Auditory information and its parameters in health persuasion
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Chapter 3

An experimental test of the relationship between voice intonation and persuasion in the domain of health
Abstract

In the process of behaviour change, intonation of speech is an important aspect that may influence persuasion when auditory messages are used. In two experiments, we tested to what extent different levels of intonation are related to persuasion and whether for some recipients the threat posed by the message information might become too strong to face. In Study 1, 130 respondents listened to a health message with either a low, moderate or high level of intonation. In Study 2 (N = 143), the same manipulations of intonation were applied but half of the respondents were affirmed before they listened to the persuasive message. Intention to increase fruit and vegetable intake was used as a dependent variable. Both studies showed that high intonation led to a significant drop in intention among respondents who perceived their own health as good. After self-affirmation, persuasion was increased. Thus, a high level of intonation seems to induce self-regulatory defences in people who do not see the necessity to change their health behaviour, whereas people with poor perceived health might perceive potential to change. The use of a normal level of intonation in auditory health messages is recommended.


We would like to thank Elsemiek van Vendeloo for her contribution to the data collection for Study 2.
An experimental test of the relationship between voice intonation and persuasion in the domain of health

Commercial advertisements or health campaigns on the radio, help-desk employees and telephone sales persons; they all aim to persuade the recipient by voice. In these instances, no visual cues are available and the voice, speech and its characteristics become more salient and may have a prominent role in the persuasive process. Potentially relevant characteristics are speech rate, voice pitch, fluency, intensity and intonation. These characteristics of voice and speech have been found to be related to persuasion in varying degrees (Chebat, El Hedhli, Gélinas-Chebat, & Boivin, 2007; Gélinas-Chebat, Chebat, & Vaninsky, 1996; Ko, Judd, & Blair, 2006; Pittam, 1990; van der Vaart, Ongena, Hoogendoorn, & Dijkstra, 2005).

In this research, it is aimed to gain more understanding of the influence and working mechanism of intonation as a paralinguistic information cue associated with the source in the process of behaviour change (as defined in the Integrated Change Model; de Vries, Mesters, van de Steeg, & Honing, 2005). Therefore, the aim of these studies was to assess how intonation may influence respondents’ behavioural intention when presented with an auditory persuasive health message.

Intonation of speech is a complex voice characteristic that can be defined as the variation in pitch while speaking. It is an indicator of speech melody, which has a ‘particular communicative value’ (Collier, 1990). When applied within a normal range, intonation provides information related to the grammatical and information structure of a sentence (Nolan, 2006). For example, the use of intonation helps the listener to organise the information and to understand a sentence or a message as a whole; it gives meaning to a sentence (whether it is a question or a statement) and it is used to emphasize particular words or ideas, especially by vocally stressing specific words (Nolan, 2006). This can be done by applying a rise or fall in pitch relatively to the prior or following words. For example, in the phrase, ‘food can cause serious health damage’ (in which ‘serious’ will be emphasized by a varying pitch relatively to the other utterances), the attention is drawn to the severity of the damage. Thus, intonation supports the receiver in the interpretation of utterances (House, 2006). Finally, intonation is also used to transfer information regarding attitudes and emotions of the speaker (Nolan, 2006; Rodero, 2010).

**Intonation and persuasion**

The effect of intonation on persuasiveness or related concepts (such as source credibility) has been investigated in different research areas, such as phonetics,
advertising and (tele)marketing (e.g., Gélinas-Chebat et al., 1996), showing mixed results. On the one hand, significant positive correlations have been found between intonation and persuasiveness, source status and solidarity (Pittam, 1990), and between intonation and purchase intention, especially under high involvement (i.e., when it concerns a relevant message; Gélinas-Chebat et al., 1996). Both outcomes represent a linear relation between intonation and persuasion: more intonation is related to more persuasion. On the other hand, in the same study, a negative relationship between intonation and source credibility was identified, again only under high involvement conditions (Gélinas-Chebat et al., 1996). This is in line with other studies that suggest there is an optimum of intonation in persuasion: To a certain extent a positive relationship between intonation and persuasion can be found, but an even greater rate of intonation (possibly, when the level of intonation is too high) may be associated with less persuasion and less influence, representing a curvilinear relation (Brooke & Ng, 1986; Chebat et al., 2007). The present studies aim to test this relation in the domain of health in an experimental design.

