The Deliberate Duchenne Smile: Perceptions and Social Outcomes

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ABSTRACT OF DISSERTATION

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Abstract

The Duchenne smile, which is a smile that involves activation of the cheek raiser muscle that creates crow’s feet around the eyes, has long been thought of as an infallible expression of genuine happiness (Ekman, Friesen, & Hager, 2002). Recent research has begun to show that the Duchenne smile can be deliberately produced (Gunnery, Hall, & Ruben, 2013; Krumhuber & Manstead, 2009). As the ability to deliberately produce a Duchenne smile continues to be documented, the questions become why someone might want to produce a Duchenne smile deliberately, and what the social outcomes of being able to do so are. The goals of the current dissertation were to first summarize the previous literature on perceptions of Duchenne smiles to gain clarity on how people who produce Duchenne smiles are perceived differently from those who produce non-Duchenne smiles (i.e., smiles without cheek raiser activation), and, second, to investigate how people who are able to produce a deliberate Duchenne smile use the Duchenne smile in real social situations. Lastly this dissertation strove to uncover what the consequences of having the ability to produce a deliberate Duchenne smile are in the contexts of persuasion and liking.

A meta-analysis was conducted to test the combined effect of differences between perceptions of Duchenne and non-Duchenne smiles. In addition to testing the overall effect, moderator analyses were conducted to test how methodological, stimulus specific, and perceiver specific differences between studies predicted the overall effect size. The meta-analysis found that, overall, Duchenne smiles and people producing Duchenne smiles are rated more positively (i.e., authentic, genuine, real, attractive, trustworthy) than non-Duchenne smiles and people producing non-Duchenne smiles. The difference between Duchenne and non-Duchenne smiles was greater when the stimuli were static photographs rather than dynamic videos, when smiles
were elicited naturally rather than through posing paradigms, and when Duchenne and non-Duchenne smiles were not matched for intensity of the lip corner puller. These results provide evidence that the benefits of how people that Duchenne smile are perceived by others may motivate people to want to deliberately produce a Duchenne smile.

Study 2 continued to examine these reasons with an investigation of how the ability to deliberately produce a Duchenne smile and use of the Duchenne smile in a social interaction were related to how persuasive an individual was rated to be. A taste perception paradigm (Feldman, Tomasian, & Coats, 1999) was utilized where targets sipped a sweet pleasant tasting juice and a very tart unpleasant tasting juice and had to smile and persuade another person to drink the juice. Participants then completed a deliberate Duchenne smiling paradigm to measure their ability to deliberately produce a Duchenne smile. Naïve perceivers watched videotapes of the taste tasks and rated how likely they would be to try the juice. Results showed that participants who showed the ability to produce a Duchenne smile were more persuasive both when persuading to drink the pleasant juice and when persuading to drink the unpleasant juice, but participants only successfully used the Duchenne smile to persuade after drinking the pleasant tasting juice. These findings indicate that people who have the ability to deliberately produce a Duchenne smile are perceived as more persuasive, and that they only use the Duchenne smile to persuade in a context where they might be feeling underlying positive affect.

Moving to a different social context, Study 3 tested the relationship between the ability to produce a Duchenne smile, use of the Duchenne smile in a social interaction, and liking. Study 3 used a dyadic interaction paradigm where two participants had a conversation with each other while being videotaped. Following the interaction, participants made ratings of how much they liked their partner. All participants, again, completed the deliberate Duchenne smiling paradigm.
Videotapes of the interaction were then coded for presence of the Duchenne smile, and these
tapes were shown to a group of naïve viewers who rated how much they liked each participant.
Results from Study 3 showed that the ability to deliberately Duchenne smile was correlated with
use of the Duchenne smile in the social interactions. However, Duchenne smiling in the social
interactions was not related to partner rated liking. Naïve raters did report liking participants who
Duchenne smiled in the interactions more when controlling for the amount participants non-
Duchenne smiled in the interaction. This indicated that while Duchenne smiles may not be used
as a cue to liking in live interactions where there are verbal cues present, when information is
limited people do rely on the presence of the Duchenne marker when deciding how much they
like another individual.

