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Sounds Expensive: The effect of voice pitch on price  
perception

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## Summary

Past research has found that lower voice pitch can lead to perception of larger product size, however it is not clear whether this effect would spill over and influence other evaluation criteria. In our studies, we aim to replicate these findings and further establish the effect of voice pitch on other product features, more specifically we aim to find how voice pitch affects price perception.

Through the literature review we present the relevant results from research already conducted in the field, showing important findings and implications for our research. We form 3 hypotheses regarding the potential effects of high and low voice pitch on price perception. The methods are described for several experiments testing different underlying explanations for the effects, illustrated by models for the different designs. In the appendix, we included scripts for the auditory stimuli and products used in the experiment.

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## Introduction

Voice pitch convey meaning through basic differences transmitting cues such as dominance, size and social status through non-verbal communication. Voice pitch can affect consumers' perception of and attitude toward products due to conceptual metaphors and misattribution of traits indirectly tied to stimulus. The research question we have established is how differences in voice pitch (high vs. low) influence consumers' perception of the product price. Through this study we consider the different potential outcomes of voice pitch effect based on different explanatory frameworks such as the meaning of sound, social status, vertical conceptual metaphors, power and dominance. In study 1 the aim is to establish the actual effect of voice pitch (dependent variable (DV)) on price perception (independent variable (IV)) of a product. Since the variables can be either positively or negatively correlated, two studies are designed to pursue both outcomes in terms of their underlying explanatory dimensions, but we find one outcome to be more likely. We believe the negative correlation between voice pitch and price perception to be expected, based on the extensive amount of literature supporting the link between low voice pitch and dominance, success, power and a high social status, and hence a lower voice pitch will most like be associated with a higher price. Therefore, study 2b might not be conducted, depending on the outcome of study 1. In study 2a we wish to examine how voice pitch (DV) influences price perception (IV) through perceived size and quality of the products. Previous research has established the relationship between voice pitch and size (Lowe & Haws 2016), where respondents evaluated a product to be larger in size, when exposed to a product advertisement with a low voice pitch. To the authors' current knowledge, the effect of voice pitch has yet to be shown in the context of price perception. Previous studies imply that managers and leaders tend to select spokespeople for commercials based on intuition with little or no knowledge about how the different elements of sound impact customers' perception (Areni 2003; Bruner 1990). Implications from our study will be relevant for marketing managers regarding planning of marketing messages, and how one can utilize voice pitch to convey price level in the communication, as well as for academic purposes and further research in the field of sensory marketing.

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## Literature review

### *Speech sound convey meaning*

The way we communicate today is based on words, but the interpretation is deeply rooted in sophisticated systems of old associations with sound. These systems have been formed by our brains as we have anticipated to understand our surroundings and interpret the sounds we hear. When communicating with others, these patterns are helping us understand the information we receive. Our neural networks are active in making sounds as well as perceiving and interpreting them (Kraus and Slater 2016), meaning that when communicating we are not only transferring sound signals but we have an interaction between individuals. Therefore, we can understand that sound provide meaning beyond words, adding several dimensions to communication (Kraus and Slater, 2016). Differences in conveyed meaning can be dependent on the frequencies in the voice pitch, and the source filter model claims that the frequencies of the voice is connected to the vocal fold vibration and the formant frequencies are connected to the vocal tract (Titze 1998). Former research (Butler et al. 1989; Titze 1998; Harries et al. 1997, 1998) states that the quantity of testosterone appearing in the subsequent stages of puberty regulates the fundamental frequency of the voice. For both genders, the voice gets lower as the vocal tract increases throughout childhood until puberty and sexual maturity (Fitch & Giedd 1999).

### *Social status and voice pitch*

Several studies have been conducted on the vocal channel of the fundamental frequency of phonation, also referred to as F0. The F0 is the frequency of the human voice below 0.5 kHz and the outcome of the research has proven that the F0 conveys nonverbal information regarding social status (Gregory et al., 1993, 1999; Gregory, 1994; Gregory and Webster, 1996). According to Gregory et al. (1997), several studies indicate that the F0 frequency has an essential impact on transmission of information about dominance and social status, and the absence of F0 cause people to perceive conversations to be of lower quality. Based on the aforementioned studies, the Communication Accommodation Theory (CAT) has been developed, explaining how individuals adapt and match their communication and behavior adjusting to social status asymmetry. When status differences exist, an individual with lower status will adapt to the individual with higher status (Gregory et al., 2001). Humans also adjust their voice pitch when leading a

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conversation with a partner having a higher social status (Gregory et al. 1996). Hughes et al (2010) found evidence supporting that both genders lower their voice pitch when leaving a voicemail to a person they find physically attractive.

