Don't You Say it that Way!

Experimental Evidence that a Controlling Voice Elicits Defiance

Netta Weinstein*
Cardiff University

Maarten Vansteenkiste
Ghent University

Silke Paulmann
University of Essex

Corresponding Author:
School of Psychology
Cardiff University
70 Park Place
Cardiff, Wales CF10 3AT
Email: weinsteinn@cardiff.ac.uk

Abstract

Motivational messages can be communicated in a controlling or pressuring way, or alternatively, speakers can support listeners' sense of choice and self-initiation. Despite this being a key aspect of daily life, little is known about the outcomes of different motivational tones on listeners' experiences. In three experiments, we tested the extent to which a controlling – rather than an autonomy-supportive – tone of voice elicited defiance, a tense desire to do the exact opposite of what motivators are asking and hoping for. Study 1 found evidence that motivational speakers using a controlling tone were perceived as more pressuring than supportive and, through these perceptions, they elicited defiant reactions from listeners. Study 2 replicated this effect and identified a perceived controlling style to be the primary predictor of defiance, even when accounting for the reduced warmth and increased power communicated by speakers using controlling tone of voice. In a final study, we observed that both semantics (i.e., words) and prosody (i.e., tone of voice) independently communicate controlling versus autonomy-supportive messages and, through doing so, elicit defiant reactions. Yet, when used in combination – likely the most typical way that motivators communicate control – they elicited the most defiance from listeners. Findings are discussed in the context of developmental, organizational, and social literatures which are concerned with how listeners can be best motivated to act.

Keywords: prosody; motivation; self-determination theory; defiance; control

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Motivational communications are those that mean to stimulate others to action (Grolnick & Ryan, 1987; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). They can take different forms, with implications in terms of how those being motivated respond to the stimulating attempt. For example, imagine a scenario where a motivator would like to see a grant application submitted using words that may convey a sense of pressure, thereby pulling for obedience: "You *have to* complete this grant application!" Alternatively, the motivator may choose words to express support and to convey a sense of choice and self-initiative: "You *may* complete this grant application" (Ryan, 1982; Vansteenkiste et al., 2004). Apart from what motivators say, the tone they use to communicate their message may matter as well (Weinstein, Zougkou, & Paulmann, 2018). Even if motivators use simple phrasing without pressuring or supportive words (e.g., "You will need to complete this grant application"), they could still communicate pressure by stating an instructional phrase using a harsh and firm tone of voice, or alternatively, communicate in a more inviting and supportive way through a softer and more gentle tone of voice. Though more subtle, the tone of voice in itself may impact on the *functional significance* or attributed meaning of the message (Deci & Ryan, 1985), thereby eliciting very similar reactions from listeners as the type of words used (Zougkou et al., 2017). Herein, we examine whether instructions given in a harsh tone may be sufficient to elicit feelings of defiance in the listener, that is, the desire to ignore the request and do the exact opposite of what is requested because their freedom for action is undermined (Van Petegem, Soenens, Vansteenkiste, & Beyers, 2015). We present findings of three experimental studies, thereby examining the independent and combined effects of controlling tone of voice and semantics in the prediction of oppositional defiance, while also controlling for other qualities (i.e., warmth, power) attributed to the motivator using a

controlling tone of voice.

Controlling versus Autonomy-Supportive Motivating Styles and Defiance

Central within Self-Determination Theory (SDT; Ryan & Deci, 2017) is the claim that human beings have the natural desire to experience a sense of choice and psychological freedom in their thinking, feeling, and acting. When people have this inherent psychological need for autonomy met, they report a myriad of positive outcomes, including improved well-being (Yu, Levesque-Bristol, & Yukiko, 2018), greater engagement (Jang, Kim, & Reeve, 2016), and more flexibility and openness (Hodgins & Knee, 2002). To nurture individuals' need for autonomy, motivators do well to adopt an autonomy-supportive motivating style, which involves validating individuals' frame of reference, supporting individuals' pace of development, building in choice, and offering a meaningful rationale in case choice is constrained (Reeve, 2009; Ryan & Deci, 2017; Soenens, Vansteenkiste, Van Petegem, Beyers, & Ryan, 2018).

Dozens of studies have documented that to the extent socializing agents in a motivating role, such as parents, coaches, teachers or health care providers, are perceived to adopt an autonomy-supportive approach, those being motivated benefit. A perceived autonomy-supportive motivating style has been found to relate to higher well-being (Vansteenkiste, Zhou, Lens, & Soenens, 2005), greater self-regulation (Perry et al., 2018), and improved performance (Gillet, Vallerand, Amoura, & Baldes, 2010; Wong, 2008). In contrast, a perceived controlling environment relates to both internalizing problem behavior (e.g., depressive symptoms, anxiety) as well as externalizing problem behavior (e.g., aggression; Pinquart, 2017; Soenens & Vansteenkiste, 2010).

At first sight, the use of controlling tactics may appear efficient as those subjected to the imposed pressure may give in to the encountered pressures. Congruent with this idea, a perceived controlling environment predicts adolescents' compulsive compliance with the

pressuring request for cooperation (Brenning et al., 2019; Chen et al., 2016). Yet, one intriguing effect that has also emerged from this literature is that those who experience the motivational climate to be controlling rather than autonomy-supportive may respond to the motivator with an increased tendency to want to rebel against her or him, or to do the opposite of what is asked, a psychological reaction known as *defiance* (Vansteenkiste, Soenens, Van Petegem, & Duriez, 2014) or *reactance* (Brehm, 1989). This compensatory reaction emerges when individuals are motivated to reassert their autonomy because the environment is perceived as a threat to their freedom (Brehm, 1989) and sense of volition (Vansteenkiste & Ryan, 2013). Both correlational (Vansteenkiste et al., 2014) and experimental (De Meyer et al., 2016) studies have shown that controlling environments predict greater defiance. The few studies that included both the outcomes of compulsive compliance and defiance even indicated that a perceived controlling climate more strongly predicts the latter, suggesting an unintended backfiring effect (Brenning et al., 2019).

The outcome of defiance in the context of human motivation is an important one because defiant reactions signal that the motivational communication is not effective. If in the process of trying to activate others and stimulate them to act, the motivator instead produces resistance in the listener, it is arguably better not to have attempted to motivate others at all. In the context of persuasive communication, for example, individuals high in dispositional reactance (i.e., defiant experiences) are more likely to view written informational communications about the undesirable effects of drinking and smoking as threatening their decision-making and, as a result, they adopt more negative attitudes toward the messages and formulate a lowered intention to reduce these undesirable behaviors (Pavey & Sparks, 2009).

Furthermore, the occurrence of defiance helps to explain why individuals who perceive the context as more controlling versus autonomy-supportive are more vulnerable to externalizing problems (Van Petegem et al., 2015a), increased distance taking from

significant others (Van Petegem, Vansteenkiste, Soenens, Beyers, & Aelterman, 2015),

greater intention to conceal important information about one's behavior (Weinstein &

Przybylski, 2018), and more hostile responding in general (Brehm, 1966; Dillard & Shen,

2005; Hodgins, Brown, & Carver, 2007). This overview suggests that defiance is a defensive

compensatory behavior in response to encountered contextual pressures, yet its engagement

comes with considerable personal and interpersonal costs (Vansteenkiste & Ryan, 2013).

Autonomy-supportive and Controlling Communication Styles

Autonomy-supportive and controlling motivating styles do not solely differ in the

type of practices being used (e.g. choice, giving a rationale), but also through the way

socializing agents communicate with those that need to be motivated. Yet, only a minority of

studies has zoomed in on the role of *motivating language* per se, thereby identifying and

examining the effect of the words used to convey the same message in more inviting,

informational, and autonomy-supportive or more threatening, evaluative, and pressuring

ways. Whereas controlling messages contain forceful language (e.g. "you should"; "you have

to"; Hooyman, Wulf, & Lewthwaite, 2014), commands (Ryan, 1982), and guilt-trips

(Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005) with the aim of pressuring the other

person into action, autonomy-supportive language is more inviting and informational (e.g.,

"you can"; "I propose"; "I ask"), thereby conveying a sense of choice and self-initiative.

These different forms of communication have received attention through three strands of

research.

First, controlling language has been assessed in a limited way as part of

multidimensional indices of *perceived* motivating styles. For instance, single items tapping

into evaluative and controlling language, broadly defined, get collapsed with other items

tapping into controlling versus autonomy-supportive strategies to form a composite score of

perceived autonomy support and perceived control (e.g., Mainhard, Brekelmans, & Wubbels,

2011). In one recent study building on this approach, Patall et al. (2018) made use of multi-item measures to tap into perceived controlling language (in addition to various other controlling and autonomy-supportive practices) and found that daily variation in science students' perceived use of controlling messages related uniquely to daily variation in their controlled study motivation and disengagement.