Taken together, these three studies provide evidence that the ability to produce a
deliberate Duchenne smile is a useful skill both as a way to communicate positive affect to others
and to present oneself in a more positive way. In addition, Studies 2 and 3 show that people with
the ability to deliberately produce a Duchenne smile, use it more in social interactions where one
might feel happy.
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Chapter 1: Introduction

The phrase “the smile did not reach his eyes” has a commonly understood meaning. The person smiled but the expression wasn’t genuine. He was not feeling genuinely happy, but smiled for some other social reason. Most people understand that when a person is expressing true and genuine happiness the smile reaches his or her eyes, and until recently scientists believed that a smile only “reached the eyes” when the person was feeling genuinely happy (Ekman, Davidson, & Friesen, 1990; Frank, Ekman, & Friesen, 1993).

This specific type of expression, known as the Duchenne smile, is a smile that includes activation of the orbicularis oculi (cheek raiser) muscle that lifts the cheeks creating crow’s feet around the eyes, slight pouching under the eyes, a slight droop in the eyelid, and slight lowering of the outer eyebrow. Using language from the Facial Action Coding System (FACS; Ekman, Friesen, & Hager, 2002), the Duchenne smile involves the activation of Action Unit (AU) 12, the lip corner puller, and AU 6, the cheek raiser. The non-Duchenne smile is a smile that lacks cheek raiser (AU 6) activation or a smile that does not reach the eyes.

Overview

This dissertation begins by quantitatively reviewing the literature on perceptions of Duchenne and non-Duchenne smiles in a meta-analysis to test for methodological, stimuli specific, and perceiver specific moderators (Study 1). Studies 2 and 3 then examine the relationship between the ability to deliberately produce a Duchenne smile and use of the Duchenne smile in social contexts. This is done to test the hypothesis that people who can produce a Duchenne smile deliberately or use a Duchenne smile in their social interactions will experience positive social outcomes as a result. Study 2 specifically tests this hypothesis in the context of persuasion by having participants taste something pleasant and unpleasant and then
persuade another person to taste both with a smile in each case. Study 3 looks at the relationship between the deliberate Duchenne smile and liking in a relationship initiation situation. Both studies measure the ability to produce a deliberate Duchenne smile outside of the social interactions in order to further measure the ability to produce a Duchenne smile deliberately and test the relationship between the ability to produce a Duchenne smile and smiling behavior within a social interaction.

The Duchenne Smile

Since the time French neurologist Duchenne de Boulogne first documented that when people feel happy their cheek raiser muscle activates in addition to a smile in the mouth (Duchenne, 1862/1990), numerous studies have found a connection between the Duchenne smile and happiness. Ekman, Freisen, and O'Sullivan (1988) found that participants were more likely to produce Duchenne smiles than non-Duchenne smiles when they reported enjoying themselves while watching films intended to elicit positive feelings, and Ekman and Davidson (1993) found that production of the Duchenne smile was related to brain activation associated with enjoyment, while production of a non-Duchenne smile was not. In a study on grief and bereavement, participants who Duchenne smiled more were found to have fewer symptoms of grief (Bonanno & Keltner, 1997), and similarly in a study of physical pain perception, Zweyer, Velker, and Ruch (2004) found that participants who Duchenne smiled more reported feeling less pain during a cold pressor task.

These previous investigations of the Duchenne smile have mostly come out of the theory that there are seven basic emotions that are universally felt, expressed, and understood (Ekman et al. 1987; Fridlund, Ekman & Oster, 1987). The Duchenne smile had been exclusively talked about in the facial expression literature as an expression that was outside of volitional control. It
stood out as the unfakeable expression that was the hallmark for the evolutionary argument for basic emotions.

The theory that the Duchenne smile was the physical representation of genuine felt positive affect across cultures meant that there were basic emotions that humans possessed innately and that the wiring for the expression of these emotions was also innate (Matsumoto, Keltner, Shiota, O’Sullivan, & Frank, 2008). However, the idea that the Duchenne smile is outside volitional control has recently been found to be untrue (Gosselin, Perron, & Beaupré, 2010; Gunnery, Hall, & Ruben, 2013; Krumhuber & Manstead, 2009).