Defensiveness

It is proposed that intonation may influence persuasion as it provides non-verbal information apart from the verbal content, especially on the emotional meaning of the content (Rodero, 2010). In the absence of visual cues, recipients might use intonation to create mental representations of the persuasive outcomes; ‘highly accessible mental images’ that can motivate behaviour change (Cameron & Chan, 2008; Dijkstra & van Asten, 2014). That is, persuasive health messages are always related to relevant outcomes, for example, referring to the risk for cancer. When the recipient feels responsible or in control of these outcomes, a self-threat is induced: The state of feeling inconsistent, non-adaptive and inadequate (Steele, 1988). The self is held responsible and is evaluated negatively. According to self-affirmation theory (Steele, 1988), people are motivated to lower this aversive state. This can be done by accepting the health information and change the health behaviour in the advocated direction: higher intonation would lead to more persuasion. On the other hand, the self-threat may be dealt with by engaging in a defensive reaction towards the persuasive information. This reaction is primarily in function of restoring the self and can also be conceptualised as a fear control process (Leventhal, 1971; Maloney, Lapinski, & Witte, 2011). In other words, an ‘emotional overload’ caused by high intonation levels may lead to defensive reactions that inhibit persuasion (Block & Williams, 2002; Leshner, Bolls, & Thomas, 2009; Na, 1999). Thus, against this background, higher intonation would lead to less persuasion.

When there is a defensive reaction at work in function of protecting the self, a self-affirmation procedure should lower defences and increase persuasion after listening to a message with a high level of intonation. This will be investigated in Study 2.
**Perceived own health**

A next question is: ‘In whom would higher intonation lead to defensive reactions?’ People who perceive their own health as relatively poor or relatively good might react differently to a self-threat after listening to the relevant health outcomes. People with a poor perceived health status may relate the information (independent of the level of intonation) to their current state. For this group, the feelings of threat can be solved by adopting behaviour change as there is an opportunity to behave more healthily: The persuasive outcomes are perceived as congruent with the own need.

On the other hand, for people who perceive their own health as good, the communicated outcomes on fruit and vegetable consumption are incongruent with the own need, as there is no perceived immediate necessity to change. They already feel good and lack a readiness to change their behaviour. For this group, the feelings of threat are more likely to be solved by engaging in a defensive response than by adopting behaviour change. It is expected that a curvilinear effect of intonation will be found in people who perceive their own health as good: intonation might then induce a defensive response.

**Study 1**

In the context of auditory health persuasion, the relation between intonation and persuasion will be tested. Intonation was manipulated experimentally into speech with a low level of intonation, a medium level of intonation, and a high level of intonation. We expected to find a curvilinear relation between intonation and persuasion, but only in recipients who perceive their own health as relatively good. Specifically, it is hypothesised that a moderate level of intonation will lead to more persuasion compared to a low level of intonation (Hypothesis 1a) and a high level of intonation will lead to less persuasion compared to a moderate level of intonation (Hypothesis 1b). On the other hand, in respondents who perceive their own health as poor, level of intonation is not expected to lead to differences in persuasion.

The auditory persuasive message advocated sufficient fruit and vegetable consumption by presenting its gains (e.g., better physical stamina) and non-losses (e.g., lower risk for cancer). The message induced the awareness that oneself is responsible for missing out on these positive effects of the advocated behaviour (Rothman & Salovey, 1997). The intention to increase fruit and vegetable intake was the dependent variable. In general, intention is the best (albeit not perfect) predictor of behaviour (Sheeran, 2002), also in fruit and vegetable consumption (Pietersma & Dijkstra, 2011), and causally related to behaviour (Webb & Sheeran, 2006).
Method

Recruitment and design. This study investigated the influence of the independent variable intonation (low, moderate and high level of intonation) on persuasion in a $1 \times 3$ between-participants design. Self-reported health status was tested as a possible moderating variable. The research was conducted in the laboratory of the faculty of Behavioural and Social Sciences among students from the University of Groningen. Most of the participants (79%) received partial (first-year psychology) course credits; 21% of the participants were given a monetary compensation (€ 5) for completing the experiment.

Procedure. Participants were welcomed in the laboratory (individual cubicles). They were randomly assigned to one of three experimental conditions (low, moderate or high intonation) in order of registration and asked to evaluate an auditory (spoken) persuasive message regarding food habits. Assessments and manipulations were all presented on a computer. After an introduction screen, a screen with informed consent information was presented to the respondents, addressing the confidentiality of the research. Then, they were presented with the pre-test questions. Next, to ascertain that the level of volume of the actual health message was sufficient and convenient, an auditory recording was presented on volume regulation. While listening to this recording, participants could adjust the volume to their individually preferred level by using volume control buttons integrated in the headphone. Subsequently, they listened to a female speaker communicating a message on the benefits of fruit and vegetable consumption. Participants listened either to a message with a low level of intonation, a moderate level of intonation or a high level of intonation. After that, additional questions were asked, representing the manipulation check and the measure of persuasion. In total, the experiment took a maximum of 30 minutes and afterwards participants were dismissed and debriefed (via e-mail).