Another model explaining the social status communicated by F0 is the Patterson's Sequential- Functional Model (SFM) of communication which combines several interactions that impacts interaction between people, such as nonverbal and verbal communication. The SFM model provides valuable information about how people adjust to the social surroundings by their habits of cognitive decoding and behavioral encoding. The model describes how an individual's encoding patterns adapts due to the behavior of a partner, and the decoding takes place when the individual makes impressions and judgments about the stimulus person. Our encoding pattern can also be influenced by our senses interacting with each other, causing cross-modal correspondence. This phenomenon is defined as the perceptual fit recognized by one sense with the sensory experience in a different sensory process (Spence 2011). Sound can express cross-modal meaning, and for example impact the product perception leading to perceiving a low voice pitch connected to a large product size. Lowe & Haws (2016) showed through several studies how acoustic pitch influences people's behavior, beliefs and evaluations of physical size because of cross-modal effects. Based on the voice pitch ability to influence people's perception and judgement, we form the first hypothesis:

*H1: Participants will perceive the price of the products to be higher (lower) when exposed to stimuli with low (high) voice pitch.*

#### *Voice pitch and vertical placement*

Another way in which voice pitch may be linked to price perception is through the metaphor of vertical position. Vertical placement refers to a stimulus placed physically higher than others in space, and the ways of placement is infinite. Previous research (Lakoff and Johnson 1999; Meier et al. 2007) has found that vertical placement seems to relate to several metaphorical associations such as power, morality and valence. This was confirmed in a study by Giessner and Schubert (2007), asking participants to evaluate a leader's power from an organizational chart. On the chart, the leader was parted from the employees with a vertical line, and the more the length of the line increased, the more power the

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participants perceived the leader to have. This shows how the vertical placement metaphor in voice pitch is related to conceptual metaphors.

Conceptual metaphors is a form of mental associations arising when people attempt to communicate effects they cannot see, touch, hear, taste or smell (Lakoff and Johnson,1980,1999). Such abstract ideas can be more clearly expressed by formulating it as a mental association. Lakoff and Johnson (1980,1999) emphasized the asymmetrical nature of conceptual associations, meaning that our thoughts rely on sensory experience, however, a conceptual thought is not needed to provide a sensory experience. Metaphors can change and manipulate how we experience events and relationships depending on which metaphor it is linked with (Lee and Schwarz 2014). A metaphorical influenced object can be perceived different due to unconscious, sensory phenomena and indirect physical links connected to the object. Many articles from the literature of psychology and consumer behavior confirm this effect. Meier and Robinson (2004) gave an example of how a child tasting candy recognize the taste as sweet and perceive the sweet taste as pleasant. The link established by the child between sweet and pleasant might later lead to the child perceiving sweet people to be pleasant. For our second study, we aim to use processing fluency as a measure to establish if price perception is connected to voice pitch through a spatial metaphor of high and low. Previous research has established that processing fluency determines how easy or difficult people find processing and assessing information (Reber, Schwarz, and Winkielman 2004; Schwarz 2004). Prior research has suggested that the metacognitive experience is identified as more positive the higher the fluency of the processing is, often leading to a misattribution of a positive impression regarding the stimulus (Schwarz 2004). The researchers in this field seem to agree that processing fluency takes place without any conscious, planned or strategic processing of the stimulus (Reber et al. 2004, Lee and Labroo 2004).

