive effect of low pitch was mediated differently depending on the elaboration conditions. When carefully thinking about a message, perceptions of speaker confidence (emerging from variations in pitch) biased thought-favorability (i.e., making thoughts more positive), subsequently affecting attitudes. However, when participants were not thinking carefully, speaker confidence did not affect thought valence but directly affected attitudes as a peripheral cue (the confident sounding source using a low pitch was more persuasive; cf. Petty et al., 1993). To date, prior research has only examined how the vocal pitch of the communicator delivering a message can influence persuasion and do so by changing these processes of primary cognition in the audience.

Vocal Pitch can Affect Secondary Cognition

Instead of focusing on changing the thoughts of recipients as a function of a speakers' pitch, the present research examined whether other sources of pitch could also influence persuasion and do so via meta-cognitive processes of secondary cognition (i.e., reliance on thoughts). Thus, in contrast with research to date focusing on how pitch from the communicator changes recipients' thoughts, the present research examined for the first time whether new sources of pitch might affect attitudes, including pitch coming from the message recipient, the channel, and the context. In addition to examining new sources of pitch, the present research also examined the impact of pitch on persuasion by affecting the use of the thoughts that recipients generate in response to a persuasive proposal, a metacognitive process of change that we describe next.

As noted, primary cognition involves people's initial association of some object with some attribute, or a projection of some object onto some dimension of judgment such as "*I like doing exams*" or "*I am a bad student*" (Briñol & Petty, 2022). These initial thoughts can be directed at any object, including a topic like exams, but also towards oneself, other people, or the environment. Anything can serve as the object of primary cognition. Following an initial thought, people can also generate other thoughts that occur at a second level, which involves

reflection on the first level thoughts (e.g., "*Am I sure that I like doing exams?,*" "*Am I certain that I really am a bad student?*"). Meta-cognition refers to these second order thoughts, or thoughts about one's primary thoughts or initial thought processes (Dunlosky & Metcalfe, 2009; Goupil & Kouider, 2019).

The present research is based on Self-Validation Theory (SVT, Briñol & Petty, 2022), which is a meta-cognitive framework that focuses on the perceived validity of one's primary thoughts. According to SVT, perceptions of validity can be manipulated by variables incidental to the content of thoughts (in this case by varying pitch) and can also be assessed by asking participants how confident they are in their thoughts. For example, participants in a study can be asked to respond to questions such as: "*How confident are you in the thoughts that you listed?*" Answering this question requires participants to reflect on their own thoughts, and to assess the validity of whatever they have in mind at the time. These kinds of questions are considered well-established measures of meta-cognitive perceptions because they involve thinking about thinking (Fleming & Lau, 2014).

In addition to measuring confidence, meta-cognitive processes also can be inferred by assessing the extent to which previously generated thoughts translate into judgments (Petty et al., 2002). The key idea behind the SVT meta-cognitive framework is that thoughts become more consequential for attitudes as their perceived validity is increased. In the current research, we hypothesize that lower pitch would be associated with higher validity because of the link in prior research between lower pitch and confidence. Specifically, the SVT approach proposes that people can misattribute the higher confidence (validity) that emerges from lower pitch to thoughts previously generated in response to a persuasive proposal. In the present studies we hypothesize that thoughts will be more predictive of attitudes in the lower pitch conditions. Therefore, participants are expected to "use their thoughts" to guide their attitudes to a greater extent in low-pitch than in high-pitch conditions.

In early SVT research, Briñol and Petty (2003) showed that thoughts written with one's non-dominant hand (which feels difficult) were rated as less valid than thoughts written with one's dominant hand (which feels easy). Consequently, thoughts written with the non-dominant hand were less impactful in forming judgments. In another SVT example, Briñol and colleagues (2007) asked participants to think about and write down either positive or negative thoughts about a new university flu-vaccination policy. Then they were asked to recall either two prior incidents in which they held power over another person (high confidence condition), or two incidents in which someone had power over them (low confidence condition). Finally, participants attitudes toward the vaccination policy were assessed. As predicted, the initial thoughts participants generated about the vaccination policy affected their attitudes toward the proposal more in the powerful (confident) compared to the powerless (doubtful) conditions. When thoughts about the policy were manipulated to be positive, feeling powerful made attitudes more favorable and increased persuasion. However, when thoughts about the policy were induced to be negative, the same confidence induction through power resulted in less favorable attitudes and reduced persuasion. Instead of focusing on ease or power as validating sources of thoughts, in the present research we examine whether pitch can affect attitudes by influencing thought usage.

In sum, these examples illustrate two important points. First, as meta-cognitive thought validity increases (due to perceived ease, power, etc.), so too does the impact of those thoughts on attitudes, and this is true for both positive and negative thoughts. Second, these studies suggest that variables that might seem incidental or even irrelevant to one's thoughts (e.g., writing with one's dominant/non-dominant hand, momentary feelings of power) can determine

whether people use their thoughts. The present research was designed to examine for the first time to what extent pitch, shown by prior research focused on features of the communicator to be linked with confidence (Guyer et al., 2018; Guyer et al., 2020; Jiang & Pell, 2014; Van Zant & Berger, 2020), can similarly influence attitudes by affecting the use of thoughts as predicted by the meta-cognitive process of thought validation. In accord with SVT, we predict that people will misattribute the validity associated with low (vs. high) pitch to the thoughts generated to a seemingly unrelated topic. People then would rely on their thoughts to guide their subsequent topic-relevant attitudes to a greater extent in low-pitch conditions than in high-pitch conditions because lower pitch is associated with more confidence.

Overview

Prior research has only explored the effects of pitch on persuasion through processes of primary cognition and by manipulating the vocal qualities of the message source. The present research was designed to test whether any effects of pitch on persuasion would emerge when manipulating pitch beyond the message source. Specifically, we tested the impact of pitch when the pitch came from the message recipient (Experiment 1), the channel/mode of communication (Experiment 2), and the context/environment in which a message is communicated (Experiment 3). Among other things, this feature of the current research is important because no other variable in persuasion (credibility, attractiveness, etc.) have been examined as potentially emerging from different origins (source, recipient, channel, and context). Therefore, this is another innovative feature of the present series of studies.