Second, in observational work among teachers (Haerens et al., 2013; Reeve & Jang, 2006) and parents (e.g., Bernier, Carlson, & Whipple, 2010; Deci, Ryan, & Williams, 1996; Wuyts, Soenens, Vansteenkiste, & Van Petegem, 2018), the use of controlling and autonomy-supportive language was observed and, similar to self-report research, collapsed with other practices to form a composite score of autonomy support and control. For instance, Wuyts et al. (2018) showed that mothers who were observed to use a more autonomy-supportive, relative to controlling, communication style when talking with their teenagers about friendships elicited more satisfaction from their adolescent children, who also disclosed more personal information during a 10-minute conversation.

A third line of research has experimentally examined these different types of motivating language, either in combination with other practices (e.g., Deci, Eghrari, Patrick, & Leone, 1994; Savard, Joussemet, Pelletier, & Mageau, 2013) or in isolation (e.g., Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005). To the extent they were studied in isolation, they have been operationalized through written instructions (e.g., Vansteenkiste et al., 2004), priming procedures (e.g., Banting, Dimmock, & Grove, 2011; Levesque & Pelletier, 2003), or oral instructions (e.g., Weinstein & Ryan, 2010). Also, different types of language have been manipulated when introducing a task (e.g., Hooyman, Wulf, & Lewthwaite, 2014) and when delivering feedback to participants (DeMuynck et al., 2017; Mabbe et al., 2018; Ryan, 1982). Regardless of the exact operationalization (i.e., written, priming, or orally) and the specific instance when the language was varied (i.e., during task

instruction or feedback delivery), the use of more inviting and informational language yielded more desirable effects compared to the use of pressuring language. Outcomes were as diverse as autonomy need satisfaction (Mabbe et al., 2018), deep-level learning (Grolnick & Ryan, 1987), intrinsic motivation (Ryan, 1982), performance (Vansteenkiste et al., 2004), and information retention (Hooyman et al., 2014) but none of them focused on defiance, the critical outcome herein.

Different Tones of Voice

Apart from this shortcoming, past research sheds little light on the role that tone of voice may play in the effects that these motivational messages have. As far as motivating language is manipulated through written instructions, it suggests that semantics suffice to elicit different reactions and outcomes among those reading the message. If instructions are orally provided, both the semantics and tone of voice may be driving observed effects (e.g., DeMeyer et al., 2016; DeMuynck et al., 2017). What is critical is to study different types of motivating prosody in isolation to examine whether it is an equally sufficient condition to produce different outcomes, but also in combination with different semantics to examine their unique role and potential interplay.

An emerging literature has begun to shed light on this issue, suggesting that motivational tone – motivational prosody – can be operationalized in terms of its controlling and informational meaning, with resulting meaningful effects on listeners' behaviors. That is, recent studies have identified prosodic qualities, with controlling, relative to autonomy-supportive, speech generally being expressed more loudly and with a harsher sounding voice. Further, speech that is perceived as controlling has been shown to link to less well-being and prosocial behavior intention in listeners (Weinstein, Zougkou, & Paulmann, 2018), and it is processed more acutely, that is within 200 ms after voice onset, as indicated in recent electro-physiological data (e.g., Paulmann, Weinstein, & Zougkou, 2019).

While there is thus ample evidence that listeners extract salient voice cues to form first impressions (Pell et al., 2015; Paulmann & Kotz, 2008; Ko et al., 2014), far less work has explored how vocal cues can predict social outcomes, though there is slowly accumulating evidence that listeners are influenced by voice cues when making decisions. For instance, Soman and Madan (2009) showed that the speaking style of individuals could successfully predict the outcomes of job interviews, suggesting that listeners were using voice cues to assess the quality of job applicants. Here, we will extend the limited literature relating prosody to listeners' reactions by testing whether prosody use by speakers elicits defiant reactions in listeners.

Present Research

While many speakers may be considerate of the words they use to stimulate others to act, they might underestimate the effect of tone of voice, and this oversight is echoed by a research body that has largely focused on listeners' reactions to semantics rather than prosody in controlling versus autonomy-supportive motivational speech (see Voße & Wagner, 2018; Weinstein et al., 2018 for exceptions). One meaningful way to explore listener reactions to these motivational styles of communicating is in terms of listeners' defiance – their tense desire to do the opposite of what is asked – since defiance represents a motivationally-relevant psychological experience that has been previously shown to have meaningful behavioral correlates (Dillard & Shen, 2005; Pavey & Sparks, 2009; Van Petegem et al., 2015, 2015a; Weinstein & Przybylski, 2018). In three experiments, we thus tested the extent that controlling sounding motivational prosody (which we use interchangeably here with tone of voice for ease of reading) elicits defiance (Study 1 through 3; Hypothesis 1), the extent to which prosody elicits defiance through perceptions of controlling communication (Hypothesis 2; Study 1 through 3) thereby controlling for other perceptions of speakers which may be elicited by controlling tones, namely, perceived power and reduced warmth (Study 2,

Bayes, 1972; Ko, Sadler, & Galinsky, 2014; Tjosovold, 1984), and the extent to which prosody elicits defiance independently of and in combination with the more established effect of controlling semantics (words; Study 3; Hypothesis 3).

Study 1

Study 1 was aimed at for the first time exploring whether controlling prosody elicits defiance in listeners, as compared to using autonomy supportive tone of voice to communicate the same lexical-semantic content (Hypothesis 1).

Method

Participants

Ninety-five native English speakers (50 males; 45 females) were recruited on Prolific Academic (Peer, Brandimarte, Samat, & Acquisti, 2017) for an Internet survey.[1] Previous studies show that survey respondents from online platforms such as this provide similar data to students and evidence higher intrinsic enjoyment of computer tasks (Farrell et al., 2017), greater effort (Farrell et al., 2017), and more attention (Hauser and Schwarz 2016) than do student participant pools. Furthermore, such samples have been successfully used for delivering audio stimuli manipulating prosody in recent research (Mauchand, Vergis, & Pell, 2019). The use of an online sample in this study offered a more diverse community sample representing broader age and sociodemographic characteristics than more homogeneous student samples. Yet, there may also be more noise in their answers attenuating the robustness of findings since participants were not sat in a controlled laboratory environment, and neither privacy, nor sound quality or volume of experimental stimuli could be held constant. Participants could, against recommendations, complete procedures from a public or

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[1] We received 96 responses, but one response was deleted before running any analyses because we identified it to be the second response from a participant with the same prolific ID

otherwise distracting space, or automatize responses. In this study, we did not test for, or exclude participants, on that basis.

Ages of participants ranged from 19 years to over 65 years old, (M = 36.4 years; SD = 11.60). We aimed for a sample of n = 90 to achieve a power of .80 for a moderate to large effect size f = .30 and α err probability = .05, for a one-way test fixed effects test contrasting two groups, but recruited five additional participants in case of technical errors due to using audio files. Sample size was determined before any data analysis took place for all studies. Two participants were deleted before any analyses were conducted because they reported in an open-ended query that the stimulus file did not open on their computer; thus, the total sample subjected to analyses included 93 respondents. These were randomly assigned to one of two conditions, a *Controlling* condition which presented spoken sentences which were pre-recorded by trained speakers with a controlling tone of voice, or an *Autonomy-Supportive condition*, which presented the same sentences but intoned by the same speakers with an autonomy-supportive tone of voice.

Experimental Materials

Stimuli were taken from a previously published inventory of spoken directive sentences – that is, sentences aimed at inducing or changing a certain behavior – manipulating only tone of voice and developed in Weinstein et al. (2018). Examples of directive sentences that were used as stimuli are "The pencil case belongs to" or "your marks will improve", and "why don't you go to school now". In this previous research, the five (one male) trained speakers whose spoken phrases were used in this study were from a local acting school. They received information on the nature of controlling and autonomy-supportive motivations, but were not instructed on how to intone these sentences to convey appropriate motivations. As discussed in Weinstein et al. (2018), two sets of scenarios had been developed to train actors on the nature of motivational qualities, one for each within-subjects

motivational condition. These scenarios had been adapted from one or more of the vignettes in the General Causality Orientations Scale (Deci & Ryan, 1985), a measure of autonomous and controlled orientation that describes interpersonal contexts imbued with these two motivational qualities. For example, one scenario involved the prompt (e.g., "You have a school-age daughter. On parents' night the teacher tells you that your daughter is doing poorly and doesn't seem involved in the work. You…") and described how one might respond with autonomy support ("Talk it over with your daughter to understand further what the problem is") or a controlling ("Scold her and hope she does better") response. Further, a trained researcher described controlling and autonomy-supportive motivational contexts without providing hints about tone of voice. Actors were encouraged to imagine themselves taking a more autonomy-supportive or controlling stance when uttering directive phrases. Recordings took place in a sound attenuated room in which speakers sat at an equal distance from high quality microphone during recordings for each condition; recordings were blocked for condition, but randomised across speakers. Presentation of sentences by male and female actors was randomized within condition and sexes were presented in the same proportions across the conditions. Ten sentences (mono channel recordings, sampling rate = 44.1 k*Hz*) were extracted from the full sample which focused on motivating in an educational context, having previously identified that an imagined school environment was a compelling motivationally-rich climate for manipulating prosody (Weinstein et al., 2018). While some sentence contexts were repeated they were not repeated by the same speaker. Sentences included: "Your marks will improve", "Why don't you go to school now", "Do well at the school play". The mean duration was 1.5 seconds for autonomy-supportive sentences, and 1.95 seconds for controlling sentences (1.84 seconds average across conditions). Acoustic parameters for this subset of materials were automatically extracted with customized scripts using *praat* software (Boersma, 2001). Results are presented in Appendix A. Descriptive

evaluations show that speakers used a higher mean pitch and spoke at a faster speech rate when uttering autonomy-supportive statements. Moreover, speakers exhibited more vocal effort when uttering controlling statements, resulting in the perception of a rough voice (as opposed to using a softer, more encouraging sounding voice for autonomy support). The latter finding is in agreement with results from previous studies (e.g., Weinstein et al., 2018) suggesting that a strident sounding voice is an important indicator of controlling statements.