**The Deliberate Duchenne Smile**

An investigation of the Duchenne smiling literature turns up many mentions of deliberate Duchenne smiles that are alluded to as insignificant methodological details, or just not discussed as actually being evidence that it is possible for the Duchenne smile to be produced when a person is not feeling genuinely happy. Frank and Ekman (1993) reported that “up to 20% of the population can consciously contract the outer portion of their orbicularis oculi muscles (AU 6) and are thus capable of producing a false Duchenne marker” (p. 18), but by calling it a false Duchenne marker these expressions are categorized differently than those expressions that are produced spontaneously. It is as though through producing the expression deliberately it is not the real thing and would not communicate the same message.

Levenson, Ekman, and Friesen (1990) brought unselected participants into the laboratory and asked them to contract a series of muscle either individually or in conjunction with other muscles. They found that 16% of participants were able to contract their cheek raiser muscle, and 25% of people were able to contract their cheek raiser muscle when their lip puller was also
activated. This is evidence that participants were able to both produce the Duchenne marker by itself as well as produce a Duchenne smile.

In another study, Ekman and Davidson (1993) found that 71% of a sample of unselected undergraduates could control the cheek raiser muscle in order to produce a Duchenne smile, a finding the authors called “quite unusual” (p. 343). Since this detail was irrelevant to the purpose of the study, it was not mentioned again, nor cited in any of Ekman’s subsequent studies as evidence that a majority of people can produce the expressions when explicitly asked to do so.

There has also been evidence of the deliberate Duchenne smile from outside of Ekman’s group. Schmidt, Ambadar, Cohn, and Reed (2006) found that 91% of their participants activated the cheek raiser muscle when asked to deliberately pose joy. In another study that instructed participants to deliberately appear happy, Smith, Smith, and Ellgring (1996) found that 100% of unselected expressors produced a Duchenne smile, a figure that dropped only to 82% in a group of patients with Parkinson’s disease (who are known to have reduced expressive control).

Krumhuber and Manstead (2009) were the first researchers to publish evidence for the deliberate Duchenne smile and call it evidence that people can deliberately produce a Duchenne smile. In a study investigating the differences between spontaneous and deliberate Duchenne smiles, Krumhuber and Manstead found that 83% of participants who were instructed to appear as if they were watching something funny while actually watching neutral stimuli produced a Duchenne smile. This did not significantly differ from the number of Duchenne smiles (70%) produced by participants who smiled spontaneously in response to amusing stimuli. This effectively showed that people were able to produce Duchenne smiles when they were not feeling genuinely happy.
Following Krumhuber and Manstead, Gosselin et al. (2010) found a similar result when asking participants to coactivate certain facial muscles. In a lab setting devoid of emotional stimuli, participants were instructed to activate AU 6 and AU 12 separately and also coactivate AU 6 and AU 12. In their study, 60% of participants were able to activate AU 6. Half of the 60% activated AU 6 by itself, while the other 30% of participants activated AU 6 while coactivating another action unit, most commonly AU 12. Gosselin et al. also found that participants who were instructed to activate AU 12 also quite often coactivated AU 6.

Gunnery et al. (2013) provided further evidence that participants are able to deliberately put on a Duchenne smile. Unlike Krumhuber and Manstead (2009), this study asked participants to smile as they would in different social situations in which they wanted to express genuine happiness in addition to fake happiness that was masking some negative affect (masked disliking, masked fatigue, and masked disappointment). Gunnery et al. (2013) found that across genuine and fake happiness scenarios 38% of participants’ smiles were Duchenne.

Gunnery et al. (2013) took the study of the deliberate Duchenne smile a step further by exploring possible individual differences that exist between people who produce Duchenne smiles deliberately and those who do not. Participants who were able to deliberately put on the expression in the genuine happiness smiling role-plays were also more likely to use it in the fake happiness smiling role-plays, and when asked to imitate a Duchenne smile. This indicated consistency in the ability across different types of tasks.

Now that it is apparent some people have the ability to willfully put on a Duchenne smile, that individual differences distinguish people who possess this ability from people who do not, and that some people also have the motivation to utilize the deliberate Duchenne deliberately in laboratory created social scenarios, the question becomes why people might choose to use it. The
present set of studies aims to answer that question by looking at first how the Duchenne smile is
perceived and then the social outcomes that result from utilizing the smile in the two different
social contexts of persuasion and relationship initiation.