Persuasive message. The positively framed message comprised of 237 words (see Appendix 1a). The outcomes presented in the message were based on Dijkstra, Rothman, and Pietersma (2011): Both negative outcomes that can be prevented (e.g., lowered health risks) and positive outcomes that can be approached (e.g., increased physical stamina) are presented. The message presented two major positive physical outcomes of sufficient fruit and vegetable consumption: a decreased risk for cancer and for heart diseases. In addition, sufficient consumption was said to lead to looking more healthily, to slow aging, and to improve physical stamina and concentration on mental tasks. Two intermediary positive physical states were presented to be related to these consequences: low blood pressure and low levels of cholesterol. These effects were told to be related to increased intake of vitamin C and E.

Intonation manipulation. A female voice was selected in collaboration with a professional recording studio. Voices were excluded when they contained disturbing
elements or specific cultural habits, such as an accent. Furthermore, it was our intention to select a voice to be characterized as gender congruent; a woman with a feminine and high-pitched voice. Ultimately, an actress with sufficient control over her voice was selected and directed by the first author to produce three versions of the health message which varied on the dimension of intonation.

Voice pitch was measured as the mean fundamental frequency ($F_0$), whereas voice intonation was identified as the variation in pitch, operationalised as the within-subject standard deviation of $F_0$ (e.g., van Doorn & Sheard, 2001). In general, when level of intonation is very low, there is no or little variability between the low and high tones. This means that there is little pitch variation around the natural pitch of the speaker (the fundamental frequency) between the words spoken; the speech is potentially characterised as monotonous. On the other hand, a message with a higher level of intonation is spoken with a higher variability between the low and high tones; speech is potentially characterised as lively with ‘more pitch variation reflecting the melodic contour’ (Gélinas-Chebat et al., 1996).

There are two ways of experimentally manipulating a specific voice characteristic; either digitally while keeping the other voice parameters constant or by instructing actors to alter a specific voice characteristic while keeping the other cues as constant as possible in a more natural way (e.g., Gélinas-Chebat et al., 1996). By using a natural manipulation of intonation, we aimed to increase the ecological validity of the findings, related to the practice of auditory persuasion.

In the professional studio, the recording process started by recording the message in which the actress spoke as naturally as possible. This was considered as a moderate (default) level of intonation. The subjective manipulations of the other two versions were established by instructing the speaker to alter the intonation into lower and higher intonation ‘within the persuasion bandwidth of acceptability’. That is, in persuasive communication there are expectations on what is normal and accepted (Burgoon & Burgoon, 2001); the recordings contained no unexpected intonation patterns. Thus, when heard on the radio, the high intonation would be within the bandwidth of acceptability. The low intonation was designed to still ‘sound natural’.

The three versions (see Appendix 2, QR-codes 1, 3, and 4) were almost identical in terms of length; 114 seconds (low level of intonation); 106 seconds (moderate level of intonation); 111 seconds (high level of intonation). In addition, acoustical measures were performed to confirm each experimental condition objectively (see Table 3.1). To determine the acoustics, the ‘Praat’ voice analysis software version 5.1.34 was applied (Boersma & Weenink, 2000) using a .01 seconds interval of measurement. All parameters were set to the given recommendations, including a pitch floor of 75 Hz and a pitch ceiling of 600 Hz (Boersma, 2004; van der Vaart et al., 2005).
Table 3.1 Objective (acoustic) measures of speech rate, pitch and intonation in the three intonation conditions

<table>
<thead>
<tr>
<th>Level of intonation</th>
<th>Speech rate b</th>
<th>Mean pitch (Hz)</th>
<th>Intonation (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>3.54</td>
<td>153.22</td>
<td>25.33</td>
</tr>
<tr>
<td>Moderate</td>
<td>3.58</td>
<td>180.2</td>
<td>50.63</td>
</tr>
<tr>
<td>High</td>
<td>3.4</td>
<td>197.72</td>
<td>64.23</td>
</tr>
</tbody>
</table>

a speech rate was also manipulated in this study; for every level of intonation, the numbers are calculated as the mean of the acoustic measures for the slow, moderate and fast speaking conditions.

b measured in actually spoken syllables per second with a syllable script written in the software program ‘Praat’ (de Jong & Wempe, 2007).

Table 3.1 shows that in the low intonation condition the standard deviation of pitch was 25.33 Hz, in the moderate intonation condition it was 50.63 Hz, and in the high intonation condition it was 64.23 Hz. This indicates a linear increase in intonation as aimed to produce between the intonation manipulations. In addition, speech rate (syllables per second) was consistent across the three conditions, while the mean pitch in the three conditions increased with intonation. This latter finding suggests that intonation is more about including instances of high pitch in one’s speech than of including instances of low pitch.