Measures

Following listening to all sentences characterized by either autonomy-supportive or controlling voice based on assignment to condition, participants responded to a measure of perceived speaker motivation as a manipulation check, and their defiant feelings. Next, they reported on affective experiences for a separate project. These scales were selected either because they had been previously used to measure consequences of motivational prosody or, in the case of defiance, because they captured state experiences of defiance, presumably more sensitive to contextual changes, well. Participants responded to all measures by clicking in the appropriate box online.

Perceptions of speakers. Spoken sentences had been previously validated (Weinstein et al., 2018) to ensure each set of sentences communicated the correct motivational quality, but to ensure participants in this study also identified motivational styles, they were asked to respond regarding the speakers: "How much did the speakers that you listened to at the start of the study sound 1 (*supportive*) to 7 (*pressuring*)". Average responses across conditions showed good variability ($M = 4.71$, $SD = 1.83$), and this item was used as a check to ensure motivational tone was effectively manipulated.

Defiance. Participants were asked how much they felt defiant of the motivational communications, using nine items of the Hong Reactance Scale (Hong & Faedda, 1996) adapted to this context and to a state measure and paired with the prompt "*Listening to the*

speakers, the things that they said...'' (these were similarly used in Weinstein & Przybylski, 2018)*. Nine from the full set of 14 items tapping into *trait* reactance were selected because the five additional items (not tested) did not fit very well to a state measurement sensitive to contextual influences (e.g., "I find contradicting others stimulating"; "It disappoints me to see others submitting to standards and rules"). Examples of used items were "triggered a sense of resistance in me", "made me angry that my freedom of choice is restricted", and "made me want to resist attempts to influence me", and all participants responded on a scale ranging from 1 (*not at all*) to 5 (*very much*). The full scale (see Appendix B) showed good reliability, $\alpha = .95$, and items were averaged to create one score, *ranging from 1 (not defiant) to 5 (highly defiant),* reflecting defiant responses to motivational messages.

Procedure

The study procedure is depicted in Figure 1. Participants were recruited for a brief (~10 minutes) online study. Before the study, participants were instructed to run a quick audio test to ensure volume was at a comfortable level. Volume was not constant across participants; participants were asked to complete the study in a private, quiet space. We did not require participants to use headphones, but we did require them to do the study on a desktop/laptop computer.

They then gave consent to study procedures, completed demographic questionnaires, listened to the manipulation on a web page programmed to forward participants to surveys only after sufficient time had passed for the sound files to play. Each participant listened to an audio file presenting 10 sentences with identical semantic content across conditions, but which manipulated tone of voice as a function of random assignment to an autonomy-supportive or controlling condition. The experimental manipulation lasted a total of 29 seconds. In preparation for this task, participants were given the instructions: "This next task involves a bit of imagination... it is very important that you take the time and effort to

immerse yourself in this different experience. You will be presented with a small number of sentences. The speakers are expressing statements that you might hear when you are at school. As you hear these, try to imagine yourself in the role of the student, hearing these sentences in the real life. It is very important that you imagine the speaker is talking directly to you; as you do so, please imagine your thoughts and feelings in having these experiences. After listening to these sentences, you will be asked to spend a few minutes writing about your thoughts and feelings in relation to these sentences." These instructions, tied to a specific context to enhance the effect of the motivational styles, were taken from Weinstein et al. (2018). Finally, participants reported on perceptions of speakers and their felt defiance, in that order, reflecting back on the various sentences that had been played simultaneously. At the end of the study, participants were debriefed regarding study procedures.

Results

Preliminary analyses. Age correlated negatively with defiance, $r = -.22$, $p = .04$, while being unrelated to perceptions of speakers. Gender did not relate to either defiance or perceptions, $ps > .40$.

Primary analyses. A multiple analysis of covariance (MANCOVA) was conducted simultaneously predicting both outcomes, while entering gender and age as covariates.[2] Overall, condition affected outcomes, $F(2, 88) = 9.04$, $p < .001$, $\eta_p^2 = .17$. Specifically, the Controlling condition ($M = 5.35$, $SD = 1.59$) elicited higher perception of speakers as pressuring versus supportive when compared to the Autonomy-Supportive condition ($M = 3.95$, $SD = 1.86$), $F(1, 89) = 15.60$, $p < .001$, $\eta_p^2 = .15$. Also, the Controlling condition ($M = 2.30$, $SD = .98$) triggered more defiance than did the Autonomy-Supportive condition ($M = 1.74$, $SD = 1.07$), $F(1, 89) = 6.94$, $p = .01$, $\eta_p^2 = .07$.

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[2] Results were identical in significance, and nearly identical in effect size when models did not adjust for gender and age for this and future studies.

Next, a test of an indirect effect was run in PROCESS (Model 4; Hayes, 2017) to explore whether motivational prosody elicited defiance through listeners perceiving speakers as being pressuring. This provided an evaluation of our hypothesis that perceived speaker motivation was a proximal outcome of prosody that would in turn elicit the proposed outcome, namely, defiance. As expected (see Figure 2), findings showed perceiving speakers as more pressuring was linked to higher defiance in this study, $b = .15$, $t = 2.52$, $p = .01$. When this proposed mediator was included in the model, the direct effect of condition on defiance fell to non-significance, $b = .35$, $t = 1.55$, $p = .12$. The model showed the indirect effect of condition on defiance through motivation perception was significant, $b = .22$, $se = .11$, 95% CI [.05, .50].[3]

Brief Discussion

Study 1 provided first experimental evidence that listening to motivators speaking with controlling versus autonomy-supportive voice predicts listeners feeling more defiant to those messages. This informs motivational and social influence literatures that have focused on how speakers employ specific *words* to create controlling or autonomy-supportive climates. Study 1 provides preliminary evidence that speakers' tone of voice alone can have meaningful effects on the efficacy of the motivational message.

Study 2

Although the findings of Study 1 were promising, we questioned whether the observed effects can be attributed to the use of controlling motivational prosody as such, or to other qualities that such prosody elicits. This is because while it is easy to link semantics to specific types of motivating communication, there is a greater challenge in isolating motivational quality through tone of voice. For example, the semantics "*you have to*" clearly

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[3] While we had reason to believe that perception indirectly related condition to defiance, the data also supported a reversed causal pathway in which condition was linked to perception of speakers' motivation through defiance, $b = .24$, se $= .15$, 95% CI [.02, .59].

convey a lack of choice in one's actions, but tone of voice may affect a voice may produce other perceptions of speakers. For example, those communicating with a controlling tone of voice may be perceived to be more powerful or less warm, which, in combination, explain listeners' desire to defy the request. Said more technically, the observed effect of controlling tone of voice may be spurious, that is, its effect may drop to non-significance after controlling for perceptions of warmth and power that may also be elicited by a controlling tone of voice. In fact, likely the most effective controlling speakers are ones that can communicate their power and strategically withdraw warmth, while simultaneously conveying the key motivational quality, that is, the pressure and coercion that defines control (Ryan & Deci, 2017). Despite the complex social exchange that likely takes place in a controlling or autonomy-supportive climate, it should be the motivationally-relevant experience – namely, the controlling versus autonomy-supportive quality of the exchange – that elicits defiance. Therefore, the main aim of Study 2 was to explore whether the defiance-enhancing effect of controlling versus autonomy-supportive tone of voice would stand after taking into account a number of speaker dimensions, namely power (Ko et al., 2014) and warmth (Davidov & Grusec, 2006; Tjosvold, 1984).

Method

Participants and Procedure

One hundred native English speakers (58% female, mean age = 34.9 years; $SD = 11.2$ years) rated their perception of warmth, power and defiance on Prolific Academic. New to this study, along with preparing participants for listening to audio files as in Study 1, we also asked participants at the end of the study "Did you listen to all the sentences in the link provided earlier in the study?" to account for the possibility that participants had access to the audio file but selected to leave their computers during the duration of the manipulation.