Experiment 1 manipulated the valence of thoughts (positive versus negative) initially generated by the message recipients, and the vocal pitch (low versus high) participants were asked to use while orally expressing those thoughts. The impact of these two independent variables on attitudes toward the persuasive proposal was then examined. Experiment 2 again manipulated thought valence, but now manipulated the pitch associated with the channel that recipients used to express those thoughts (i.e., the sound emitted by a keyboard while the recipients typed their thoughts). Once again, attitudes toward the persuasive proposal served as the main dependent variable. Finally, Experiment 3 manipulated the thought valence of the message recipients regarding their own academic abilities, along with the pitch of a sound recipients heard in the background while generating their thoughts. In this experiment we tested the impact of those variables on attitudes toward the self rather than attitudes toward objects external to the self, as in Experiments 1 and 2. Together, these experiments were designed to examine whether pitch can influence thought validation and thereby attitudes when the pitch does not come from the message source. Importantly, these experiments vary the origin of the pitch from something directly related to the recipient (their own voice, Experiment 1) to the channel used to express their thoughts (the keyboard, Experiment 2) to a totally incidental sound in the background (a contextual noise, Experiment 3). Across experiments, we expected that induced low (vs. high) pitch, regardless of the origin, would increase reliance on the thoughts generated, and therefore would enhance the impact of thought valence on subsequent attitudes. This would be evident in a Pitch × Thought valence interaction on attitudes.

Experiment 1

Experiment 1 was designed to examine to what extent vocally expressing one's own thoughts using either low or high pitch would influence attitudes via thought reliance. Participants first were asked to generate either positive or negative thoughts about comprehensive exams. Next, using a cover story, they were asked to express those thoughts using high or low pitch. Following these two inductions, participants indicated their attitudes

toward the topic (dependent variable), then rated how confident they were in each thought (potential mediator). Finally, all participants answered several demographic questions and ancillary measures. We expected that expressing thoughts with low (vs. high) vocal pitch would enhance reliance on those thoughts, thus leading to subsequent attitude polarization.

Method

Participants and Design. Undergraduates (N=183) from the Universidad Autónoma de Madrid (UAM; 138 females, 45 males; M_{age} = 19.10; SD = 1.51) were randomly assigned to conditions in a 2 (Thought Valence: positive versus negative) × 2 (Vocal Pitch: low versus high) between-participants factorial design. All experimental sessions were conducted on an individual basis in private rooms on the university campus. Course credit was provided in exchange for participation. Because no prior research had specifically examined our key predicted interaction, an a priori power analysis was performed using G*Power (Faul et al., 2007), which assumed a relatively low effect size (Cohen's f = .20) for the predicted interaction. Results of this analysis suggested that the desired sample size for a two-tailed test (α = .05) with .80 power was N = 199. Our final sample was slightly below that number because we chose to stop data collection at the end of the academic semester so that we could analyze the data and prepare a follow-up study for the next semester. Thus, a sensitivity analysis indicated that our final sample size had .80 power to detect an effect size of f = .21. All data and materials for the three experiments reported in this manuscript can be found on our OSF page:
https://osf.io/dnra2/?view_only=2860d36532ff4b4e99cfbe64d2e57e1d

Procedure. Participants were assigned to individual booths, informed that their responses were anonymous, and advised that the booth was fully soundproof, thus ensuring privacy while completing the Experiment. All experimental materials were presented using Qualtrics on computers provided by the researchers. Participants first read an introductory passage that described a policy under consideration by UAM that would require all students to pass a comprehensive exam in their academic major before receiving their university degree (e.g., Petty & Cacioppo, 1984). We used a personally relevant topic to ensure that motivation and ability to think was relatively high. This is important because meta-cognitive processes like thought validation are more likely to operate when people not only have thoughts but also think about those thoughts (Briñol & Petty, 2022). Following the proposal, participants were randomly assigned to list up to either three positive or three negative thoughts about the exam requirement. Following this thought valence manipulation, participants were given a cover story to establish the high/low vocal pitch conditions. Specifically, they were told that the university IT department wanted their help to test the sound quality of a recently acquired audio recording program. Then, participants were, by random assignment, given the low or high pitch instructions. After reading their thoughts aloud, participants indicated their attitudes toward senior comprehensive exams. Next, they were shown the thoughts they had previously listed and were then asked to rate how confident they were in each thought. Following this, participants responded to several demographic and ancillary questions. Finally, each participant was debriefed and received information clarifying the purpose of the experiment.

Independent Variables.

Thought valence. Participants were randomly assigned to read a passage that described either positive or negative aspects of implementing comprehensive exams at their university. After reading the passage, participants were asked to write down up to three positive or negative thoughts about the proposed exams, matching the condition of the valence of the message to

which they were initially assigned. This manipulation has been used successfully to create a pattern of positive or negative thoughts (e.g., see Briñol et al., 2007).

Pitch. After listing their thoughts about comprehensive exams, participants were asked to help the researchers test the sound quality of a recently acquired audio recording program (see Briñol & Petty, 2003; Wells & Petty, 1980, for similar cover stories based on testing sound quality of devices). To ensure the believability of the story, participants pressed the record button on the audio software before they began to read their thoughts aloud. Thus, participants were aware that the audio software was recording them as they read their thoughts out loud. However, for ethical reasons, no recordings were saved. Our procedure followed earlier cover stories that were found to be effective in combating suspicion. Specifically, participants were randomly assigned to read aloud the thoughts they had previously written using either a lower or higher pitch than they would normally use when talking.

Dependent Measures.

Thought Favorability. Two independent judges coded the favorability of participants' thoughts using a 3-point scale (−1 = negative, 0 = neutral, 1 = positive), while blind to condition (e.g., Cacioppo & Petty, 1979; Petty & Cacioppo, 1984). An index of the valence of thoughts was created for each participant using the following formula (Petty & Cacioppo, 1986): Thought Favorability = (Number of positive relevant thoughts – Number of negative relevant thoughts)/ Total number of thoughts. This measure served as a thought valence manipulation check.

Attitudes. Participants reported their attitudes toward the proposed comprehensive exams using four, 7-point unipolar rating scales: *good, bad, positive, negative* (adapted from Crites et al., 1994), anchored by 1 = *Not at all*; 7 = *Definitely.* Final scores were computed by reverse coding the negative items, then averaging the scores across all items. Item-ratings were highly correlated ($\alpha = .92$), thus were averaged to form one overall attitude index. Higher scores reflect more positive attitudes toward the exams.

Thought confidence. Participants indicated the extent to which they were confident in each of their three thoughts using a 7-point Likert scale anchored by 1 = *Not at all*; 7 = *Extremely*. Item ratings were highly correlated ($\alpha = .72$) and were averaged to form one overall thought confidence index. Higher scores reflect more confidence in one's thoughts. This measure has been used previously in meta-cognitive research (Briñol & Petty, 2003; Petty et al., 2002; Tormala et al., 2007).