Measures. At pre-test, gender and age were assessed as demographic variables. Next, participants were asked to indicate to what extent they considered themselves as healthy (perceived own health status, based on CBS, 2013). This item could be answered on a six-point scale ranging from (‘my health is…’) ‘very good’ [1] to ‘very bad’ [6]. The item was recoded to ensure that high scores correspond with good health (M = 5.05, SD = .63). Then, intention to start consuming more fruit and vegetables in the next year was assessed with two items: ‘I am planning to…within one year’ and ‘How likely is it that you…within one year?’. These items could be answered on five-point scales ranging from ‘absolutely not’ [1] to ‘absolutely’ [5]. The item scores were averaged to create a composite measure score of pre-test intention (r = .76, p < .001, M = 3.23, SD = 1.00). In addition, two items assessed perceived consumption of fruit and vegetables, respectively. These items could be answered on a five-point scale (‘minimal’ [1] / ‘few’ [2] / ‘slightly insufficient’ [3] / ‘sufficient’ [4] / ‘more than sufficient’ [5]). Again, a composite measurement was created (r = .33, p < .001, M = 3.53, SD = .75).

At post-test, perceived voice characteristics (voice pitch, intonation, and speech rate) were assessed with the following items: ‘How was the intonation of the voice of the
speaker?’ and ‘The voice pitch / the speech rate of the speaker was…’ Participants could respond to these 1-item measures on seven-point scales with item-specific endpoints, ranging from ‘very monotonous’ [1] to ‘very lively’ [7], ‘very low’ [1] to ‘very high’ [7] and ‘very slow’ [1] to ‘very quick’ [7], respectively. Then, process variables not pertinent to the present study were administered. Next, the main dependent variable, intention to start consuming more fruit and vegetables, was assessed with three items regarding the extent to which participants were planning to perform this behaviour in one month, six months, and five years respectively (α = .93, M = 4.48, SD = 1.62). To lower the probability of participants answering strategically (remembering their pre-test score), these items could be answered on seven-point scales ranging from ‘absolutely not’ [1] to ‘absolutely’ [7].

**Statistical analyses.** First, to assess the efficacy of the intonation manipulation, a one-way analysis of variance (ANOVA) was used with intonation as a between-subjects factor and the three perceived voice characteristics as dependent variables. To test the hypotheses, the interaction between intonation and perceived health status was tested using ANCOVA with post-test intention to increase fruit and vegetable intake as dependent variable and (standardised) pre-test intention and perceived fruit and vegetable intake as covariates. Perceived health status was included as a standardised continuous variable. To interpret the interaction, the main effect of intonation was tested within the two levels of perceived health status. To this purpose, the complete dataset was used to model a group with good perceived health and a group with poor perceived health, by adding and subtracting one standard deviation from the standardised mean scores on perceived health status, respectively (Cohen, Cohen, West, & Aiken, 2003).

**Results**

**Participants and randomisation checks.** The initial sample consisted of 150 participants, of whom 20 participants were excluded from the data-set (e.g., when reporting technical problems or when having participated in a previous study including the auditory message). The final sample consisted of 130 Dutch student participants (76.2% females), ranging from 17 to 32 years old (M = 20, SD = 2.71), randomly distributed over the conditions: Low intonation condition (n = 43); moderate intonation condition (n = 44); high intonation condition (n = 43).

Univariate analyses were conducted to analyse whether the conditions differed on relevant pre-test measures. No significant differences were found regarding the distribution of gender (χ²(2) = 1.07, p = .59), age (ρ = .75), pre-test intention (ρ = .58), perceived fruit and vegetable consumption (ρ = .35) and perceived own health status (ρ = .17). Still, all analyses regarding intention were performed while controlling for pre-test intention and perceived fruit and vegetable intake, as these variables are conceptually related to the reception of health messages.
**Manipulation check.** There was a significant linear effect of the intonation manipulation on perceived intonation in the expected direction, \( F(2, 127) = 29.56, p < .001, \eta^2_p = .32 \): The higher the level of manipulated intonation, the higher the perceived intonation (low intonation condition, \( M = 2.33, SD = 1.43 \); moderate intonation condition, \( M = 3.93, SD = 1.49 \); high intonation condition, \( M = 4.79, SD = 1.61 \)). Post hoc contrast analyses showed all three contrasts to be significant; \( ps < .01 \). In addition, the manipulated level of intonation had significant effects on the perception of voice pitch; \( F(2, 127) = 24.06, p < .001, \eta^2_p = .28 \): The higher the level of manipulated intonation, the higher the perceived pitch. Again, all three contrasts were significant; \( ps < .02 \). Level of manipulated intonation had no significant effect on perceived speech rate (\( p > .56 \))\(^1\). These relationships are in line with the pattern as demonstrated by the objectively measured voice cues in Table 3.1.