As in the previous study, we aimed for a sample higher than $n = 90$ to achieve a power of .80 for a moderate to large effect size $f = .30$ and α err probability = .05, assuming we will be conducting a fixed-effects model with two groups and have a directional hypothesis. However, we recruited additional participants in case of technical errors due to using audio files, and now to account for participants informing us they did not listen to all files. All participants reported listening and no participants reported technical errors; therefore, all were retained for analyses.

As in Study 1, participants listened to directive communications using either a controlling or autonomy-supportive tone of voice, based on random assignment to condition. Following this, all reported on their perceptions of speakers. We measured participants' perceptions that speakers were controlling versus autonomy-supportive by asking participants to rate speakers the extent speakers were (1) "*supportive*" to (7) "*pressuring*" as a single item. Thus, higher scores on this item reflected more perceived speaker control and lower perceived speaker autonomy support. Presented in a randomized order, participants used the same scale ranging from 1 to 7 to rate the extent to which speakers were "powerless – powerful" (*power*) and "warm – cold" (*warmth*). Such adjectives have been shown to be interpretable by participants, and to load highly with similar items making up measures reflecting perceived power and warmth (Anderson, John, & Keltner, 2002; Fast, Sivanathan, Mayer, & Galinksy, 2012; Fiske, Cuddy, Glick, & Xu, 2002; Fletcher, Simpson, & Thomas, 2000; Van Kleef, Homan, Finkenauer, Gündemir, & Stamkou, 2011). Higher scores on these items therefore reflected more speaker power and less speaker warmth. Finally, participants responded to the same defiance scale as was used in Study 1 (current study α = .94). There were no other manipulations, or exclusions; other measures were taken.[4]

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[4] Additional measures that were included, but not of interest in the present research involves self-congruent goal pursuit (Sheldon & Kasser, 2001), and corresponding perceptions of speakers associated with those goals (e.g., empathy). This additional research has not yet been written up for publication. As for the perceptions of

Results

Preliminary analyses. An independent t-test indicated that women perceived

speakers to be more pressuring, $t(98) = -2.38$, $p = .02$, while age related negatively to

defiance, $r = -.22$, $p = .03$. No other associations were present with gender and age, $ps > .09$.

Primary Analyses. A multiple analysis of covariance (MANCOVA) was conducted

simultaneously predicting all four outcomes, and controlling for gender and age as

covariates.[5] Overall, condition affected outcomes, $F(4, 93) = 4.01$, $p = .005$, $\eta_p^2 = .15$. As can

be noticed in Table 1, the condition effects were in the same and expected direction, with

participants in the Controlling condition perceiving the speakers as more controlling and less

warm compared to participants in the Autonomy-Supportive condition. However, condition

was not found to predict perceived speaker power. Directly replicating the effect identified in

Study 1, the Controlling condition triggers listeners' defiance more than the Autonomy-

Supportive condition.

Using PROCESS similarly to Study 1, we simultaneously modeled the effect of the

two prosody conditions on perceived speaker motivational quality, perceived speaker power,

and perceived speaker warmth, and their unique relations with defiance when controlling for

shared variance of these three potential mediators. Findings of this model (Figure 3) showed

no effect of perceived speaker power, $b = .02$, $t = 0.23$, $p = .82$, or perceived speaker warmth,

$b = .04$, $t = 0.57$, $p = .57$, on defiance. On the other hand, perceiving speakers as being more

controlling as compared to autonomy-supportive was linked to higher defiance in this study

as was the case in Study 1, $b = .19$, $t = 2.55$, $p = .01$; the effect held even when controlling for

speaker power and warmth. Further, when perceived speaker motivation was included in the

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speakers in Study 2, three items were presented for each perception scale. After considering high correlations (>.7) between the full scales of perceptions, and cross-loadings of items across the three constructs, we present results from the theoretically most proximal item per type of perception. Results were comparable in both 1-item and 3-item tests.

[5] Results were identical in significance, and nearly identical in effect size when models did not adjust for gender and age.

model the direct effect of condition on defiance was no longer significant, $b = .35$, $t = 1.63$, $p = .11$. Moreover, the model showed the indirect effect of condition on defiance through the perception of a controlling communication style was significant, $b = .22$, se = .11, 95% CI [.04, .47].[6] Consistent with their non-significant main links with defiance, there were no indirect effects of condition through power, $b = .01$, se =.03, 95% CI [-.08, .08], or warmth, $b = .04$, se = .08, 95% CI [-.09, .02].

Brief Discussion

In Study 2, we identified that effects of motivational prosody on defiance were unique to perceiving speakers as being controlling. Though the use of a controlling tone of voice also led participants to perceive the speakers as more powerful and less warm, neither perceived speaker power or warmth accounted for the effect of condition on defiance. This was an important finding because, although low warmth and high power appear to be by-products of controlling tone of voice, they do not represent the mechanism for why controlling tone of voice produces more defiance. Furthermore, this finding was in line with our expectation that defiance reflects a *motivationally relevant* outcome that should be activated within autonomy-restrictive interpersonal contexts rather than representing a broad negative reaction to challenging interpersonal contexts in omnibus ways (e.g., because others are emotionally distant; or imposing a power differential). Indeed, the effects of controlling tone of voice needs to be specifically attributed to the pressure and choice-constraining nature of such prosody.

Study 3

In a final study, we aimed to understand how motivation is communicated and affects defiance through both its *lexical-semantics*, the meaning of the words that are used, and its

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[6] As in Study 1, we hypothesized that perception indirectly related condition to defiance, and in this study data did not support a reverse causal pathway, $b = .07$, se = .06, 95% CI [-.03, .21].

prosody, the tone that speakers employ. Both semantics and prosody can make unique or combined contributions to speech communications (e.g., Kotz & Paulmann, 2007). In emotional prosody research, it has further been shown that these two channels can have additive effects (e.g., Paulmann, Jessen, Kotz, 2011; Paulmann & Pell, 2011). Yet, this specific issue has not been examined with respect to motivational prosody. We thus expected that using autonomy-supportive versus controlling motivational *words* and *tone of voice* would affect listeners' defiance in comparable ways, and that their combined use would have a more pronounced effect.

Method

Participants and Procedure

Two-hundred and eighty-five native English speakers were recruited on Prolific Academic. Of these 158 (55.4%) were female and ages of participants averaged, $M = 36.2$ years ($SD = 19.2$ years), comparable to sample compositions for the previous study and well-representative of the adult population in terms of these two characteristics.

Participants were once again asked whether they had listened to all sentences serving as experimental stimuli. We recruited 45 participants per condition for a comparable sample size and power to the two previous studies, along with 15 additional participants in case of technical errors or reports audio files did not work. Only two participants reported they did not listen to all files, and they were removed from analyses.

The study was aimed at understanding the relative contributions of motivational prosody and the more established contribution of motivational semantics. We thus used a 2 (*motivation*: Controlling vs. Autonomy Support) X 3 (*mode of communication*: Prosody vs. Semantics vs. Both) design, and participants were randomly assigned to a condition which determined which type of motivational communication they would receive.

Stimuli used the same semantic content as in the previous studies now read by two experts in motivational psychology (one male, one female), and complemented with additional sentences that used similar language but manipulated motivational content (semantics) both using neutral and motivationally rich voices. For example, controlling phrases contained semantics like, "you must finish this or else", "your attendance in class is compulsory", and "it is necessary for you to do this", while autonomy-supportive phrases included semantics such as, "it is your option to continue", "make the right decision for you", "do what you think is most important". Study stimuli were recorded similarly to the procedure for recording Study 1 and 2 stimuli. The presentation of sentences by male and female speakers was presented in a mixed order within condition. Once again, 10 sentences (mono recordings, sampling rate = 44100 Hz) were extracted from the full sample. The mean duration was 1.63 seconds for autonomy-supportive sentences, and 1.90 seconds for controlling sentences, and 2.12 seconds for prosodically neutral sentences (1.89 seconds average across conditions). Figure 4 depicts waveforms, spectrograms, and pitch contours for example sentences, which visually depict how tone of voice was used to communicate both controlling prosody and autonomy-supportive prosody. Acoustic parameters were extracted using praat (Boersma, 2001) and can be found in Appendix A. Differences in terms of expression styles between Studies 1 and 2 and Study 3 can be observed for pitch and speech rate measurements (c.f. Weinstein et al. (2018) for similar findings when comparing intonation for professional and non-professional speakers), while the variables associated with the strongest effects in earlier studies (i.e., proportion of energy in a sentence, leading to the perception of roughness and intensity), align between our different studies and with previous work (Weinstein et al., 2018).

These items were subjected to a validation study that relied on a sample of 350 participants recruited on Amazon's Mechanical Turk. Participants listened to the materials

and rated each item as being more pressuring or supportive using the scale *support* to *pressure*. They identified that, as compared to the Autonomy-Supportive condition, the Controlling conditions was felt to be more pressuring across all modes of communications (semantics, prosody, or the combination of semantics and prosody), $t(248) = 15.09$, $p < .001$ ($MD = 1.83$; 95% CI [1.59, 2.07]). Thus, this validation study demonstrated that, broadly, the two motivational conditions could be contrasted along their proposed motivational dimension.