We establish the second hypothesis based on the aforementioned research and we assume that the spatial conceptual metaphor regarding high and low prices connected to high and low voice pitch will influence the participants price perception using processing fluency as a measurement, and hence:

*H2: When exposed to the stimulus of a low(high) voice pitch, participants will perceive the price to be lower(higher).*

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*Power, dominance, size and voice pitch*

According to Feinberg et al. (2006) low frequencies in male voices are connected to reproductive health and masculinity. Former research has proven that men with deeper voices tend to have higher testosterone levels (Dabbs & Maling 1999). They also found that lower frequencies in male voices are wrongly associated with a larger body size of the speaker and a hairier chest. This has also been proven by former studies (Fitch 1994; Fitch & Hauser 1995; Fitch & Giedd 1999). Therefore, studies have been conducted to prove female preference for large vocal tract lengths and low voice pitch. Collins (2000) provided evidence that male voices with lower frequencies and smaller harmonic spacing's were found to be more attractive. Confirming this research is the study by Pawłowski et al. (2000) who found that women prefer the voices of men sounding larger, and they claimed the reason for that to be male size positively correlated with reproductive fitness. Fitch and Giedd (1999) found that women's preference for male body size were affected by their own height and weight, bringing us back to the social context's influence found by Gregory et al. (2001). Men tend to lower their voices when speaking to a competitor they experience as less dominant than themselves. Opposite, when males feel less dominant than a competitor, they raise their voice pitch (Puts et al. 2006). Borkowska and Pawłowski (2011) conducted a study proving that women with lower pitched voices are seen as more socially dominant. We also mentioned that men are perceived as physically stronger when their voice has a lower pitch. Previous studies have proven that people elect leaders with lower voice pitch (Klofstad et al. 2012,; Tigue et al. 2012). They also discovered that a lower pitched voice was perceived to be more trustworthy, competent and stronger, in other words, more capabilities connected to being a better leader regardless of gender of spokesperson and perceiver. The low voice pitch is in other words associated with physical dominance, reproductive health and larger size amongst other favorable traits, and we will now look at how a larger body size can influence how a person is being perceived.

In regards to dominance and body size, previous studies have found that taller people receive premium wages, opposite to their shorter colleagues (Persico et al., 2004) and the effect of height having a positive effect on income is also significant when controlling for age, gender and weight (Judge and Cable, 2004). The same study found that height also has a positive impact on success at work for both women and men. This indicates that there could be a link between



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perceived size of a person and perceived success of a person based on the perceived dominance in the voice pitch. Based on previous research of dominance, size and power, Lowe and Hawks (2016), discovered that the voice pitch affect how big respondents estimated the products in a commercial to be. They found a consistent pattern where a lower voice pitch made participants evaluate the product as larger in size. In the study, they also considered the price aspect, but without finding significant results for any relation between the two. We see from the research stated above that low voice pitch is associated with dominating and favorable traits such as success, being rich, credible and physically attractive, and having a larger physical body size.

The price of a product will in most situations be dependent on either the size or the quality (brand, material, etc.) of the product. We wish to establish if there is a difference in how people perceive the price level when estimating prices of products either related to size (burgers) or quality (orange juice). Hence we establish the third hypothesis:

*H3: When exposed to stimuli with high/low voice pitch, participants will evaluate the prices of burgers (size) different from the prices of the products of orange juice (quality).*

## **Methodology**

### ***Study 1- Pilot study***

The purpose of study 1 is to replicate the findings from Loewe and Hawks (2016) regarding voice pitch and size perception and to test hypothesis 1, that is, participants will perceive the price (DV) of the products to be higher (lower) when exposed to stimuli with low (high) voice pitch (IV). The design is randomized between-subjects design.



*Figure 1*

### ***Participants***

At least 200 participants (102 males) will be recruited from the online panel, Amazon Mechanical Turk (MTurk), and participation will be rewarded with a moderate financial compensation. The choice of an online panel instead of a

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controlled lab experiment, is based on previous research showing that it does not *significantly* affect the result of the study (Feinberg et. al. 2008). By using an online panel, we get participants that cover a larger base of demographics, thus ensuring a high external validity.

#### *Voice Pitch Manipulation*

The participants will listen to the same ad for burgers used by Lowe and Haws (2016), and the voice pitch manipulation will be the same. The ad was pre-tested by Lowe and Haws who asked the respondents to rate their agreement with three statements after listening to the ads: “The ad sounded strange”, “The ad was realistic” and “the ad was high quality”. The ratings were measured on a 7-point scale between “Strongly disagree” and “Strongly agree”. A t-test confirmed that there was no significant difference in the rating of the two versions.