Results

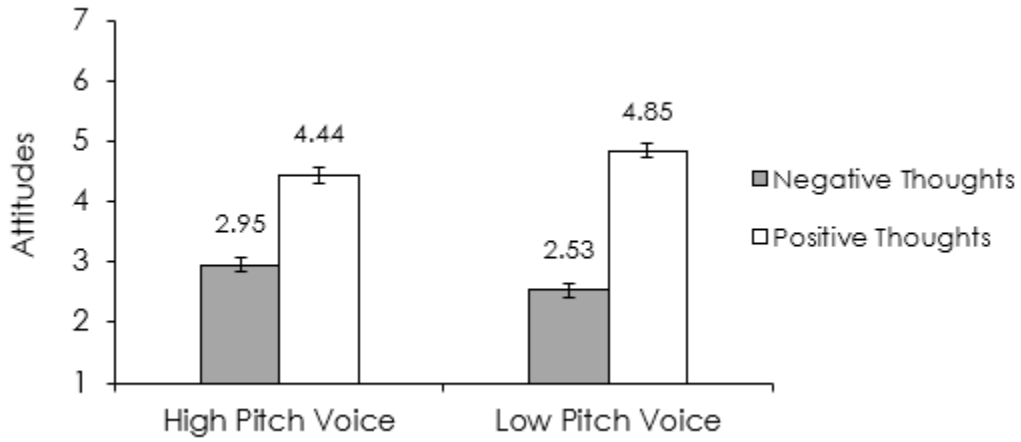
Thought Favorability. A 2 × 2 ANOVA with thought valence and vocal pitch as the independent variables revealed a main effect of thought valence such that participants assigned to the positive thoughts condition ($M = 0.97$, $SE = .03$) had more favorable thoughts toward the exams than those assigned to the negative thoughts condition ($M = -0.92$, $SE = 0.03$), $F(1, 179) = 7921.88$, $p < .001$, $\eta_p^2 = .978$. No other effect reached significance, $F(1, 179) < 2.27$, $p > .134$, $\eta_p^2 < .013$.

Attitudes. A 2 × 2 ANOVA with thought valence and vocal pitch as the independent variables revealed a main effect of thought valence such that participants assigned to the positive thoughts condition ($M = 4.64$, $SE = .11$) had more favorable attitudes toward the exams than those assigned to the negative thoughts condition ($M = 2.74$, $SE = 0.11$), $F(1, 179) = 141.30$, $p < .001$, $\eta_p^2 = .441$. No main effect of vocal pitch was found, $F(1, 179) = 0.00$, $p = .975$, $\eta_p^2 = .000$. Of central importance was the predicted two-way interaction between thought valence and vocal pitch, which was significant, $F(1, 179) = 6.65$, $p = .011$, $\eta_p^2 = .036$, $f = .18$ (see Figure 1; error bars in all figures represent standard errors). This interaction stemmed from the fact that

although positive thoughts led to more favorable attitudes than negative thoughts under both low pitch, $F(1, 179) = 104.06$, $p < .001$, $\eta_p^2 = .368$, and high pitch, $F(1, 179) = 43.56$, $p < .001$, $\eta_p^2 = .196$, attitudes were more polarized in the former conditions.

Thought confidence. We examined the effects of thought valence and pitch on the extent to which participants perceived themselves as confident in their thoughts in another 2 × 2 ANOVA. A significant main effect of thought valence emerged, $F(1, 178) = 51.69$, $p < .001$, $\eta_p^2 = .23$, such that participants assigned to the positive thought condition ($M = 5.03$, $SE = .10$) were less confident in their thoughts than participants assigned to the negative thought condition ($M = 6.08$, $SE = .10$). Against expectations, no main effect of pitch appeared, $F(1, 178) = .86$, $p = .357$, $\eta_p^2 = .005$. No interaction was predicted or detected, $F = 1.24$, $p = .267$, $\eta_p^2 = .007$. Given the absence of a main effect of pitch on thought confidence, we did not conduct further mediation analyses in this study.

Figure 1. *The Effects of Thought Valence and Recipient Vocal Pitch on Attitudes*



Discussion

These data provide initial evidence suggesting that how individuals vocally express their thoughts can influence attitudes by affecting thought reliance. Specifically, the effect of thought valence on attitudes was greater when participants vocally expressed their thoughts using low (vs. high) pitch, as predicted. This experiment is the first to demonstrate that the effects of pitch on attitudes are not limited to situations when changes in pitch emerge from the message source (e.g., Guyer et al. 2018). Furthermore, this study is the first to demonstrate that pitch can influence attitudes by affecting thought reliance rather than changing the valence and the number of thoughts, dimensions of primary cognition examined in prior research. However, although the pattern of results inferred from the impact of thought valence on attitudes was consistent with a thought validation process, pitch did not influence thought confidence in this study.

Experiment 2

The primary goal of Experiment 2 was to test whether the effects of pitch on thought validation would still emerge when the logical relevance of pitch as a means of inferring thought validity was reduced from the recipients expressing their own thoughts verbally (Experiment 1) to pitch produced by a keyboard while recipients typed their thoughts. In this Experiment, participants were first asked to type either positive or negative thoughts about comprehensive exams. While participants typed their thoughts, each stroke on the keyboard was previously programmed to emit either a relatively low or high pitch tone. Thus, in Experiment 2, pitch came

from the sound produced while typing rather than from the recipient's voice as in Experiment 1. Consequently, we reduced the extent to which pitch might be perceived as relevant to inferring thought validity by separating the origin of pitch from an internal source (one's own voice) to an external source (a keyboard). Next, participants reported their attitudes toward the exam proposal (dependent measure), then rated how confident they were in each thought (potential mediator). Finally, all participants answered several demographic questions. We expected that when the expression of thoughts was associated with low (vs. high) pitch sounds produced by a keyboard, this would lead to increased thought usage and attitude polarization.

Method

Participants and design. Undergraduates (N=240) from UAM (207 females, 31 males, 2 missing data; M_{age} = 19.53; SD = 1.45) were randomly assigned to conditions in a 2 (Thought Valence: positive versus negative) × 2 (Pitch: low versus high) between-participants factorial design. As in Experiment 1, all experimental sessions were conducted on an individual basis in private rooms on the university campus. Course credit was provided in exchange for participation. Sample size was calculated based on the effect size of the core two-way interaction in Experiment 1 (f = .18). Results of a G*Power analysis (Faul et al., 2007) indicated that the desired sample size for a two-tailed test with an effect size of f = .18 and .80 power was N = 220. Once this number was achieved, data collection continued for the remainder of the week until all scheduled sessions had been completed.