Participants in the main study reported on their perceptions of speakers as controlling versus autonomy supportive with three items: "flexible – demanding", "supportive – pressuring"; and "unempathic – understanding" (r). Items were averaged such that higher scores on the combined scale reflected more control and less autonomy support ($\alpha = .88$). As in previous studies, participants also completed a scale measuring their defiance in response to these communications with items and directions identical to those of the two previous studies (current study $\alpha = .95$). There were no other manipulations or exclusions, and other measures were taken for a separate study as described in Study 2.

Results

Analytic strategy. As in previous studies, primary analyses were conducted using ANOVAs, but this time models examined the main and interacting effects of motivational quality (Autonomy-Supportive vs. Controlling) and mode of communication (Semantics vs. Prosody vs. Both) since the study used a 2 (motivational quality) X 3 (mode of communication) design. PROCESS models examined direct effects predicting perceptions of speakers and defiance from motivational qualities, separately for each mode of communication. Further PROCESS models simultaneously tested indirect effects through perceptions of speakers as being controlling and not autonomy supportive predicting defiance.

Preliminary analyses. Women reported less defiance across conditions, $t(281) = -2.08$, $p = .04$, yet no other correlations were present with gender and age, $ps > .29$.

Primary Analyses

Main and interaction effects. A multiple analysis of covariance (MANCOVA) was conducted simultaneously predicting both outcomes, and inserting gender and age as covariates.[7] Overall, the motivation manipulation (Autonomy-Supportive vs. Controlling) affected outcomes, $F(2, 274) = 68.81$, $p < .001$, $\eta_p^2 = .33$, although the mode manipulation (Prosody vs. Semantics vs. both) did not, $F(4, 548) = 1.27$, $p = .28$, $\eta_p^2 = .01$. Interestingly, the motivation and mode manipulations also interacted in predicting outcomes, $F(4, 548) = 4.60$, $p = .001$, $\eta_p^2 = .03$.

Mirroring the multivariate effects, for both perceived controlling communication and defiance, a main effect was found of manipulated semantics, but not of mode of communication. Also, type of semantics and mode of communication interacted in the prediction of both perceived controlling communication, $F(2, 275) = 8.61$, $p < .001$, $\eta_p^2 = .06$, as well as defiance, $F(2, 275) = 3.36$, $p = .04$, $\eta_p^2 = .02$.

The means and standard deviations for both outcomes across all six conditions can be found in Table 2 and means are also presented in Figures 5 (perceived motivation) and 6 (defiance). To gain further insights in this interaction pattern, simple effects of manipulated semantics examined each of the three modes of communication separately. As the means in Table 3 reveal, the Controlling, relative to the Autonomy-Supportive, condition elicited greater perceptions of controlling communication when delivered through either semantics, $F(1, 84) = 21.34$, $p < .001$, or prosody, $F(1, 97) = 29.45$, $p < .001$. Yet, when both prosody and semantics were used concurrently, the effect of manipulated semantics was most

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[7] Results were identical in significance, and nearly identical in effect size when models did not adjust for gender and age.

pronounced, $F(1, 92) = 102.80$, p < .001. A similar pattern of findings emerged in the case of defiance. Simple effect analyses of each of the three modes separately indicated that the Controlling, relative to the Autonomy-Supportive, condition elicited more defiance when delivered through either semantics, $F(1, 84) = 8.89$, p = .004, or through speakers' tone of voice, or prosody, $F(1, 97) = 5.61$, p = .02 but difference in defiance was most pronounced when prosody and semantics were both controlling as opposed to being autonomy-supportive, $F(1, 90) = 30.61$, p < .001

Mediational models: Indirect effects. PROCESS models examined each of the three modes of communication separately (semantics only, prosody only, and both semantics and prosody combined) to test the effects of motivational conditions on defiance within each of these three modes. Thus in three models, we tested indirect relations on defiance through perceptions of speakers as controlling versus autonomy-supportive, although it is noteworthy the relation between this mediator (perceptions of speakers) and the outcome (defiance) was a correlational one. Table 3 summarizes findings of these models.

As can be seen in Table 3, PROCESS direct effect findings showed speakers perceived to be controlling rather than autonomy-supportive elicited more defiance when conditions were delivered through semantics only, through prosody only, and through both semantics and prosody combined. That is, regardless of mode of communication, the motivational qualities of sentences impacted defiance in the hypothesized direction.

As was hypothesized, when expressed through semantics, the Controlling versus the Autonomy-Supportive condition increased defiance through perceived controlling quality of speakers, $b = .52$, $se = .13$, 95% CI [.28, .80]. Furthermore, this was also the case for

motivation conveyed through prosody, $b = .74$, $se = .12$, 95% CI [.52, .98], and the combination of prosody and semantics, $b = .85$, $se = .17$, 95% CI [.52, 1.19].[8]

When accounting for variance in perceived motivation, the direct effect between controlling versus autonomy-supportive semantics, prosody, and the combination of the two and defiance fell to non-significance (Table 3). Thus, in all three modes of communication we saw that perceptions of motivation were responsible for the effects of the Controlling conditions eliciting defiance.

Brief Discussion

The final study replicated findings of the two previous ones showing that controlling, as compared to autonomy-supportive prosody predicted more defiant reactions from listeners. Furthermore, in Study 3 we identified that prosody is as capable of conveying motivational quality as the more established effect of motivating words (Hodgins et al., 2010; Levesque & Pelletier, 2003; Radel, Sarrazin, & Pelletier, 2009; Vansteenkiste et al., 2004;Weinstein & Ryan, 2010). As may be expected and in line with other literatures studying how prosody and semantics contribute to verbal communications (Paulmann et al., 2011; Paulmann & Pell, 2010; Paulmann & Pell, 2011), their combined use was most effective at conveying perceptions of controlling versus autonomy-supportive communication and elicited the greatest differences in defiance.

Discussion

SDT and reactance theory (Brehm, 1966; Deci & Ryan, 1985) suggest that controlling motivational climates elicit defiance – a tense desire to resist influence, yet we have little understanding about whether and how this happens through the spoken qualities of

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[8] As in previous studies, we hypothesized that perception indirectly related condition to defiance, although data also supported a reverse causal pattern for all three modes of communication: Prosody, $b = .44$, $se = .16$, 95% CI [.16, .79], Semantics, $b = .75$, $se = .20$, 95% CI [.40, 1.17], and both, $b = .49$, $se = .15$, 95% CI [.22, .78].
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motivating communications. Here, we tested the possibility that merely by using controlling *tone of voice*, motivating speakers could produce defiance, suggesting that speakers' use of tone may in some cases backfire.

Consistent with our primary hypothesis, listening to controlling sounding voice consistently and robustly predicted listeners feeling defiant to messages. This finding extends past work on defiance, which found it to be a predictor of reduced ownership of introduced parenting rules (Missotten, Luyckx, Branje, & Van Petegem, 2018; Vansteenkiste et al., 2014; Van Petegem et al., 2017) or communicated health messages in health care settings (Dillard & Shen, 2005). The present findings then suggest that in these varied settings, the way that speakers (e.g., teachers, health care providers) convey motivational messages through their prosody may shape the motivational climate to a substantial degree, and should be given attention when considering how to create a supportive climate for eliciting behavioral change.

These findings should also be understood in the context of research showing the harmful consequences of defiance outside the context of prosody. Previous research has shown that feeling defiant might lead one to adopt goals in opposition to wishes (Chartrand, Dalton, & Fitzsimons, 2007), to conceal information about one's behavior from motivators (Weinstein & Przybylski, 2019), to take more distance from motivators (Van Petegem et al., 2015b) and to engage in more problematic behaviors (Van Petegem et al., 2015a). Further, studies such as Quick and Stephenson (2008) and Weinstein and Przybylski (2019) have examined behavioral outcomes of felt defiance (in these cases, studies relied on attitudes or behaviour intention) in lab experiments comparable to the one used in the present studies, and other lab studies have examined defiant behaviors in opposition to motivator's wishes but did not test felt defiance (e.g., Matland & Murray, 2013). These studies serve as paradigms for experimentally testing implications of prosody effects relevant to political, education, sports,

and other domains where defiance could result from motivators' particular tone of voice. Furthermore, although we did not test potential outcomes in the current study, given these previous links we might anticipate that tone of voice would result in undesired behaviors. However, it is noteworthy that despite these previously established links between self-reported defiance and counterproductive behaviors, we can only assume that defiant feelings would have fostered uncooperative behavioral reactions in response to controlling versus autonomy-supportive prosody as we did not test such related behavioral outcomes here per se.