**Effects on persuasion.** No significant main effect of intonation was found (\( p > .14 \)), but the two-way interaction was significant, \( F(2, 122) = 3.57, p < .05, \eta^2_p = .06 \). In case of good perceived health, level of intonation had a (marginal) significant effect on intention, \( F(2, 122) = 2.90, p = .059, \eta^2_p = .05 \). The mean intentions in the low, moderate, and high intonation conditions were 4.49, 4.82, and 4.03, respectively, representing a curvilinear pattern, which is depicted in Figure 3.1. Intention in the high intonation condition was significantly lower compared to the intention in the moderate intonation condition (\( p = .018 \)), supporting evidence for Hypothesis 1b. On the other hand, persuasion was not significantly higher in the moderate intonation condition compared to the low level of intonation condition, suggesting there is no direct evidence for Hypothesis 1a. A post-hoc polynomial contrast demonstrated that the quadratic trend was almost significant (\( p = .051 \)), whereas the linear trend was not (\( p = .14 \))

In case of poor perceived health, level of intonation had no significant effect on intention (\( p > .12 \))\(^2\). The mean intentions in the low, moderate and high intonation conditions were 4.94, 4.27, and 4.52, respectively (see Figure 3.1). An unexpected significant difference between the low and moderate intonation conditions was found

\(^1\) Besides the manipulation of intonation, speech rate was as well manipulated in this study (slow, moderate and fast). Adding speech rate as a between-subjects factor to the model (including interaction term) did not affect the findings of manipulated intonation on perceived voice characteristics. In addition, no significant main effects of speech rate were found on perceived intonation and voice pitch (\( p > .05 \)), except for perceived speech rate; \( F(2, 121) = 93.92, p < .001, \eta^2_p = .61 \). The means showed a linear pattern as predicted with significant contrasts. The manipulation of speech rate did not have additional value in the context of the presented manipulation check.

\(^2\) The model was also tested with speech rate as additional factor. The three-way interaction was not significant (\( p = .35 \)), neither was the two-way interaction between speech rate and perceived health status (\( p = .86 \)), suggesting that speech rate was redundant. Speech rate did affect the findings of manipulated intonation: The interaction between intonation and perceived health status became marginally significant after including speech rate (\( p = .055 \)) and the effect of intonation in people who perceived their own health as good was not significant (\( p = .20 \)).


$(p < .05)$. Furthermore, a post-hoc polynomial contrast showed that both the quadratic and linear trend were not significant $(p = .08$ and $p = .23)$. Together, these findings give us a first indication of a curvilinear effect of intonation on persuasion, especially among respondents with good perceived health.

Figure 3.1 The effect of level of intonation on the intention to consume more fruit and vegetables for respondents with a poor and participants with a good perceived health status ▼

Study 2

The second experiment will attempt to replicate the findings of Study 1 and to unravel an aspect of the underlying process regarding the lowered persuasion after listening to a message with a high level of intonation. To examine whether this specific drop in persuasion can be interpreted as a defensive response after the aversive experience of a self-threat, self-affirmation was applied in half of the participants before listening to the persuasive message, as this procedure can prevent a defensive response (Epton & Harris, 2008; Harris & Napper, 2005).

In a self-affirmation procedure, important individual characteristics of participants are affirmed (McQueen & Klein, 2006). This makes people feel good about themselves; the procedure makes them realise that their self-worth does not hinge on temporary or situational evaluations of their self-image. Therefore, a self-affirmation procedure induces
a psychological state of ‘open-mindedness’. The result is that people dare to face the potential threat and they accept the threat without denial (Harris & Napper, 2005; Sherman & Cohen, 2006). This leads to an increased potential for persuasion (Epton & Harris, 2008; Pietersma & Dijkstra, 2011).

As high intonation only lowered persuasion in case of good perceived health, self-affirmation can be expected to affect persuasion only in this group. In line with this reasoning, the starting point was the three-way interaction between intonation, self-affirmation and perceived own health status on persuasion. It is hypothesised that for recipients who experience the own health as good, a decrease in persuasion after high level of intonation is observed when no self-affirmation is applied (replication of Study 1), and that this decrease is prevented after self-affirmation (Hypothesis 2). This will inform us on the usefulness of the self-threat perspective in this specific context of auditory health persuasion.

**Method**

**Recruitment and design.** This study investigated the influence of the independent variables self-affirmation (self-affirmation versus no self-affirmation) and intonation (low, moderate and high level of intonation) on persuasion in a 2 x 3 factorial design. In addition, self-reported health status was tested as a possible moderating variable. The same auditory persuasive messages with the same manipulations of intonation as in Study 1 were used. The experiment was conducted in the laboratory of the faculty of Behavioural and Social Sciences among students from the University of Groningen. Most of the participants (88%) were given a monetary compensation (€ 5) for completing the experiment; only 12% of the participants received partial (first-year psychology) course credits.