Perceptions of Duchenne Smiles

If some people (as data suggest) are able to deliberately put on a Duchenne smile, the
question becomes why individuals might choose to do this. It is obvious from the recent
literature that a sizeable minority of people have the capacity to physically move their facial
muscles so that they can voluntarily put on a Duchenne smile, but there is a motivational
component to the process as well. People must not only have the capacity to deliberately
Duchenne smile but also be motivated to do it. A clear reason a person may be motivated to
produce a Duchenne smile deliberately is the way in which the expression is perceived.

Much research has investigated how people perceive Duchenne smiles. Overall, previous
findings show that Duchenne smiles are perceived more positively than smiles that lack the
Duchenne marker, or cheek raiser activation (e.g., Frank & Ekman, 1993; Thibault, Gosselin,
Brunel, & Hess, 2009).

As will be outlined in more detail in Chapter 2, the list of positive characteristics that
people attribute to those displaying Duchenne smiles is quite lengthy. Mehu, Little, and Dunbar
(2007) found that people showing Duchenne smiles were rated as more generous and extroverted
as compared to people showing non-Duchenne smiles. Woodzicka (2008) found that in a job
interview context, people who produce Duchenne smiles are rated as more hireable and
competent than people who display non-Duchenne smiles. Bernstein, Sacco, Brown, Young, and
Claypool (2010) found that people prefer others who are displaying genuine (or Duchenne)
smiles as opposed to non-Duchenne smiles after they have faced social exclusion.
The above studies are only a small sample from a larger tradition of published work, but they demonstrate both that Duchenne smiles are perceived more positively than non-Duchenne smiles, and that the vast majority of work looking at how Duchenne smiles are perceived and how people might benefit from producing the expression has been completed under the assumption that the Duchenne smile is a genuine expression of enjoyment that can only be produced when someone is feeling genuinely happy.

If observers attribute more positive states or traits to people who can and do deliberately produce Duchenne smiles, or observers feel more positively when perceiving Duchenne smiles than non-Duchenne smiles, as the literature suggests, then someone might be quite motivated to deliberately put on a Duchenne smile in the absence of genuine felt positive affect. A meta-analysis of these studies looking at methodological differences as moderators has the potential to tell us whether differences in how the smile is expressed, who is perceiving the smile, and how perceivers are asked about the expression or the expressor changes their perceptions of the Duchenne smile.

**Social Outcomes of Duchenne Smiles**

There are many studies on the social outcomes of smiling. Some of these findings show that people who smile more are seen as more attractive (Otta, Abrosio, & Hoshino, 1996), are given more leniency after an academic infraction (Lafrance & Hecht, 1995), and are seen as more cooperative and therefore are more likely to be trusted (Scharlemann, Eckel, Kacelnik, & Wilson, 2001). There is very limited data on the social outcomes of Duchenne smile. Grandey, Fisk, Mattila, Jansen, and Sideman (2005) found that analog customers reported higher satisfaction with an encounter with a standardized service provider when the service provider had expressed a Duchenne rather than a non-Duchenne smile during a videotaped encounter. An
investigation of the consequences of producing a Duchenne smile in live social interactions has not been conducted, and there are no published studies to date that measure the social outcomes of being able to deliberately produce a Duchenne smile. The current dissertation aims to fill some of these gaps in the smiling literature.

The Duchenne Smile as a Social Signal and Self-Presentation

The Simulation of Smiles (SIMS) model (Niedenthal, Mermillod, Maringer, & Hess, 2010) proposes that the smile serves the three functions of showing happiness, affiliation or friendliness, and dominance, and that embodied simulation is used to determine what function a smile is serving. While this model comes from the framework that the Duchenne marker is a mostly involuntary facial movement, it also argues that the involuntary nature of the Duchenne marker does not mean that it is the only smile feature that is used to distinguish smiles that are expressing happiness from those that are expressing a desire for affiliation or dominance.