Procedure. The same positive and negative passages and similar thought instructions were used as in Experiment 1. However, pitch was manipulated by randomly assigning participants to use a keyboard that emitted a low or high pitch tone with each keystroke when participants entered their thoughts about exams. Next, participants reported their attitudes toward the proposal, after which they were shown the thoughts they had previously listed and were then asked to rate how confident they were in each thought. Following this, participants responded to several demographic and ancillary questions. Finally, each participant was debriefed and received information clarifying the purpose of the Experiment.

Independent Variables.

Thought valence. The procedures and passages used to establish our thought valence manipulation were identical to those used in Experiment 1. That is, participants were asked to generate either positive or negative thoughts about the exam proposal after reading positive or negative arguments regarding the exams.

Pitch. While participants typed their thoughts, each stroke on the keyboard emitted either a low or high pitch tone (the volume and pitch of each tone in each pitch condition was held constant), thus subtly associating participants' positive or negative thoughts with the sound produced by the channel through which they expressed their thoughts. Assignment to either the low or high pitch keyboard tone condition was random. The technical specifications of this manipulation, including audio examples, can be found in the supplementary material file.

Dependent Measures.

Thought Favorability. The same procedure used in Experiment 1 to determine thought favorability was used in the current Experiment.

Attitudes. Participants reported their attitudes toward the proposed senior comprehensive exams using four 9-point semantic differential scales anchored with: good-bad, positive-negative, in favor-against, and favorable-unfavorable. Ratings were highly inter-correlated (α = .96), thus averaged to create one overall attitude index. Higher scores reflect more positive attitudes toward comprehensive exams.

Thought confidence. As in Experiment 1, participants indicated the extent to which they were confident in each of their three thoughts using a 7-point Likert scale anchored by 1 = *Not at all*; 7 = *Extremely*. Item ratings were highly correlated (α = .77), and thus were averaged to form one overall thought confidence index. Higher scores reflect more confidence in one's thoughts regarding comprehensive final exams.

Results

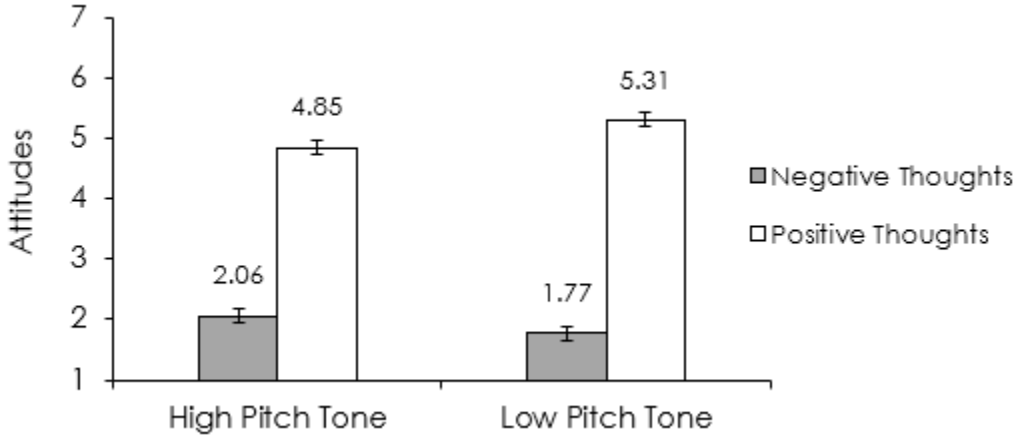
Thought Favorability. A 2 × 2 ANOVA with thought valence and vocal pitch as the independent variables revealed a main effect of thought valence such that participants assigned to the positive thoughts condition (M = 0.94, SE = .029) had more favorable thoughts toward the exams than those assigned to the negative thoughts condition (M = -0.97, SE = 0.029), $F(1, 235) = 9226.46$, $p < .001$, $\eta_p^2 = .975$. No other effect reached significance, $F(1, 235) < 0.21$, $p > .646$, $\eta_p^2 < .001$.

Attitudes. A 2 × 2 ANOVA with thought valence and pitch as the independent variables produced a main effect of thought valence such that participants assigned to the positive thoughts condition (M = 5.08, SE = .13) had more favorable attitudes toward comprehensive exams than participants assigned to the negative thoughts condition (M = 1.92, SE = .13), $F(1, 236) = 283.70$, $p < .001$, $\eta_p^2 = .546$. No main effect of pitch was found, $F(1, 236) = 0.18$, $p = .675$, $\eta_p^2 = .001$.

Of central importance was the predicted two-way interaction between thought valence and pitch, which was significant, $F(1, 236) = 4.02$, $p = .046$, $\eta_p^2 = .017$, $f = .11$ (see Figure 2). This interaction stemmed from the fact that although positive thoughts led to more favorable attitudes than negative thoughts under both low pitch, $F(1, 236) = 188.72$, $p < .001$, $\eta_p^2 = .444$, and high pitch, $F(1, 236) = 103.97$, $p < .001$, $\eta_p^2 = .306$, attitudes were more polarized in the former conditions.

Thought confidence. A 2 × 2 ANOVA revealed a significant main effect of thought valence, $F(1, 236) = 80.03$, $p < .001$, $\eta_p^2 = .253$, such that participants assigned to the positive thought condition (M = 5.07, SE = .09) were less confident in their thoughts than participants assigned to the negative thought condition (M = 6.16, SE = .09). No main effect of pitch was found, $F(1, 236) = .60$, $p = .439$, $\eta_p^2 = .003$. No interaction was predicted or detected, $F = .55$, $p = .459$, $\eta_p^2 = .002$.

Figure 2. *The Effects of Thought Valence and Channel Pitch on Attitudes*



Discussion

Experiment 2 replicated the pattern shown in Experiment 1 regarding the interplay between thought valence and pitch on attitudes. Specifically, the impact of the valence of thoughts on attitudes increased when the process of generating thoughts was associated with low (vs. high) pitch sounds that occurred as the thoughts were typed. These data raise the possibility that the effect of pitch on attitudes transcends voice since the pattern replicated Study 1 even when pitch came from a keyboard. Although the pitch emitted from a keyboard while typing has no obvious relevance to any specific psychological state the participants might be experiencing, it could be the case that people derive and use information from such factors, nonetheless. This experiment provides evidence that the effects of pitch on attitudes can extend beyond situations in which changes in pitch emerge from the message source as well as from the message recipient. Importantly, we provide further support to the notion that pitch can affect persuasion through processes of thought reliance. Again, however, pitch failed to impact measured thought confidence.

Experiment 3

Experiment 3 was designed to examine whether the impact of pitch on attitudes might emerge when the origin of pitch was not associated with the recipients who expressed their thoughts; that is, through exposure to pitch heard in the background while people generated thoughts. Additionally, Experiment 3 explored whether findings from Experiments 1 and 2 could be replicated in the absence of a persuasive proposal. In this experiment, participants first listed either positive or negative thoughts about their academic abilities while listening to either low or high pitch meditation-style music playing in the background.