#### *Main study*

In the main study, the participants will hear one of the two versions of the of the advertisements (high vs low pitch). The versions of the advertisements will be randomly assigned to the participants. In advance of the study the participants will be told to use headphones to ensure the quality of the recording. In the introduction of the study the participants will be told through a message on the screen that they were going to listen to a radio advertisement of a new product, then respond to various questions about the advertisement and the product being advertised. Additionally, the participants will be given a scenario that they are on their way to the supermarket in order to prime a similar situational price reference for the participants. This is to strengthen the internal validity. No additional visual stimuli will be provided. To reduce suspicion of the focal variable (price perception), most of the questions were not central to the study (Size, Usability, Quality, Weight, Ease of use, Willingness to purchase, product liking). To make sure we measure the effects of price perception and not the effect of priming from the other questions, the questions on price will always be the first to be asked in the questionnaire.

The questions will be answered through a 7-point semantic differential scale and was designed from the scale presented by Kirmani, Sood, and Bridges (1999). The question regarding price perception was presented in 7-point semantic scale, anchored on “Cheaper than average” and “More expensive than average”.

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### *Expected results*

For study 1, we have two possible scenarios. In scenario one, we approve hypothesis 1, and reject hypothesis 2. In this scenario, we proceed with study 2a. In the second scenario, we proceed with study 2b. We expect the result of the study to verify hypothesis 1, subsequently, rejecting hypothesis 2. Therefore, we will proceed with study 2a. Study 2b can be found in appendix 2.

### *Study 2a*

The purpose of this study is to test hypothesis 3, that is, to establish whether there is a difference in the effects voice pitch have on price perception when channeled through quality or size. The design is 2 (high pitch vs. low pitch)  $\times$  2 (hamburger vs. orange juice)  $\times$  2 (quality questionnaire vs. size questionnaire) between subjects design. We chose a between subjects design in order to strengthen internal validity and avoid participants getting aware of the manipulation.

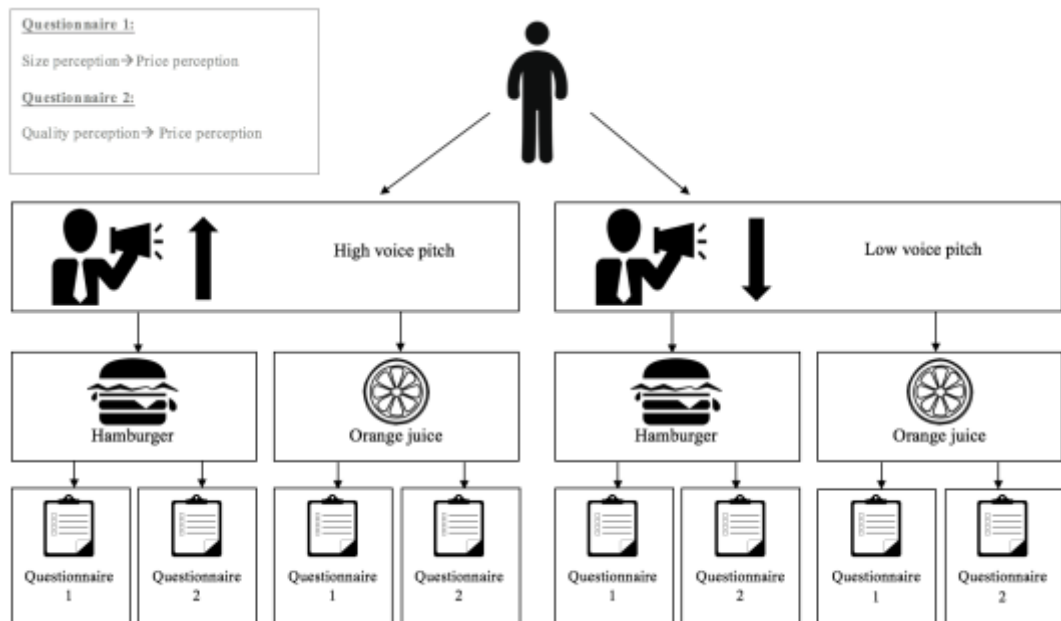


Figure 2

### *Participants*

As in study 1, the participants will be recruited through an online panel (MTurk). We will recruit at least 480 participants (60 per group). As explained in study 1, using an online panel participants cover a large base of demographics, thus ensure a high external validity.