This dissertation will follow in this framework by presenting the Duchenne smile as a multi-functional tool used for social signaling and self-presentation. Though nonverbal behaviors are thought to be more automatic displays of underlying thoughts and feeling than verbal behaviors, nonverbal behavior can be as a social signal to communicate thoughts and feelings to others (Knapp, Hall, and Horgan, 2013). In addition to being purely communicative people can use nonverbal behavior as a strategy for self-presentation. Self-presentation describes a set of behaviors used to intentionally convey a certain message about the self to others (Jones & Pittman, 1982). While nonverbal behaviors are sometimes viewed as involuntary readouts of underlying thoughts and feelings, they can and often are used by expressors to present themselves in a certain way.
As DePaulo (1982) outlines, nonverbal behaviors (especially facial expressions) have characteristics that make them less controllable than verbal behaviors. People can never see their own facial expressions in the same way that the people they interact with view them, as at best a person only sees a mirror image. Also, nonverbal expressions happen with more speed than verbal behaviors, and are thought to take less conscious thought. As a result of these characteristics, people perceive nonverbal behaviors as more genuine and trustworthy communications than verbal behaviors because a person’s immediate facial expression following an occurrence often reflects more about his or her underlying feelings than what is said.

Despite nonverbal behaviors having these characteristics, DePaulo (1992) states that it is still possible to use nonverbal behaviors for self-presentational purposes. This dissertation aims to add further support for these theories of nonverbal behavior by showing how the Duchenne smile may be beneficial as a self-presentational tool and as a social signal.
Chapter 2: Study 1 - A Meta-Analysis of Differences in the Perceptions of Duchenne and Non-Duchenne Smiles

Introduction

The majority of research on the Duchenne smile has been on how and when it is expressed, but there is a limited literature on the differences in the perceptions of Duchenne and non-Duchenne smiles. A majority of the studies that have investigated this perceptual distinction have found that Duchenne smiles are perceived more positively on a number of dimensions than non-Duchenne smiles. While this literature is small and quite clear in its overall finding, its studies provide ample variation for a meaningful analysis of moderators in a meta-analysis.

After surveying the literature on these specific perceptions it is predicted that a synthesis of these findings across dependent variable type will produce a significant effect indicating that Duchenne smiles are perceived more positively than non-Duchenne smiles. Throughout this meta-analysis, the term positively is used to indicate an aggregate of many dependent measures which test the perception of Duchenne smiles with adjectives anchored with positive and negative poles. An example of an adjective included is genuine (positive)/deceptive (negative). In future sections the term positivity rating will be used to discuss these dependent variables more generally.

While these individual studies all find that Duchenne smiles are perceived more positively than non-Duchenne smiles, they do so with diverse stimulus types, perceiver characteristics, and types of measurements. The differences in these studies could produce new and interesting findings about what moderates the relationship between smile type and smile perception. These differences fit into three categories: differences in how these perceptions are measured, differences in stimulus type, and differences in perceiver characteristics.
**Differences in Dependent Measures**

Duchenne smiles are written about in the literature as genuine, authentic, real, and as displays of enjoyment, while non-Duchenne smiles are described as social, inauthentic, fake, false, and displays of politeness. One tradition of research that measures differences in the perceptions of Duchenne and non-Duchenne smiles does so using measures that are specific to this distinction made between Duchenne and non-Duchenne smiles. These Duchenne specific dependent measures include making continuous ratings of how happy, genuine, amused, or authentic the smile is (e.g., Krumhuber & Manstead, 2009) or forced choice ratings of whether the smile is expressing real or false happiness (e.g., Gosselin et al., 2002), is a real smile or a deceptive smile (e.g., Sacco, Hugenberg, & Sefcek, 2009), or is amused or not amused (e.g., Ambadar, Cohn, & Reed, 2009). Another tradition has perceivers make trait inferences of the person after seeing him or her either produce a Duchenne or non-Duchenne smile. These include ratings of the individuals’ attractiveness, trustworthiness, competence, and persuasiveness based on whether they displayed a Duchenne or non-Duchenne smile (Gunnery & Hall, under review; Mehu, Little, & Dunbar, 2007; Woodzicka, 2008).

**Differences in Stimuli**

Differences in stimulus type include whether the smiling stimuli (both Duchenne and non-Duchenne) were produced naturally or were posed in some experimentally instructed paradigm, if the Duchenne and non-Duchenne smiles being perceived were of the same intensities, and if the stimuli were dynamic or static in nature. These three categories are explored further below.