**Procedure.** The procedure of this study was the same as in Study 1 with one exception: just before listening to the auditory message, half of the participants were exposed to a self-affirmation procedure. Participants were told that the study was about their values and interests and they were debriefed immediately after the experiment.

**Self-affirmation manipulation.** The self-affirmation procedure was based on the frequently used procedure of Allport, Vernon, and Lindzey’s (1960) ‘study of values’ (e.g., McQueen & Klein, 2006; Sherman, Nelson, & Steele, 2000; van Koningsbruggen & Das, 2009). Participants were provided with six domains (theory, economics, aesthetics, social aspects of life, politics, and religion) and they selected both their most and their least valued domain. Next, respondents had to respond to ten dichotomous questions. In the self-affirmation condition, most of the questions included one option referring to the most important value of the respondent, providing the respondent with the opportunity to repeatedly choose answers reflecting their most important value, comprising the actual self-affirmation manipulation. In the no-self-affirmation condition
most of the dichotomous questions contained options concerning the least important value of the respondent.

**Measures.** The pre-test measures were the same as in Study 1. Perceived own health status was again recoded to ensure high scores corresponded with good health \((M = 5.16, SD = .59)\). Composite measures of pre-test intention \((r = .64, p < .001, M = 3.33, SD = .84)\) and perceived consumption of fruit and vegetables \((r = .35, p < .001, M = 3.45, SD = .80)\) were created. At post-test, the participants’ intention to increase fruit and vegetable intake was assessed with two items on the likelihood that they would start to consume more fruit and vegetables in the coming one month, and six months, respectively. These items could be answered on a seven-point scale, ranging from ‘very unlikely’ [1] to ‘very likely’ [7] and were averaged to create a composite measure of persuasion \((r = .85, p < .001, M = 4.52, SD = 1.54)\). Then, the evaluation of the voice characteristics was assessed as in Study 1.

**Statistical analyses.** The same analyses as in Study 1 were applied. In addition, a one-way ANOVA was conducted to test the efficacy of the self-affirmation manipulation. The three-way interaction between self-affirmation, level of intonation and perceived health status was tested using ANCOVA with post-test intention as dependent variable. Perceived health status was included as a standardised continuous variable and the same covariates as in Study 1 were used. To interpret the interaction, the same procedure was used as in Study 1 (Cohen et al., 2003).

**Results**

**Participants and randomisation checks.** The initial sample consisted of 154 participants, of whom 11 participants were excluded from the data-set (e.g., when participated in a previous study including the auditory message). The final sample consisted of 143 participants (72.7% females), who varied in age from 17 to 31 years \((M = 21.06, SD = 2.30)\); self-affirmation conditions: low \((n = 24)\), moderate \((n = 25)\), high \((n = 20)\) level of intonation; no self-affirmation conditions: low \((n = 26)\), moderate \((n = 25)\), high \((n = 23)\) level of intonation.

No significant differences were found regarding the distribution of all relevant pre-test variables: gender \(\chi^2 (5) = 3.55, p = .62\), age \((p = .21)\), pre-test intention \((p = .47)\), perceived fruit and vegetable consumption \((p = .91)\) and perceived own health status \((p = .25)\). As in Study 1, all analyses regarding intention were performed while controlling for pre-test intention and perceived fruit and vegetable intake.

**Manipulation checks.** Again, participants’ evaluations of the level of intonation differed significantly across the three conditions, \(F(2, 140) = 33.90, p < .001, \eta_p^2 = .33\): low intonation condition, \(M = 2.46, SD = 1.15\); moderate intonation condition, \(M = 4.14, SD = 1.55\); high intonation condition, \(M = 4.72, SD = 1.45\). Contrast analyses showed that all three contrasts were significant \((p < .05)\). As in Study 1, the intonation
manipulation also affected the perception of voice pitch, $F(2, 140) = 18.39, p < .001, \eta_p^2 = .21$: again, the perception of voice pitch increased as the level of intonation increased. The same pattern was found for perceived speech rate ($F(2, 140) = 13.02, p < .001, \eta_p^2 = .16$). For both voice characteristics, the contrasts between the low and moderate, and between the low and the high intonation conditions were significant ($p < .05$). The mean scores on perceived voice pitch and speech rate did not differ between the moderate and high intonation conditions ($ps > .25$).

To test the efficacy of the self-affirmation manipulation (e.g., van Koningsbruggen & Das, 2009), we counted the number of times the manipulated value was chosen: a score of 1 was only given when respondents selected the option corresponding to the manipulated value (either their most or least important value). A composite measure was created, ranging from 0 to 10 with higher scores representing higher affirmation. Self-affirmed respondents selected the manipulated value more often ($M = 6.81, SD = 1.52$) than non-affirmed respondents ($M = 2.53, SD = 1.45; F(1, 141) = 299.11, p < .001, \eta_p^2 = .68$).