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*Voice Pitch Manipulation*

In order to manipulate voice pitch, we will follow technical methods used in previous studies: Titze (1998) established that male speakers have a fundamental frequency (F0) between 85 Hz and 180 Hz. Traunmüller and Eriksson (1994) suggest an average male voice pitch of 124 Hz. Thus, we will use an English native speaker with a baseline F0 124 Hz for the recordings for the different studies. After the recordings of the advertisements, the voice pitch will be digitally manipulated by altering the pitch of the voice. As reported by Hyde and Peretz (2004) humans can perceive differences in voice pitch at 25 audio cents. It is important that the changes in voice pitch seem realistic and not distorted. The “high voice pitch” will be raised by 100 audio cents, and the “low voice pitch” will be lowered by 100 audio cents. We will use the same male voice and do the same alterations for both the hamburger commercial and the orange juice commercial.

The audio stimuli will be pretested, to make sure that the stimuli seem realistic and not distorted. At least 60 pre-test participants will be randomly assigned to hear one of the four versions (114Hz and 134Hz). After listening to one of the ads, the respondents were asked to rate their agreement with three statements: “The ad sounded strange”, “The ad was realistic” and “the ad was high quality”. These statements were based on a similar pretest in study done by Lowe and Haws (2016). The ratings were measured on a 7-point scale between “Strongly disagree” and “Strongly agree”.

*Main study*

The participants will be assigned randomly to either the low or high voice pitch condition. As mentioned, the voice recorded for the ads will be a male spokesperson. The voice will be tuned out of a “normal” perceived voice pitch of 124 Hz. The high pitch condition will be elevated by 100 audio cents while for the low pitch condition it will be lowered by 100 audio cents based on previous studies (Traunmüller and Erikssons 1995). In the introduction of the study the participants will be told through a message on the screen, that they are going to listen to a radio advertisement for a new product, and then respond to various questions about the advertisement and the product being advertised. No additional visual stimuli will be provided.

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When the participants have received and understood the introductory message, they will listen to a recording of a hamburger commercial or an orange juice commercial. The recording will be spoken either in a high voice pitch or in a low voice pitch. In order to remove those participants that have not paid attention to or heard the content of the commercial, the participants also will have to answer questions about the commercial. After that, the participants will answer questions either about their perceptions about quality related or size related attributes of the product. Then, the participants will answer questions about their price perception of the product. The questions will be answered through a 7-point semantic differential scale and designed from the scale presented by Kirmani, Sood, and Bridges (1999). The question regarding price perception will be presented in 7-point semantic scale, anchored on “Cheaper than average” and “More expensive than average”. To analyze the result from the experiment, a repeated-measures of variance (ANOVA) is preferred to examine the ratings of the different price perceptions across the different conditions.

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## **Appendix 1: Advertisements scripts**

### ***Study 1:***

*“You know it – when things get just a little too safe. Now and then you need a little spice in your life. You need a little heat in your week, and you need it as part of a flavor combination you can love, and all at a place you know. The new Jalapeño Jack Burger at Clark’s. You need it. You crave it. You love it. Clark’s – Dig in.”*

*Source: Lowe, M. L., & Haws, K. L. (2016)*

### ***Study 2a: Radio Advertisement – Orange juice***

*My precious oranges, destined for greatness. To create the most perfectly delicious orange juice in the world. Apparently, the juice does not fall far from the tree. Try the new Klemens’ Farm Juice.*