Across all three studies we identified that speakers using controlling voice were perceived by listeners as being more pressuring and less supportive than those using autonomy-supportive tone of voice, further validating our modifications of using prosody to achieve this. Interestingly, acoustic differences between stimuli sets still allowed listeners to perceive the speakers' intentions. This highlights that there may not be one *single* way to express autonomy support or control, but that speakers can use a variety of cues of which one (or possibly more) can vary, if the other signalling cues are still strong enough to convey the motivational intention of the speaker. Across all three studies, and in line with previous work (Weinstein et al., 2018), the indicator which seems to be most consistently used when expressing control is voice quality (i.e., perception of rough- or firmness versus softness). It can thus be speculated that the perception of voice quality plays a more dominant role when conveying motivations than the perception of pitch direction or possibly speech rate (as those parameters varied across studies). Crucially, the perception of controlling tone was strongly linked to higher defiance in all three studies. Importantly though, the links identified between perceptions of speakers and defiance were correlational ones, and data from two studies (Studies 1 and 3) also supported a reverse causal pathway best described as the prosody manipulation eliciting perceptions of speakers through defiance. Furthermore, it is worth

noting that mediating constructs measured before the defiance outcome may have influenced responding to this outcome, perhaps exaggerating the effects of condition. Although our findings built on past research providing compelling causal evidence that perceived motivation elicits defiance (e.g., De Meyer et al., 2016), future studies should test this indirect model with methods that allow confident causal interpretations in the context of understanding motivational prosody. This could be achieved by uncoupling the presumed mediator and outcome in time such that the mediator precedes the assessment of time, which better justifies their positioning in a sequential way.

Study 2 further explored autonomy-supportive versus controlling speakers would be perceived on dimensions other than motivation, focusing on perceptions that controlling speakers are also less warm and more powerful, both characteristics of speakers that may be expressed through the voice (Davidov & Grusec, 2006; Ko et al., 2014; Tjosvold, 1984). Findings showed that speakers' use of controlling versus autonomy-supportive tone of voice led to perceptions that they were less supportive (more pressuring), but they were also perceived to be more powerful and less warm. These findings fit well with research showing that controlling individuals are less well liked (Weinstein et al., 2010), and they are first to inform our understanding of how motivating figures are perceived. Although the current study operationalized these constructs simply and proximally using the terms most closely associated with them, we suggest future research should explore adjectives of speakers that might provide multi-item measurements of these constructs. For example, power can also be described in terms of dominance versus submissiveness (Hareli, Shomrat, & Hess, 2009) and warmth, friendliness, and kindness are closely intertwined (Phelan, 2012). It may be that a more nuanced measurement of constructs would pick on relational and motivational dynamics in a different way.

Our final study played an important role in contextualizing the current findings focusing on prosody with those of the much more established effects of words (lexical-semantics). The findings of this study replicated studies that relied on word manipulations to understand their effects of motivation and well-being (e.g., Radel et al., 2009; Ryan, 1982; Vansteenkiste et al., 2004, 2005), and directly compared these effects to those of prosody. In addition, we tested their potential additive and synergistic effects. Much like previous studies on *emotional* prosody showing that both prosody and lexical-semantics can communicate emotion, and that emotion communication using them both is most effective (Burgental, Henker & Whalen, 1976; Burgental & Love, 1975; Paulmann & Pell, 2011), we found that a motivating communication style can be conveyed through both the words used and the tone of voice, which yielded comparable effects on listeners' defiance, and that their combination has the most profound effect on listeners' defiance. Thus, study findings suggested that motivation can still affect listeners in the same when lexical-semantic motivation biasing cues (e.g. "you must") are missing (e.g., "time to leave", can be said in either a controlling or autonomy-supportive way).

Future Directions and Limitations

This study helps to shape future research studying how motivation is conveyed through speakers' tone of voice. For example, in future studies researchers could record and identify acoustic correlates associated with speech used in naturalistic settings, such as used by bosses or teachers, and then synthetically modify specific acoustic parameters (e.g., amount of energy used) to explore how such changes affect behaviour of listeners in these contexts. This approach would allow researchers to draw causal conclusions about the relationship between complex acoustic configurations and specific behaviours. Moreover, this work would inform research observing teachers' use of controlling tone and words in classrooms (De Meyer et al. , 2014; Reeve & Jang, 2006) by distinguishing the influence of

each form of communication (that is, words and tone), and by using physical measures of the acoustic signal as more objective indicators of voice profiles (Burgoon, Buller, & Woodall, 1989). Indeed, we cannot be sure the current work extends to other contexts outside the lab or in different interpersonal contexts (e.g., when parents, teachers, friends, romantic partners, bosses, or strangers are controlling vs. autonomy-supportive). Although motivational research in these various contexts suggest defiant reactions to control should be similar across contexts, it is unclear whether controlling prosody would also play out similarly. For example, perhaps a boss using controlling tone may elicit more compulsive compliance and less defiance, than, a parent doing so. Apart from the domain, also the more general motivating style used by the socializing agent may play a role such that the defiance-enhancing effect of a controlling tone of voice may get minimized or exacerbated in case the socializing agent is perceived to be autonomy-supportive or controlling overall.

Further, because the current studies were undertaken with an experimental manipulation delivering sentences spoken by strangers, it is unclear from these findings whether the added benefit of combining motivational prosody and semantics identified in Study 3 would extend to real-life relationships. On one hand, the effect size for their additive effect (prosody + semantics) above that of semantics only was statistically significant but small, which begs the question of whether it would be meaningfully detected by listeners in these different real-life situations. On the other hand, the small effect size may be an artefact of the experimental design, which likely made the motivational phrases less compelling and thus less impactful. As a result, we might see prosody and semantics effects are enhanced when delivered as part of real-life relationships where meaningful speakers create affectively-laden and consequential motivational climates. The quality of the relation between the socializing agent and the person being instructed may also play a role here, such that controlling tone of voices may elicit less defiance when a strong bond exists between both.

In addition, it would be fascinating to explore the extent to which the personalities of listeners affect their reactions to tone of voice which are either autonomy-supportive or controlling. For example, individuals can be distinguished by the extent they are high in trait *reactance* (Hong & Faedda, 1996; Shen & Dillard, 2005) and these individual differences effect defiant reactions to messages (Quick & Stephenson, 2008) and even moderate their effects (Chartrand & Fitzsimmons, 2006; Quick, Scott, & Ledbetter, 2011, Van Petegem et al., 2015). Thus, it may further be that individuals high in trait reactance are more likely to react with defiance to controlling tone of voice, and therefore they are more vulnerable to speakers who use such tone.

Similarly, taking shifts across the lifespan into account, it is apparent that defiance may be particularly relevant for adolescents (e.g., Vansteenkiste et al., 2014) and presumably young adults, who, in developing their sense of independence and identity separate from others are more prone to responding with defiance when meeting circumstances that restrict these explorations. In the first two studies, we found support for this idea in adult samples – older adults responded with less defiance to motivational sentences. Yet a third study failed to replicate the effect of age, despite the sample being characterized by higher variance in age. Taking these findings together, it may be important for future research to explore defiant responses to motivational tone and communications, more broadly, as a function of age.

Finally, future work should explore the effects of motivational prosody when semantics and prosody mismatch, for example in the case of speakers who convey a controlling message using an autonomy-supportive tone of voice. This may be a fascinating way of exploring subtle and perhaps deceptive motivationally climates. For example, bosses may wish to appear autonomy supportive, and thus select choice-promoting non-verbal language, whereas in reality they want to pressure and coerce subordinates.

Our findings should be understood in light of four noteworthy limitations. The first is that findings relied on self-reports of defiance. While this was intentional because, in its essence, defiance reflects the subjective experience of wanting to opposite motivators' wishes, findings could have been an indirect reflection of some other emotion felt. Indeed, defiance may be a particularly difficult to capture as a self-report because accurate self-reporting requires a high level of conscious awareness of one's experience and willingness to cooperate in sharing it, and defiance is fundamentally characterized as a defensive desire to do the opposite of what is asked (Brehm, 1989; Vansteenkiste & Ryan, 2013). An alternative explanation is that listeners could have felt generally negative affect which they reported as feeling defiance in the absence of other questions asking them to report how they feel, or otherwise angry feelings reflecting the emotional side of a defiant reaction. In future studies, convergence between this self-report and oppositional behavior should be sought as has been done in naturalistic settings outside the context of understanding prosody (Van Petegem et al., 2015b). Furthermore, future researchers may seek to measure defiance implicitly and test both self-reported and implicit responses (e.g., Van der Kaap-Deeder, De Houwer, Hughes, Spruyt, & Vansteenkiste, 2018) to motivational climates, including the use of differing motivational prosody.

Second, it is important to keep in mind that Study 2 tested alternative mediators – warmth and power – simply, taking these two specific terms as face valid representations of their respective constructs. While these terms have been used before to operationalize the two constructs (Anderson et al., 2002; Fast et al., 2012; Fiske et al., 2002; Fletcher et al., 2000; Van Kleef, et al, 2011), frequently these adjectives are embedded in larger scales reflecting warmth and power measured more diversely. Further research should therefore try to determine whether mediation results for Study 2 hold when more robust or extensive measurements are taken of these alternative mediators.

Third, the lab setting – while holding potential confounds such as the words used, the motivational climate more broadly, and relationship history constant – still does not accurately reflect the experiences that individuals have when they are motivated by those who may matter to them, such as parents, bosses, or teachers. As such, findings should be replicated in more naturalistic settings, or, alternatively if seeking to clearly isolate the effects of prosody in future experimental research, using stimuli recorded by those who play domain-relevant motivating roles, for example parents when testing defiance in youngsters.