**Effects on persuasion.** The three-way interaction was significant, $F(2, 129) = 3.70, p < .05, \eta_p^2 = .05$. In addition, the two-way interaction of self-affirmation and intonation was marginally significant ($p = .081$), whereas the two-way interaction between self-affirmation and perceived own health, and the two-way interaction between intonation and perceived own health were not significant ($ps .91 and .21$, respectively). No significant main effects were found either.

Figure 3.2 displays the means in the six conditions for respondents modelled as having a poor and a good perceived health status. On the one hand, when perceived health status was poor, the interaction-effect between intonation and self-affirmation was not significant ($p = .97$). The mean scores in the six conditions were relatively high, ranging from 4.43 to 4.76 and no significant contrasts were found ($ps > .44$).

On the other hand, when perceived health status was good, the interaction between self-affirmation and intonation was significant ($F(2, 129) = 6.39, p = .002, \eta_p^2 = .09$). The main effect of intonation was marginally significant ($p = .070$). For this group, listening to a voice with a high level of intonation resulted in lowered persuasion when they were not affirmed ($M = 3.31$). When they were affirmed, persuasion was significantly higher ($M = 4.80; p = .002$), verifying Hypothesis 2. In addition, the curvilinear pattern found in Study 1 among participants with a good perceived health status was replicated: When no self-affirmation procedure was applied, persuasion in the high intonation condition was significantly lower ($M = 3.31$) compared to the moderate intonation condition ($M = 5.21; p < .001$) and the low intonation condition ($M = 4.65; p = .012$). The difference in persuasion between the low and moderate intonation condition was not significant ($p = .28$).
Figure 3.2 The effect of self-affirmation and level of intonation on the intention to consume more fruit and vegetables for respondents with a poor and good perceived health status. 

### Good perceived health status

<table>
<thead>
<tr>
<th>Intention</th>
<th>Level of intonation</th>
<th>Self-affirmation</th>
<th>No self-affirmation</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td>5,5</td>
<td>5</td>
<td>.012</td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td>4,5</td>
<td>4</td>
<td>.001</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>3,5</td>
<td>3</td>
<td>.002</td>
</tr>
</tbody>
</table>

### Poor perceived health status

<table>
<thead>
<tr>
<th>Intention</th>
<th>Level of intonation</th>
<th>Self-affirmation</th>
<th>No self-affirmation</th>
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<td>High</td>
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<td>3,5</td>
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<td>.002</td>
</tr>
</tbody>
</table>
Discussion

Two studies found that a high level of intonation lowered persuasion, but only in respondents who considered their own health as good. We explained the results from the self-threat perspective as Study 2 also showed that in these people, the self-affirmation procedure prevented the drop in persuasion. This suggests that the defences were in function of protecting the self, thereby inhibiting persuasion (Sherman & Cohen, 2006). In contrast, people with a poor perceived health status were not affected by the self-affirmation procedure, suggesting that there were no defensive processes at work in those respondents. Instead, they reported relatively high intentions to engage in behavioural change in all conditions. These results provide support for Hypothesis 1b and Hypothesis 2. On the other hand, Hypothesis 1a was not confirmed: No significant difference in persuasion between the low and moderate level of intonation was found (although this was significant for people with a poor perceived health status, in Study 1 only). Thus, the found pattern on persuasion was not so much curvilinear but the highest level of intonation did lower persuasion. In contrast, other research on the relationship between intonation and persuasion (Chebat et al., 2007) did not find significant differences in behavioural intention between a ‘marked’ intonation level and moderate or ‘unmarked’ intonation levels.

Although the measurement of underlying processes was limited, we explain these results in the following way. Firstly, after listening to the health message, it is reasoned that all recipients know that they are to some extent responsible for the risk of the negative outcomes and more or less, they might feel inadequate and non-adaptive. It is likely that this feeling of threat will be similarly present in people with poor and good perceived health, as perceived health status is not directly related to actual health behaviour. That is, people who see themselves as healthy do not necessarily eat sufficient fruit and vegetables.