### ***Study 2a: Radio Advertisement – Hamburger***

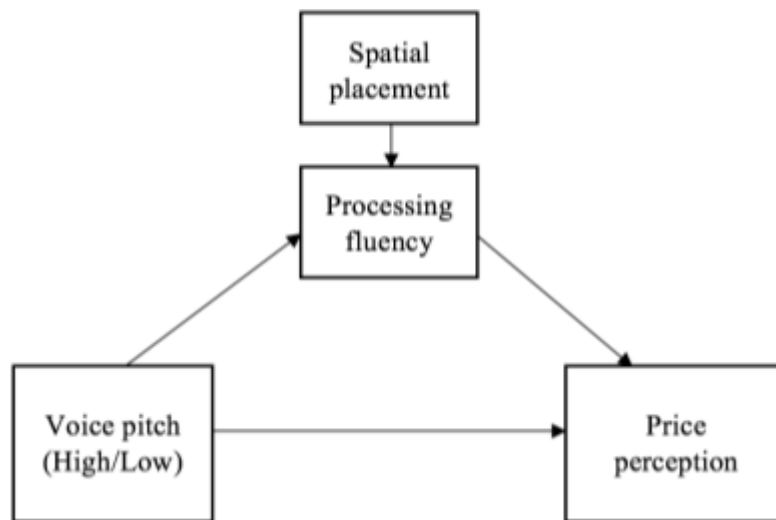
*Howdy folks! Clark here, with the new Outlaw burger! Other places have BBQ burgers, but not with the kick this one has. Outlaw burger is loaded with hickory smoked bacon, onion rings, and topped with barbeque sauce. Come and try the new Outlaw Burger at Clark’s!*

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## Appendix 2:

### *Study 2b*

Study 2b is a lab experiment with the purpose to examine the spatial conceptual metaphor between voice pitch (IV) and price perception (DV) where the spatial metaphor plays the role as a moderator. The study tests mainly hypothesis 2: When exposed to the stimulus of a low(high) voice pitch, participants will perceive the price to be lower(higher). The results would be measured through processing fluency; the participants would evaluate and perceive the price of the product more accurately and faster if being exposed to a lower voice pitch, and that the price has a lower placement on the vertical axis of the screen. Thus, the expected effect would be a positive correlation between the two variables.



### *Participants*

120 random students from Handelshøyskolen BI would be recruited as participants and they would be offered a small compensation in exchange for participation in the experiment. The participant sample is relatively small, but as Easterby Smoth (2012) stated, small samples can represent a large population. The choice of using students as participants was favourable as they are easy to recruit, flexible in their schedule and do not acquire an extensive amount in return. However, the use of students could concern generalization of the study results and hence the external validity, as students can be biased in both age, experience, social class, ethnicity and intellectual ability.

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*Main study*

Due to the use of processing fluency as measurement, all other variables needed to be controlled for, hence a lab setting would be appropriate for conducting the experiment. Participants would use headphones and computers when being exposed to two manipulation conditions with two levels each. The study was therefore a 2 (pitch: low/high) x 2(Price: cheap/expensive) between subject design. During the introduction to the study, participants would be told that they would be a part of an experiment and given instructions on the procedure they were about to be exposed to.

In the experiment, the participants will be shown 7 different products (See appendix 2) one by one, and a male spokesperson will continuously tell the numerical price of the products. The products chosen for the experiment will be products with both cheap and expensive versions available in the market as well as being gender neutral. The participants will be asked to answer whether they perceived the price for the exposed products cheap or expensive by dragging the product up or down on the computer screen. The time from the exposure of the product and price until participant would give an answer whether they perceive it as cheap/expensive is measured, but without the participants knowing about the measurement or having any time constraints.

The participants would be randomly divided into four groups of 30 participants each, all assigned with different manipulation conditions. All participants will be given a reference price at the beginning of the experiment. Group 1 and 2 will be exposed to a low pitch voice. The difference between the group tasks would be for group 1 that the expensive item is to be placed high in the vertical axes of the screen and cheap item is to be placed on the low vertical axes of the screen, and vice versa for group 2. Group 3 and 4 will be exposed to a high pitch voice, and group 3 will be asked to place the expensive item low on the vertical axes of the screen, and cheap choice was to be placed high in the vertical axes of the screen, vice versa for group 4. Similar to study one, the voice recorded for the experiment will be elevated by 100 audio cents for the high pitch condition, while for the low pitch condition it will lowered by 100 audio cents tuned out of a “normal” perceived voice pitch of 124 Hz (Traunmüller and Erikssons, 1994). The products shown to the participants and the spokesperson of the ad would not differ and would be in the same order for all 120 participants. After the procedure is done,

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the participants will be asked for their age and gender before the study is concluded. To analyze the result from the experiment, a repeated-measures of variance (ANOVA) is preferred to examine the ratings of the different price perceptions across the different conditions.