Asking people to generate either positive or negative thoughts is a procedure capable of changing attitudes through a process of self-persuasion (e.g., Briñol et al., 2012; Killeya & Johnson; 1998). Therefore, instead of using a traditional persuasion paradigm in which an external message is presented with a proposal (e.g., mandatory exams), this experiment used a self-persuasion paradigm in which participants were asked to generate thoughts about a different topic (academic skills) in the absence of any external message. The topic of this study was high in personal relevance and thus thinking was likely to be high. Importantly, we argue that our validation logic can apply to any mental contents, regardless of how those initial thoughts are generated and regardless of whether the thoughts are about an external proposal or about academic skills. That is, the confidence that comes from pitch can be misattributed to any thoughts regardless of how those thoughts are generated in the first place (e.g., in response to a persuasive proposal or an external request), and regardless of whether the thoughts are about the self or about a topic like comprehensive exams. The essential point is that those initial thoughts can change subsequent evaluations (e.g., attitudes about exams, attitudes about the self), and do so to a greater extent for low (vs. high) pitch.

Next, participants indicated their attitudes toward the self (dependent variable). Then, participants rated how confident they were in each thought (potential mediator). We expected that when the expression of thoughts took place in an environment in which a low (vs. high) pitch sound could be heard in the background, this low (vs high) pitch would lead to increased thought usage and attitude polarization. Finally, we once again examined whether pitch would affect perceived thought confidence, and if so, if it served in a mediational role.

Method

Participants and design. Undergraduates (N=269) from Instituto de Empresa University (IEU) in Madrid, Spain (180 females, 85 males, 4 other; M_{age} = 20.62; SD = 4.31) were randomly

assigned to conditions in a 2 (Thought Valence: positive versus negative) × 2 (Pitch: low versus high) between-participants factorial design. All data were collected online by sharing a link to the experiment via email. Before starting the experiment, all participants provided informed consent and were assured that their responses were anonymous. After completing the experiment, all participants were debriefed. Sample size was calculated based on the average effect size of the core two-way interaction in Experiments 1 and 2 (f = .16). Results of a G*Power analysis (Faul et al., 2007) indicated that the desired sample size for a two-tailed test with an effect size of f = .16 and .80 power was N = 309. Our final sample (N = 269) was below that number because we chose to stop data collection at the end of the academic year. A sensitivity analysis indicated that our final sample size had .80 power to detect an effect size of f = .17.

Procedure. Before starting the experiment, participants read a brief introduction designed to encourage them to think carefully about the information in the experiment and respond honestly to all questions, as in our prior experiments. Participants were then randomly assigned to list either three positive or negative thoughts about their general academic abilities. While listing their thoughts, a meditation-style song was played in the background. Half of the participants were randomly assigned to a condition in which the pitch of the music was digitally manipulated to be lower than the original recording and the other half were assigned to a condition in which the pitch was manipulated to be higher.

After the thought listing task, participants answered several questions regarding their general attitude toward their academic ability. Next, participants were shown the thoughts they had previously listed and were asked to rate how confident they were in each thought. After this, participants answered a series of demographic and ancillary questions and were debriefed and excused.

Independent Variables

Thought valence. Participants were randomly assigned to one of two conditions that required them to write down either three positive or three negative statements regarding their perceived overall academic skills. Participants were informed of the importance of their answers and asked to be as specific as possible in their responses. Prior research has shown that self-assessments vary as a consequence of thinking about personal strengths and limitations (e.g., Briñol & Petty, 2003; Briñol et al., 2009, 2013; Tice, 1992).

Pitch. Participants were randomly assigned to one of two conditions in which they heard a piece of meditation style instrumental music (i.e., no lyrics) whose pitch had been digitally manipulated using an advanced audio program (Audacity©) to be either relatively lower (-60Hz) or higher (+90Hz) than the original baseline (432Hz). Manipulation of the pitch with the recording software ensured that no other feature of the sound (e.g., volume, speed) was changed except pitch. Each condition was created using the same baseline, which can be accessed via the following link: (https://www.youtube.com/watch?v=eWLVBP3VrO4&t=794s). The music was always played for the same duration of time (i.e., 10 minutes) to ensure that all participants had an opportunity to list up to three thoughts before the music stopped. Given this duration, it is likely that the music was still playing in the background while participants completed the attitude and thought confidence measures, which were presented immediately following the thought listing measure.

Dependent Measures

Thought Favorability. The same procedure used in Experiments 1 & 2 to determine thought favorability was used in the current Experiment.

Attitudes. Participants indicated their perceptions of their academic competence using the same 7-point unipolar scales as in Experiment 1: good, bad, positive, and negative. The scales were anchored by 1 = *Not at all*; 7 = *Definitely*. Item ratings were highly correlated ($\alpha = .83$) and were averaged to form one overall attitude index. Higher scores reflect more positive attitudes toward one's academic abilities.

Thought confidence. Participants indicated the extent to which they were confident in each of their three thoughts using a 7-point Likert scale anchored by 1 = *Not at all*; 7 = *Extremely*. Item-ratings were highly correlated ($\alpha = .82$), thus were averaged to form one overall thought confidence index. Higher scores reflect more confidence in one's thoughts.