Here, we report data from only a small set of stimuli which revealed that speakers seem to vary pitch and speech rate in different directions across studies while the proportion of energy used to express materials was used consistently across materials in this and previous work (e.g., Zougkou et al., 2017; Weinstein et al., 2018). This may indicate that processing of motivational prosody, similar to what has been reported for emotional prosody (e.g., Schirmer & Kotz, 2006), relies on first identifying relevant cues (e.g., those signaling salience) and then combining the set of cues to form a meaningful motivational composition (c.f. Zougkou et al., 2017 and Paulmann et al., 2019 for electrophysiological evidence supporting this hypothesis). As part of this processing route, is likely that listeners match incoming information against an acoustic "prototype"; however, it remains to be tested if this ideal acoustic configuration will be the same across different speaker backgrounds (e.g., language, culture, or ethnicity). The available data to data seems to suggest that voice quality remains constant across speakers, while other traditionally well-described features (e.g., pitch, loudness) seem to be more variable. Thus, in addition to manipulating relationship dynamics between motivator and listener, future studies could aim to expand materials to a larger pool of speakers (potentially using different dialects, gender, and ethnicities). By systematically testing variations across speakers and their relations to listeners' perceptions of motivational quality, we will be able to further delineate which acoustic parameters are

most strongly associated with motivational prosody.

Conclusions

Despite these findings, the experiments conducted in this paper were only the second to test the extent motivational prosody characterized by either control or autonomy support impacts listeners' experiences (following Weinstein et al., 2018) and the first of which we are aware to study its intriguing influence on defiance, an outcome which directly speaks to the effectiveness of these two motivational approaches. Further, our findings that controlling tone of voice elicited defiance were robust, consistent, and independent from the potentially confounding effects of motivational words used and perceptions of speakers which inadvertently arise as a consequence of controlling motivational tone. These findings thus speak to an important way in which motivators such as parents, teachers, coaches, and health care providers can be effective in their verbal communications, namely by using motivational tone that provide support for autonomy – that is, inviting and communicating receptiveness – rather than by emphasizing pressure and control through their tone of voice.

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Table 1

Study 2 Cell Means and Standard Deviations for Controlling and Autonomy-Supportive

Prosody and Results of MANOVA Follow-Up Analyses Predicting Each Outcome.

	Controlling Prosody	Autonomy-Supportive Prosody	Controlling versus Autonomy-Supportive Prosody		
	Cell means (SDs)	Cell means (SDs)	$F(1,96)$	p	η_p^2
Speaker motivation	5.47 (1.40)	4.28 (1.84)	11.43	.001	.11
Speaker power	5.21 (1.44)	4.89 (1.31)	1.03	.31	.01
Speaker cold	5.14 (1.36)	4.14 (1.77)	10.79	.001	.10
Defiance	2.63 (1.03)	2.01 (1.05)	6.24	.01	.07

Note. Rows present condition results predicting perceived speaker motivation (speaker

pressure vs. support), perceived speaker power (powerless vs. powerful), perceived speaker

coldness (warm vs. cold), and reported defiance in response to the messages.

Table 2

Study 3 Cell Means and Standard Deviations for Controlling and Autonomy-Supportive Prosody and Results of MANOVA

Follow-Up Analyses Predicting Perceived Speaker Motivation (left) and Defiance (right).

	Motivation					Defiance				
	Controlling Style	Autonomy-Supportive Style	Controlling versus Autonomy-Supportive Style			Controlling Prosody	Autonomy-Supportive Prosody	Controlling versus Autonomy-Supportive Prosody		
	Cell means (SDs)	Cell means (SDs)	F	p	η_p^2	Cell means (SDs)	Cell means (SDs)	F	p	η_p^2
Semantics	5.61 (0.98)	4.20 (1.81)	21.34	.001	.20	2.74 (1.11)	2.01 (1.10)	8.89	.001	.10
Prosody	5.42 (1.12)	3.99 (1.53)	29.45	.001	.23	2.31 (0.89)	1.87 (0.93)	5.61	.001	.06
Both	6.06 (0.99)	4.52 (1.97)	102.80	.01	.53	2.84 (1.11)	1.68 (0.93)	30.61	.01	.25

Note. Autonomy-Supportive and Controlling conditions were contrasted separately for semantics (top row), prosody (middle row) and their

combination (both; bottom row).

Table 3

Study 3 Indirect Models Presenting the Perceptions of Speaker Motivation to Defiance Relation (left), Condition to Defiance Link Accounting for

Perception (middle), and Indirect Effect (right) for the Semantics Contrast, Prosody Contrast, and Combined Semantics and Prosody Contrast,

separately.

	Perception - Defiance		Condition – Defiance[#]		Indirect Effect		
	b	*t*	*b*	*T* [*p*]	*b*	*se*	95% CI
Semantics	.37	4.92**	.18	0.78[.44]	.52	.13	[.28, .80]
Prosody	.35	7.85**	.04	0.22[.83]	.74	.12	[.52, .98]
Both	.34	5.88**	.02	0.09[.93]	.85	.17	[.52, 1.19]

Notes: **p < .001. Autonomy-Supportive and Controlling conditions were contrasted separately for semantics

(top row), prosody (middle row) and their combination (both; bottom row). The left hand columns present the

relation between perception of speaker motivation and defiance, accounting for condition, the middle columns

present the link between condition and defiance accounting for perception (that is, the mediated direct effect),

and the right hand columns present the indirect effect: Autonomy-Supportive versus Controlling conditions to
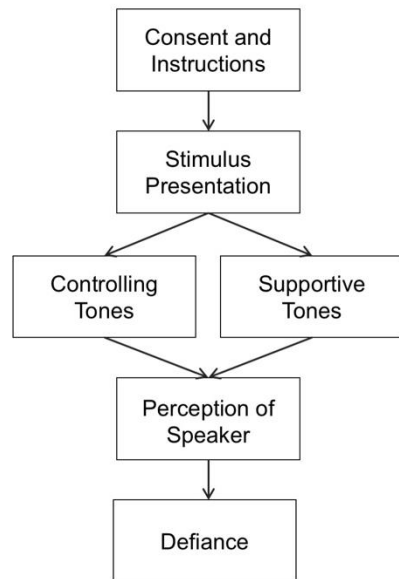
perception of speaker motivation to defiance.

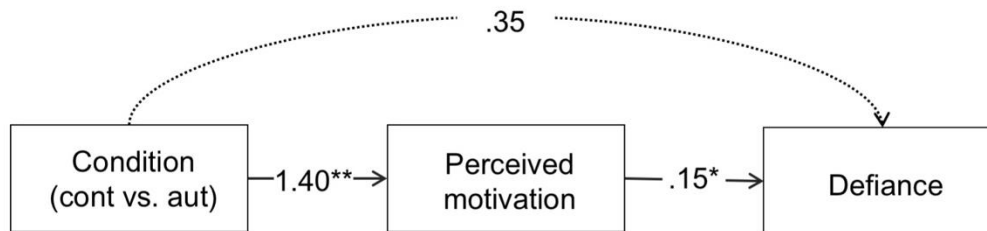*Figure 1*. Study 1 procedure outlining order of key study activities.

Figure 2. Study 1 mediation model results. Unstandardized coefficients and the significance of paths is

indicated with **p* < .05; ***p* < .01. Condition is coded 2 for the Controlling condition and 1 for the

Autonomy-Supportive condition. The links between perceived motivation, warmth, and power and defiance