**Posed versus natural stimuli.** Stimuli are most often created from videotapes gathered from a Duchenne smile expression study which can either be natural or posed (e.g., Krumhuber...
& Manstead, 2009), or they are created by instructing individuals to specifically activate certain muscles which are always posed\(^1\) (e.g., del Giudice & Colle, 2007). Natural stimuli are created by inducing a person to feel happy and recording the resulting facial expression, while posed stimuli are created by instructing the smiler to act as if they are feeling a certain way or to activate the necessary muscles to create Duchenne or non-Duchenne smiles. The distinction between posed and natural stimuli is different from that made between deliberate and spontaneous smiles, as it is possible for both deliberate and spontaneous smiles to occur in natural smiling situations, but all smiles created in posed situations are deliberately produced based on the instructions given by the experimenter.

**Smile intensity.** Hess, Kappas, McHugo, and Kleck (1989) found that smiles where the lip corners are pulled back further creating bigger, or in FACS terms more intense, smiles are perceived as indicating more happiness, and it has been shown that Duchenne smiles are typically more intense than non-Duchenne smiles (e.g., Gunnery et al., 2013). Some studies match for intensity in their stimuli and some do not. If the Duchenne smiles in a study’s stimuli are of a higher intensity than the non-Duchenne smiles, any differences in perceptions of Duchenne and non-Duchenne smiles could be an artifact of perceptual differences of smiles with differing intensities. This could be the case both if more positive characteristics are attributed to people displaying greater intensity smiles than lesser intensity smiles and if perceivers categorize smiles of greater intensity as real or genuine while smiles of lesser intensity are categorized as fake or polite.

**Static versus dynamic.** The last major way that stimuli differ in the literature is whether they were shown in static photographic form or as dynamic video clips. This choice seems to be based on what stimuli are most easily accessible, but it is quite likely that whether the stimulus is
static or dynamic could facilitate or dampen the relationship between smile type and perception. This is an important distinction because in the social contexts that this dissertation is interested in, all smiles are dynamic. If this meta-analysis finds an interaction between smile type and stimulus presentation where people perceive static Duchenne smiles more positively than static non-Duchenne smiles, but do not perceive dynamic Duchenne smiles more positively than dynamic non-Duchenne smiles, then how Duchenne smiles are perceived is not likely to be what motivates one to produce a Duchenne smile in everyday life. It is hypothesized that the difference in how Duchenne and non-Duchenne smiles are perceived will be greater for dynamic stimuli than static stimuli because dynamic stimuli offer more information, such as smile duration, that may be helpful in distinguishing between the two types of smiles (Krumhuber & Kappas, 2005).

Differences in Perceivers

The other potential source of moderators is differences in the perceiver. There is variability in the age of participants across studies. It has been found that children (ages ranging from 5 to 11 years old) are less likely to categorize Duchenne smiles as smiles produced when a person is feeling really happy and less likely to categorize non-Duchenne smiles as those produced when a person is pretending to be happy than adults (ages 18 and over) (Gosselin et al., 2002). It is predicted that age will moderate the difference between perceptions of Duchenne and non-Duchenne smiles when looking at the combined findings.

Gender is the second individual difference predicted to moderate the effect as women tend to be more accurate in nonverbal judgments than men (Hall, 1984). While some studies do compare men’s perceptions of Duchenne and non-Duchenne smiles to women’s perceptions within studies, because this meta-analysis is interested in the overall difference between
perceptions of Duchenne and non-Duchenne smiles gender needs to be looked at as a between studies variable. To do this, the percentage of perceivers who are women will be analyzed as a continuous between studies moderator.

**Method**

**Literature Search Procedure**

The search engine used was PsycINFO (American Psychological Association, through March, 2013). The keywords Duchenne smile, genuine smile, and smile perception were used. Because many Duchenne smile perception studies were found as second studies and not the main focus of many papers, all papers with the keywords Duchenne and smile were inspected for the presence of a perception study. Similarly all papers on the perceptions of smiles were inspected for the presence of a comparison of Duchenne and non-Duchenne smiles. Reference sections of included papers were then checked for any missed articles.

**Inclusion Criteria**

In order to be included in the meta-analysis, studies needed to (1) be published in a scholarly journal or book, (2) be written in English, (3) consist of participants and targets (stimuli) who were at least five years of age, (4) consist of participants from a typical population with no physical or cognitive impairments, and (5) if there was an experimental manipulation, such as socially excluding a group of participants before measuring their perceptions of the smile, then a control group needed to be present that was free of the experimental manipulation. The fourth criterion was not used to exclude any studies as all studies that met the other four criteria were from typical populations. See Table 1 for a list of the 23 included studies.