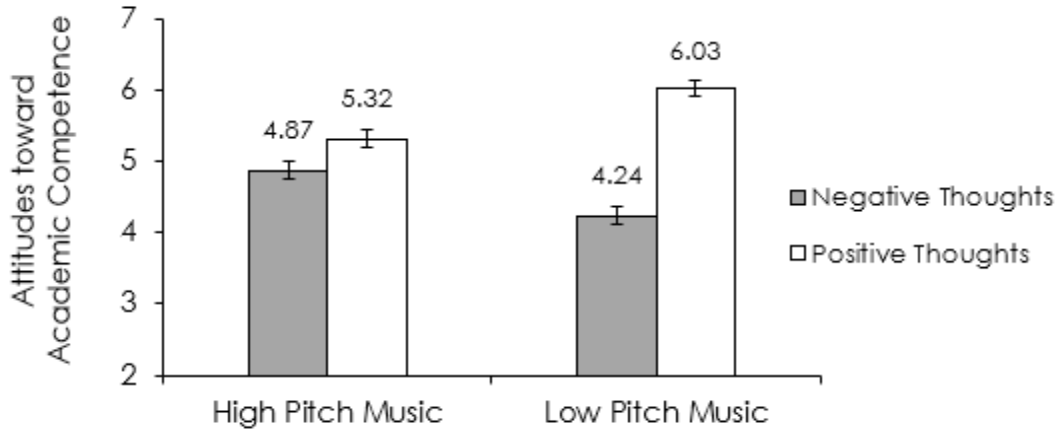
Results

Thought Favorability. A 2 × 2 ANOVA with thought valence and vocal pitch as the independent variables revealed a main effect of thought valence such that participants assigned to the positive thoughts condition ($M = 0.97$, $SE = .05$) had more favorable thoughts toward the exams than those assigned to the negative thoughts condition ($M = -0.89$, $SE = 0.05$), $F(1, 265) = 2818.55$, $p < .001$, $\eta_p^2 = .914$. A significant effect of pitch also emerged, $F(1, 265) = 4.22$, $p = .041$, $\eta_p^2 = .016$, such that participants in the low pitch condition generated more favorable thoughts ($M = 0.088$, $SE = 0.49$) than participants in the high pitch condition ($M = -0.005$, $SE = 0.51$), The two-way interaction did not reach significance, $F(1, 265) = 0.013$, $p = .910$, $\eta_p^2 < .001$.

Attitudes. A 2 × 2 ANOVA with thought valence and music pitch as the independent variables and attitude towards own's own academic competence as the dependent variable revealed a main effect of thought valence showing that participants assigned to the positive thoughts condition ($M = 5.67$, $SE = .08$) had more favorable self-attitudes than participants assigned to the negative thoughts condition ($M = 4.55$, $SE = .08$), $F(1, 265) = 105.21$, $p < .001$, $\eta_p^2 = .28$. No main effect of music pitch emerged, $F(1, 265) = 0.15$, $p = .696$, $\eta_p^2 = .001$.

More relevant to the present concerns was a significant two-way interaction between thought valence and music pitch, as predicted, $F(1, 265), = 37.51$, $p < .001$, $\eta_p^2 = .124$, $f = .37$ (see Figure 3). As in Experiments 1 and 2, this interaction resulted from the fact that although positive thoughts led to more favorable attitudes than negative thoughts under both low pitch, $F(1, 265) = 139.81$, $p < .001$, $\eta_p^2 = .35$, and high pitch, $F(1, 265) = 8.19$, $p = .005$, $\eta_p^2 = .030$, attitudes were more polarized in the former conditions.

Figure 3. *Effects of Thought Valence and Background Music Pitch on Attitudes*

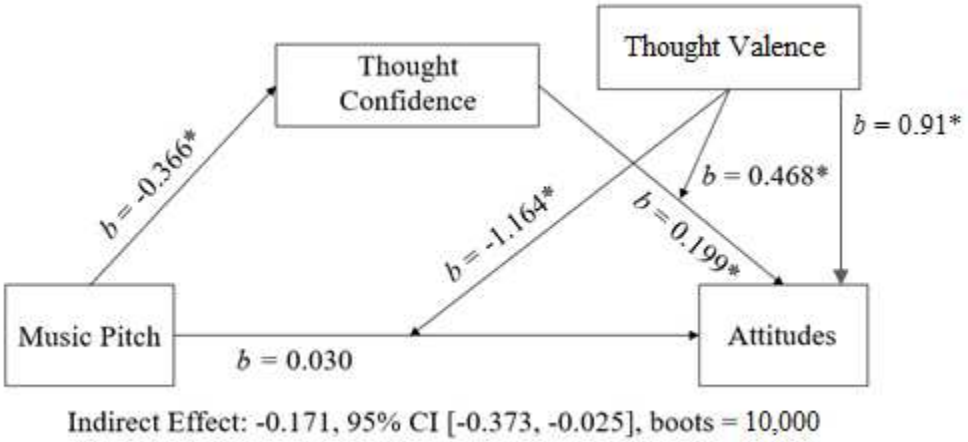


Thought confidence. We examined the effects of thought valence and music pitch on the extent to which participants perceived themselves as confident in their thoughts. A significant main effect of thought valence emerged $F(1, 265) = 70.92$, $p < .001$, $\eta_p^2 = .21$, such that participants assigned to the positive thoughts condition ($M = 6.01$, $SE = .10$) were more confident in their thoughts than participants in the negative thoughts condition ($M = 4.80$, $SE = .10$). Furthermore, a significant main effect of music pitch emerged, $F(1, 265) = 6.19$, $p = .013$, $\eta_p^2 = .023$, such that participants assigned to the low pitch condition ($M = 5.58$, $SE = .10$) were more confident in their thoughts than participants assigned to the high pitch condition ($M = 5.23$, $SE = .10$). No interaction was predicted or detected, $F = .04$, $p = .851$, $\eta_p^2 = .000$.

Mediation analysis. To examine whether self-reported thought confidence mediated the effect of pitch on attitudes toward one's academic abilities, a bias-corrected bootstrapping procedure was conducted with 10,000 bootstrap re-samples using Hayes process macro (Model 15; Preacher & Hayes, 2004; Shrout & Bolger, 2002). In this analysis, music pitch was the independent variable, attitude toward participant's own academic abilities was the dependent variable, thought confidence was the mediating variable, and thought valence was a moderator of the b-path from thought confidence to attitudes (and the direct path from pitch to attitudes, see Figure 4). This approach includes procedures that bootstrap a 95% CI around two conditional indirect effects (one in the negative thought condition, and one in the positive thought condition), with significant mediation indicated when these CIs do not include zero. It also tests if the conditional effects differ from one another. We would expect that the conditional indirect effects would differ from one another and from zero, because lower pitch should produce more negative attitudes through higher thought confidence in the negative thought condition (producing a positive indirect effect, henceforth "IE"), but lower pitch should produce more positive attitudes through higher thought confidence in the positive thought condition (producing a negative IE). As expected, the 95% CI of the moderated mediation index did not include zero, $CI_{MMI} = [-.37, -.03]$, indicating that the conditional indirect effects differed significantly from one another. As expected, the indirect effect was significantly negative in the positive thought condition, $IE = -.16$ [-.33, -.02], but unexpectedly it was non-significant in the negative thought condition, $IE =$

.01 [-.03, .07].[1] This and the analysis in Footnote 2 provide evidence of the predicted mediation by thought confidence.[2]

Figure 4. *Effects of Thought Valence × Music Pitch, mediated by Thought Valence × Thought Confidence, on Attitudes.*



Discussion

Experiment 3 conceptually replicated the patterns found in Experiments 1 and 2 regarding the interplay between thought valence and pitch on attitudes. Specifically, self-evaluations were more affected by the induced valence of thoughts in a context in which the background music was programmed to be low (vs. high) in pitch. Moreover, these data revealed that the effect of pitch on attitudes was mediated by perceptions of confidence in one's thoughts. That is, the confidence induced by pitch was presumably misattributed to the thoughts available in mind at that time even though the content of those thoughts was unrelated to the incidental background music. Thus, we were able to conceptually replicate the finding from Experiment 2