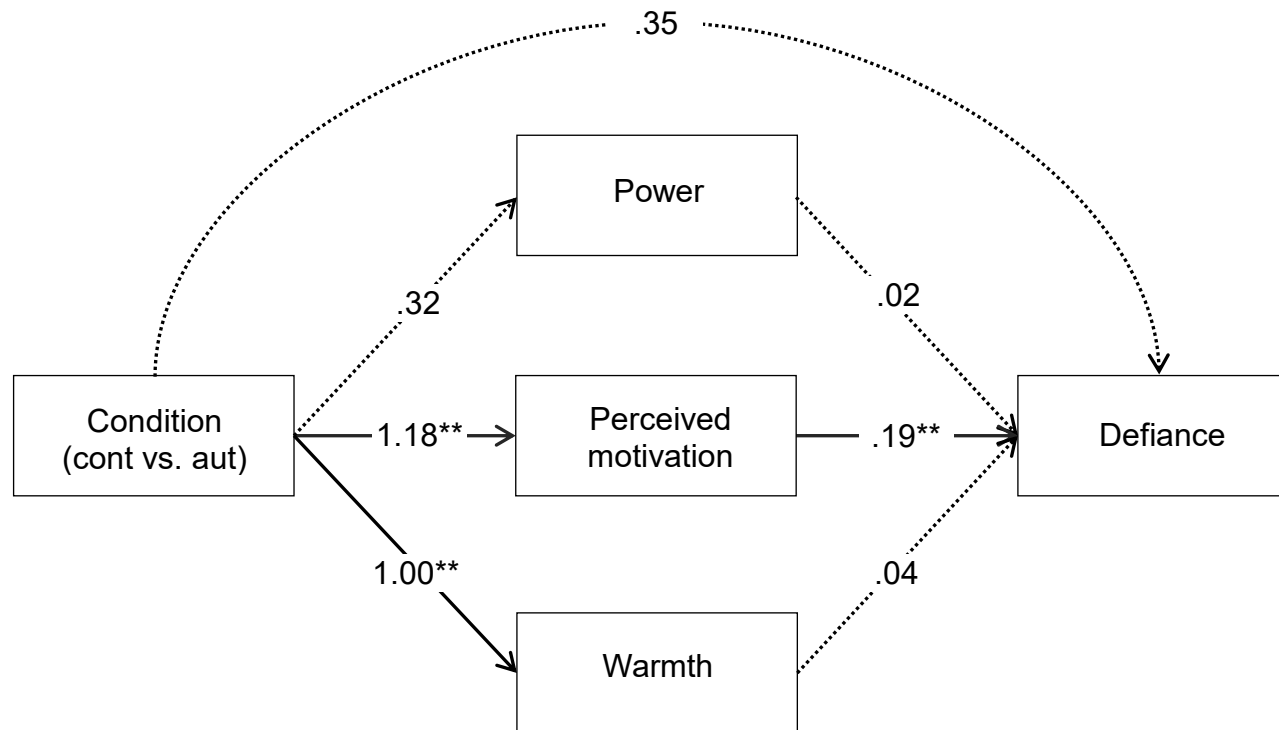are correlational and causality in the direction depicted is assumed.

Figure 3. Study 2 mediation model results from PROCESS model. Unstandardized coefficients and the significance of paths is indicated with

p < .05; **p* < .01. Condition is coded 2 for the Controlling condition and 1 for the Autonomy-Supportive condition. The links between

perceived pressuring motivation, cold vs. warmth, and power and defiance are correlational and causality in the direction depicted is assumed.
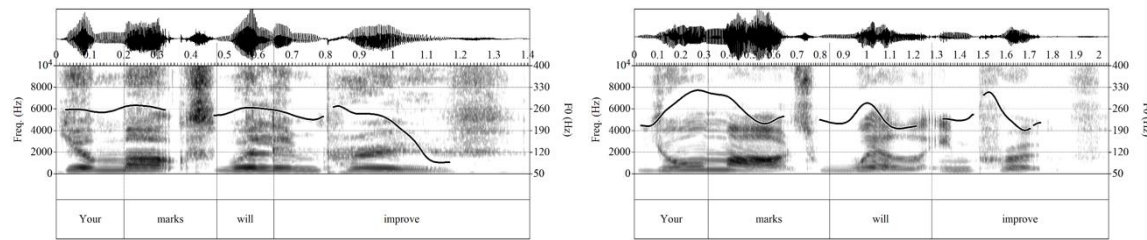
Figure 4. Example waveforms for motivationally prosody sentences of Study 3. Panel A shows an autonomy-supportive tone with neutral semantics. Panel (B) shows the same semantically neutral sentence content spoken in a controlling tone.
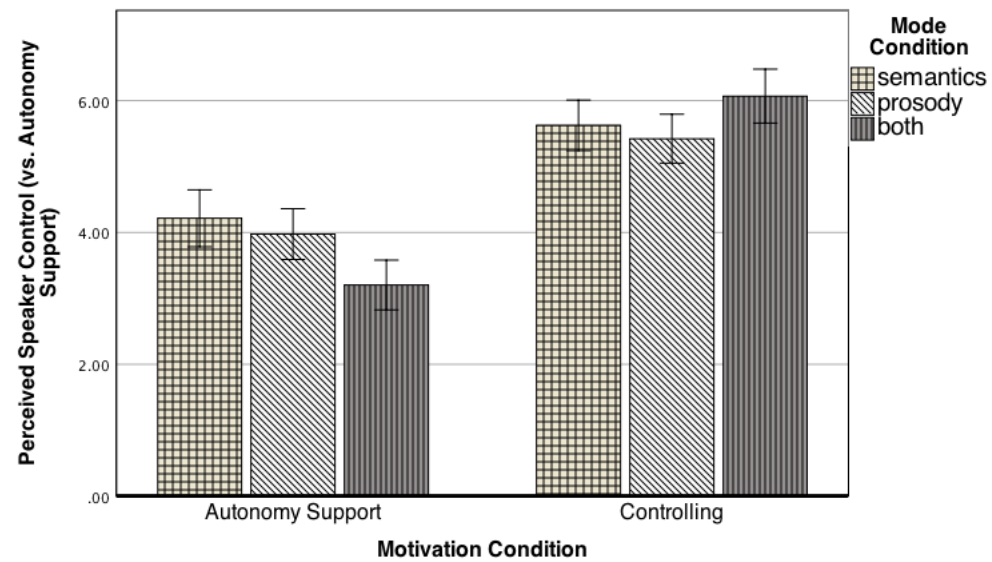
Figure 5. Means and standard errors for perceived speaker motivation, separately for Autonomy-Supportive or

Controlling conditions, and further split by semantics, prosody, and their combination.
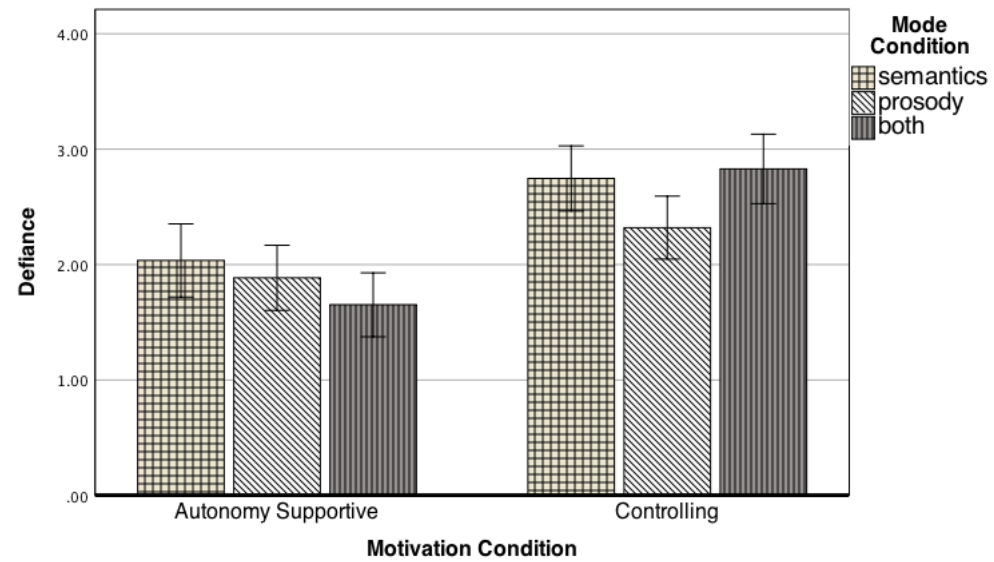
Figure 6. Means and standard errors for defiance, separately for Autonomy-Supportive or Controlling

conditions, and further split by semantics, prosody, and their combination.

Appendix A

Studies 1 and 2	Mean F0 (Hz)		Mean Intensity (dB)	Speech Rate (sps)	Low Frequency Band (dB)	High Frequency Band (dB)
	F	M				
autonomy support	230.4	152.0	55.8	4.5	28.4	8.7
control	226.3	112.0	61.9	3.5	35.1	10.7

Study 3	Mean F0 (Hz)		Mean Intensity (dB)	Speech Rate (sps)	Low Frequency Band (dB)	High Frequency Band (dB)
	F	M				
autonomy support	225.9	138.9	63.8	5.0	37.8	14.3
control	228.8	115.2	65.5	4.0	39.7	17.5
neutral	195.3	115.2	60.2	4.1	35.0	13.3

Note. Means of extracted acoustic measures were averaged across speakers for Studies 1 and 2 (top) and Study 3 (bottom) separately. Pitch was averaged for materials spoken by female and male speakers separately. Speech rate was calculated using the number of syllables in an utterance and dividing this by the utterance duration (in seconds), meaning that speech rate is expressed in syllables per second. Finally, we calculated the relative amounts of energy for a low (0-1000Hz) and high (5000-8000Hz) frequency band range.

Appendix B

Listening to the speakers, the things that they said...

1 = Not at all
2 = A bit
3 = Somewhat
4 = Quite a bit
5 = Very much

1. Triggered a sense of resistance in me
2. Made me angry that my freedom of choice is restricted
3. Made me want to resist attempts to influence me
4. Induced me to want to do the opposite
5. Were frustrating because I am unable to make free and independent decisions
6. Felt like an intrusion
7. Made me think I want to do exactly the opposite
8. Were irritating because they are so obvious to me
9. Felt aggravating