Secondly, the reflection of a current health status is likely to determine whether behaviour change is perceived as necessary in the first place. Although it is not directly investigated in the current study, it is reasoned that the self-threat could be resolved by following the persuasive message. Then, the experienced need to change the feeling of threat might decide whether or not to engage in the health behaviour. When the recipients’ health was perceived as good, it was resolved by a defensive response: It is acknowledged that the information is personally relevant (self-threat) but they feel no need to actually change. The information on health outcomes was incongruent with their behavioural tendency and need. However, when recipients feel not so healthy, it seems they transfer the self-threat into the direction of behaviour change, probably because the message was congruent with their need. Thus the occurrence of a self-threat, and the differences in handling the self-threat are thought to underlie the patterns of persuasion as found in the current study.
The few earlier studies that manipulated intonation also showed that the effects of intonation on persuasion-related variables were moderated: The effects differed for levels of involvement regarding the persuasive message (Gélinas-Chebat & Chebat, 1992; Gélinas-Chebat, et al., 1996). From the perspective of the elaboration likelihood model (Petty & Cacioppo, 1986), these authors argue that voice characteristics are peripheral cues that only influence persuasion when involvement is low, that is, when recipients are not so much interested in the content message. This hypothesis was supported in one study, showing that higher intonation lowered message acceptance when involvement was low (and when voice intensity was low as well; Gélinas-Chebat & Chebat, 1992). It may be that the moderator, perceived health status, is a parameter of involvement: perceiving one’s health as poor may be an indicator of high involvement towards a message on the health effects of fruit and vegetable consumption. It would add to the explanation why in our study different levels of intonation only influenced persuasion in participants with a good perceived health status: they might have been less interested in the topic itself, (although they acknowledge that it is relevant to them) and were influenced by contextual features (level of intonation) of the content information.

As we did not directly assess all underlying processes (e.g., the self-threat), we cannot rule out that other basic mechanisms than self-threat played a role. For example, from an information processing and working memory angle, intonation increases the density of the information as more variation and, thus, more meaning is included in the message (Kitayama, 1996). More intonation may lead to a more transparent, clear and persuasive message but the limitations of the working memory might set a threshold: When the information becomes too dense, persuasion does not further increase or might even decrease because of an ‘information overload’ of the cognitive system (Basil, 1994). From a source evaluation angle, intonation may provide information about the source, for example about its credibility (e.g., Chebat et al., 2007). Increased perceived source credibility may subsequently increase persuasion (Pornpitakpan, 2004), but a high level of intonation may signal persuasive intent as well, that might work as a forewarning for the recipient (Lee, 2010; Petty & Cacioppo, 1977), thereby disturbing the persuasive process. Although the interpretation of the results and the patterns of persuasion that are found do not rule out explanations from the information processing perspective and the source evaluation perspective, we argue that the self-threat perspective is a sufficient explanation of the drop in persuasion in our studies (Harris & Napper, 2005; Sherman & Cohen, 2006).

The present results should be interpreted against the background of some relevant limitations. As the curvilinear relationship between intonation and persuasion was only partly confirmed by the data, the question arises whether a relevant difference between the low and moderate level of intonation was manipulated. However, these conditions showed large differences regarding both the objective acoustical measure of intonation
as reported in Table 3.1 and the subjective perceived level of intonation. Thus, despite the finding that participants - even in our between-subject designs - did notice the difference in intonation, it did not differentially influence persuasion. Our study may not have included the extreme low intonation that is associated with lower persuasion as all three intonation conditions were designed still to be in a normal or acceptable range.

Furthermore, there are indications that gender is relevant when it comes to persuasion (Whipple & McManamon, 2002). Here, in both studies a female voice was used: it cannot be ruled out that a male voice would have been differently related to a self-threat in the current context of auditory health persuasion. Another issue on the voice is that we used only one voice of one unique actress. Although the voice was selected to be a ‘standard’ voice without disturbing or deviating pronunciations and accents, it cannot be ruled out that other voices with unique characteristics should have led to other results. In addition, the participants were students, not necessarily representative of other populations but appropriate to join these studies on basic mechanisms in persuasion. Lastly, the dependent variable was the intention to increase one’s fruit and vegetable consumption, not a behavioural measure. It is clear that not all people live up to their intentions and the intention-behaviour gap is renowned (Sheeran, 2002; Webb & Sheeran, 2006). However, it is the best predictor of behaviour available, and in an earlier study intention assessed immediately after exposure to the persuasive message predicted actual vegetable consumption one, and four weeks later (Pietersma & Dijkstra, 2011).

In the development of health interventions via the auditory channel (e.g., via MP3), two parameters (conditions) under which auditory persuasion can be effective were identified (Bartholomew, Parcel, & Kok, 1998; Schaalma & Kok, 2009). These parameters refer to aspects within the message (level of intonation) and the recipient (current perceived health status): Especially for people who perceive the own health as relatively good, high level of intonation can decrease persuasion. This suggests that auditory persuasion may not always be persuasive for everybody. Nevertheless, auditory persuasion has the potential to reach many people, for example, when provided through radio or smartphone applications, and small individual effects may then have large population effects. The present results contribute to our understanding of the processes involved in such large-scale population interventions.