[1] For purposes of comparison with prior SVT research which reported mediational analyses using Hayes process macro, Model 4 (Preacher & Hayes, 2004; Shrout & Bolger, 2002), we also conducted a bias-corrected bootstrapping procedure with 10,000 bootstrap re-samples using Model 4. In this analysis, the thought direction × music pitch interaction term (product) was the independent variable, attitude toward participant's own academic abilities was the dependent variable, and the thought valence × thought confidence interaction term was the mediating variable. This approach includes procedures that bootstrap a 95% CI around the indirect effect, with significant mediation indicated when this CI does not include zero. The result of this bootstrapping procedure revealed that the 95% CI of the indirect effect (i.e., the path through the mediator) did not include zero, CI = [-.33, -.05], suggesting that thought confidence helped to explain the influence of pitch on attitudes.

[2] Analyses of a manipulation check item designed to assess whether participants "noticed a sound in the background while writing their thoughts" revealed that 52 of the 269 participants in Experiment 3 reported not noticing a sound in the background. Thus, we re-ran all analyses in Experiment 3 after removing these participants from the data file. Results confirmed that all effects observed using the full sample (both in moderation and mediation analyses) remained significant when these 52 participants were excluded. Furthermore, we also re-ran all analyses using only the 52 participants who reported not noticing the sound in the background. Although not necessarily expected due to the small sample size, the effect on attitudes of the two-way interaction between thought direction and pitch remained significant for those 52 participants as well, $F(1, 48), = 11.84$, $p = .001$, $\eta p^2 = .198$. This suggests that it might not be necessary for participants to consciously be aware or recall the sound for it to have had an impact. However, mediation by confidence was not significant for this small subsample of participants (CI = -0.15, 0.67).

that pitch can affect thought usage even when the source of pitch is not logically relevant as a basis for making inferences regarding the quality of one's thoughts. Furthermore, Experiment 3 demonstrated that the effect of pitch on thought usage emerged even when the source of pitch was completely detached from the expression of thoughts. That is, whereas pitch was directly associated to the expression of thoughts in Experiment 1 (recipients who generated the thoughts), and indirectly linked to the expression of thoughts in Experiment 2 (keyboard sound while typing thoughts), Experiment 3 fully separated the source of pitch from the person expressing thoughts.

Additionally, whereas the focal object in the first two experiments was external to the participant (comprehensive exams), in Experiment 3, the focal object was now internal to the participant: attitudes towards their own academic abilities. This suggests that the effect of pitch on thought use can generalize to different content of thoughts and occur regardless of whether the target of one's thoughts is about the self or not. As noted, any treatment (e.g., appeals, explicit requests) that elicits primarily favorable thoughts toward a particular attitude object (e.g., exams, the self) produces more favorable evaluations (more persuasion) than treatments that elicit mostly unfavorable thoughts toward that object, and this research shows that those valenced thoughts are more consequential for low (vs. high) pitch.

Finally, Experiment 3 showed that pitch was capable of affecting thought confidence, and that changes on confidence significantly mediated the impact of pitch on attitudes, at least for positive thoughts. Notably, in Experiments 1 and 2, exposure to the source of pitch was present only when participants listed their thoughts but not when they reported their attitudes or thought confidence. That duration of pitch exposure was enough to observe the expected results on attitudes in both studies, but not to influence ratings of thought confidence. Based on the findings of the first two experiments, we did not expect that the attitude results obtained for Experiment 3 would change if the music in the background had been stopped earlier (e.g., stopped immediately after participants finished listing their thoughts). However, the effects of pitch on rating confidence might have been affected if the circumstances changed. That said, future research in this context should establish the extent to which pitch needs to be present at the time participants report their attitudes and confidence (as in Experiment 3) or whether it is enough that the source of pitch is present exclusively at the time when thoughts are generated but not when completing the dependent variables (as in Experiments 1 and 2).

General Discussion

Prior research has established that the pitch of persuasive sources could affect recipients' perceptions of speaker confidence and subsequent attitude change by affecting the valence and number of thoughts people generate in response to a persuasive proposal. As noted, this previous research only examined how the relationship between vocal pitch and confidence could influence persuasion in the context of changing primary cognition processes. Instead of focusing on primary cognition, the present research examined whether pitch might also influence persuasion in accord with predictions based on meta-cognitive processes of secondary cognition (i.e., via thought reliance), thus expanding theoretical understanding of how pitch can shape persuasion.

Moreover, as noted, prior research has only explored the pitch-confidence link by manipulating the vocal qualities of the persuasive source advocating for a proposal by speaking to participants. The present research was designed to test whether any effects of pitch on persuasion would still emerge when manipulating pitch beyond the message source. Specifically, we tested the impact of pitch when the origin of pitch was (a) both the source and recipient of persuasion (participants verbalizing their own thoughts), where one's own pitch is directly relevant for making inferences about one's own thoughts (Experiment 1), (b) indirectly relevant

to one's thoughts because pitch originated from the computer keyboard when thoughts were typed (Experiment 2), and (c) completely dissociated from one's thoughts because pitch came from background music (Experiment 3). As predicted, we found convergent evidence across different paradigms (i.e., topics of high personal relevance: the self; and for other topics: exams), procedures, mediums of data collection (online and in person) and materials that pitch can impact the extent to which people rely on their thoughts when making evaluations about a target, whether pitch was linked or not linked to those thoughts, and regardless of the content of those thoughts.

The SVT framework (Briñol & Petty, 2022) posits that factors commonly associated with perceived validity (ease, power) have the potential to increase thought usage regardless of the thoughts' content or the incidental nature of the validating variable. For this reason, Experiment 3's finding that thought confidence mediated the effects of pitch only for positive (not for negative) thoughts was unexpected. Thus, we conducted an internal meta-analysis across our three experiments to determine if both manipulated pitch and measured thought confidence each increased the effect of both positive and negative thoughts on attitudes (see Supplementary Online Materials for details). Indeed, we found that thoughts (both positive and negative) predicted subsequent attitudes to a greater extent for those who were assigned to the low (vs. high) pitch condition. Additionally, thoughts (both positive and negative) predicted subsequent attitudes to a greater extent as participants' reported thought confidence increased.

Theoretical Insights

Research is increasingly uncovering the different processes by which variables can influence persuasion in different situations (Petty et al., 2019). Most relevant to the current project, previous research on SVT has addressed questions such as under what circumstances are people most likely to make inferences about thought validity, and subsequently rely on the perceived validity of their thoughts to influence relevant judgments. Moderators of validation processes include the extent of thinking in which the person is engaged and the timing of the validation induction (Briñol & Petty, 2022). In the current studies, inductions of pitch accompanied thought generation in conditions set to be high in motivation to think (e.g., personally relevant topics), therefore facilitating the operation of self-validation processes. Recall that existing literature has focused only on identifying different processes by which attitudes can be affected by positive properties of voice (e.g., confidence, power) in the context of predictions based on primary (but not secondary) cognition (see Guyer et al. 2018). Thus, our data add to the literature on the persuasive effects of pitch by providing the first evidence that under high-thinking conditions, and when pitch accompanies thought generation, pitch can affect attitudes in a manner predicted by the meta-cognitive process of thought-validation.

According to the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986; Petty & Briñol, 2012), the link between variables like pitch and persuasion can vary as a function of the processes by which pitch is more likely to work. Which specific process emerges is determined by where a person falls on the elaboration continuum (i.e., from low-elaboration to high-elaboration), a construct which reflects the extent to which a person is motivated or enabled by individual and situational factors to think carefully about the information in a persuasive message. When ability and motivation to think are high (i.e., high elaboration), people tend to carefully examine the quality of the evidence provided. In contrast, when ability and/or motivation are low, careful examination of the evidence is less likely.

Thus, at the low end of the elaboration continuum, a variable (e.g., paralinguistic markers of confidence such as vocal pitch) is more likely to influence attitudes by functioning as a simple

peripheral cue, whereby evaluative judgments about a target arise by way of a low thought process such as serving as a heuristic, classical conditioning, or a self-perception process (e.g., the message must be right because the speaker seems confident). At the high end of the elaboration continuum, a variable (pitch) affects attitudes by processes that require more thought. For example, at high elaboration, pitch can either (1) serve as an argument for or against the message, (2) bias the valence of message-relevant thoughts to be more or less favorable, or (3) as we demonstrate for the first time in the present research, pitch can determine whether an individual relies on their own thoughts generated in response to a message. In the middle of the elaboration continuum, when message processing is not constrained to be either high or low by other factors, a variable like pitch can affect the amount of processing that occurs.

In summary, prior research had only investigated how vocal qualities of the message source influence persuasion and only focused on processes of primary cognition (e.g., Guyer et al., 2019). The novelties of the present research can be summarized as twofold. The first innovation centers on the fact that our studies examined how vocal qualities, such as pitch, plausibly can affect persuasion via processes of secondary cognition by affecting thought reliance. The second novelty is that we examined the effects of pitch beyond the persuasive source, investigating its impact for situations in which pitch comes from the background and the channel of persuasion. In closing, we refer the reader to the supplementary online materials for further information regarding a meta-analytical mediation test across studies, a sensitivity analysis, and beyond (e.g., a discussion of potential demand effects in Study 1).

Practical Applications and Future Directions

These data hold promise for their practical relevance in a variety of applied contexts. At a broad level, consider how a better understanding of vocal properties might translate into increasing the effectiveness of auditory or written consumer reports or background sounds at a store. More relevant to the present research, these data suggest that the persuasive effects of one acoustic property associated with voice (i.e., pitch), can emerge even when the origin of pitch is completely unrelated to the individual or group seeking to persuade. This information could be applied by marketers aiming to increase the impact of the initial responses generated by consumers on their attitudes toward a given product (assuming those responses were positive) by incorporating low pitch music into a purchasing context, whether in a physical store or on a website, assuming that the initial thoughts generated are positive and thinking conditions are high. Additional applications might include clinical settings intended to improve patient self-perceptions, healthcare contexts in which individuals recovering from surgery are often encouraged to think about a full recovery, and even televised or radio advertisements encouraging environmentally friendly behaviors such as recycling. The use of background pitch could also be employed in televised or radio announcements intended to increase the impact of negative thoughts on consumer's attitudes towards products that carry detrimental effects to health, in public service announcements discouraging environmentally unfriendly behavior such as littering, and even boycotting corporations who take advantage of workers through low wages and poor working conditions in order to increase company profits.

In thinking about potential directions for future research, it is important to bear in mind that the meaning attached to variables that affect thought validity, such as pitch, is flexible. First, the present results rely on the idea that low pitch is typically associated with high confidence, and the results (most explicitly Experiment 3) bear that out at least under certain conditions. More broadly, the external stimuli that people encounter (e.g., pitch in the background) can have default or common meanings when related to personal experiences that people have (e.g., low

pitch is associated with validity and/or pleasantness). However, changing the meaning of pitch (from high to low validity, or vice versa), would change the effect that the experience of this variable has on thought usage. Thus, the meaning of many validating variables (e.g., ease, power) can depend on the person or the situation. For example, discovering that the reason a speaker is communicating using low pitch is because of an illness is more likely to lead the recipient to associate pitch with sickness, a negative meaning, rather than with high validity, a positive meaning (Niedenthal et al. 2009; Topolinski & Strack, 2009; Willems & Casasanto, 2011).

Second, if people perceive pitch to be a potential source of bias (i.e., a mental contamination that they believe should not affect their judgments; Petty & Wegener, 1993; Wilson & Brekke, 1994), they might attempt to correct for this perceived bias by adjusting their evaluations. For example, if the pitch of the background music (Experiment 3) is made salient to participants and they perceive pitch as something capable of contaminating their judgments, they will likely engage in correction processes to adjust their judgments away from those unwanted influences (e.g., Schwarz & Clore, 1983).

Finally, in addition to measuring attitudes toward attitudinal objects unrelated to the thoughts listed (e.g., toward the music, toward the room), one limitation of the present work is that we do not directly assess feelings of power and other potentially relevant constructs (e.g., ease, pleasantness) that could contribute to a better understanding of the link between pitch and confidence. Indeed, consistent with this possibility, previous research on SVT has shown that variables other than pitch (e.g., induction of dominant postures, taking on powerful roles, thinking about experiences of having power, perceiving that one´s thoughts are supported by the majority) can induce feelings of power and therefore increasing confidence and subsequent reliance on one's thoughts (e.g., Briñol et al., 2007*;* see Briñol et al., 2017, for a review on validation through power).

In conclusion, the present research showed that, in addition to pitch impacting attitudes via processes predicted by theories of primary cognition (e.g., amount and valence of thoughts) as in prior research, pitch can also influence persuasion in accord with theories that postulate meta-cognitive processes of secondary cognition (i.e., reliance on thoughts). Additionally, the current work also showed that the effects of pitch on attitudes still emerged when manipulating pitch beyond the message source.

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