**Duchenne and non-Duchenne smiles.** In addition to the above criteria the studies had to measure the perceived difference between Duchenne and non-Duchenne smiles and not just one
of the expressions compared to a neutral expression. If the independent variable had a third neutral level the results had to be presented in a way that the effect size for the difference between Duchenne and non-Duchenne smiles could be extracted. The smiles needed to be identified as Duchenne and non-Duchenne using the criteria set forth in the FACS Manual (Ekman et al., 2002).

**Dependent variables.** The dependent measure of interest was how positively the smiles were perceived. Any measures that were not anchored on a positive to negative dimension were excluded. Dependent variables were coded by the author and a second graduate student. Any disagreements were discussed until a consensus was reached. Competitiveness was the only dependent variable that was excluded from the meta-analysis, because being more or less competitive can be either positive or negative depending on the context. See Table 1 for an exhaustive list of all included dependent variables by study.

**Variables Coded From Each Study**

The following variables were coded from each study when they were available: (1) number, mean age, and gender breakdown of perceivers, (2) number, mean age, and gender breakdown of targets in stimuli, (3) whether targets were professional actors paid to produce the smiles or from an unselected population, (4) number of stimuli used, (5) whether stimuli contained a neutral comparison, (6) whether the same targets were shown expressing both the Duchenne and non-Duchenne smile or if one set of targets displayed Duchenne smiles and one set displayed non-Duchenne smiles, (7) whether Duchenne smiles were elicited from targets through a posing paradigm or were induced naturally through some type of emotion induction, (8) whether the stimuli were presented in a dynamic or static format, (9) if there was verbal content present in the stimuli, (10) if the intensity of lip puller activation in the Duchenne smiles
was matched with the intensity of the lip puller activation in the non-Duchenne smiles, (11) what specific dependent variable was measured, (12) whether the dependent variable was measured on a continuous or dichotomous scale, (13) whether the unit of analysis was the target or the perceiver, (14) and whether or not the study compared one group of perceivers’ ratings of Duchenne smiles to a separate group of perceivers’ ratings of non-Duchenne smiles (between groups analysis) or whether the study compared a group of perceivers’ ratings of Duchenne smiles to that same group of perceivers’ ratings of non-Duchenne smiles (within groups analysis).

Whether the unit of analysis was the target or the perceiver indicates whether the effect size extracted was based on how an individual was rated by a group of perceivers based on their smiling behavior or how individuals rated a group of stimuli. As this is a major methodological difference, studies that used the target as the unit of analyses will originally be included in the overall analysis, and then subsequently excluded from moderator analyses. An additional moderator analysis will not be conducted on the target-as-unit studies because, as shown in Table 1, there were only five studies that used the target as the unit of analysis, and this number is too small for a meaningful moderator analysis.

**Variables of interest as potential moderators.** Of the numerous variables coded, those of most interest as moderators fell into three distinct categories. First, some substantial methodological and statistical analysis variables were treated as moderators to validate analyzing all the studies in one meta-analysis. These variables included whether the dependent variable was specific to Duchenne smiling, meaning it included a word such as genuine or amused that has been used to distinguish Duchenne from non-Duchenne smiles, or if it was a trait inference; whether the dependent variable was measured continuously or dichotomously; if the unit of
analysis was the perceiver or the target; and if the analysis, independent of whether the unit of analysis was the perceiver or the target, was between or within subjects.

Second, there were three variables that were coded in order to test for stimulus relevant moderators. These were whether the stimuli were elicited naturally or through a posing paradigm, whether the stimuli were dynamic or static, and whether the intensity of the Duchenne smiles and the intensity of non-Duchenne smiles were matched.

Third, there were two variables that were important in looking at how characteristics of the perceiver moderated the relationship between Duchenne smiling and perceivers’ ratings. These two moderators of interest were perceiver age and perceiver gender.

**Methods of Statistical Analysis**

The author and a second trained graduate student independently extracted all effect sizes using Pearson’s product-moment correlations. Any disagreements in effect sizes were resolved through discussion. If a study reported more than one dependent measure that fit the inclusion criteria, the results were averaged across dependent measures to make an overall effect size. If one individual study reported both trait inferences of the smiler and evaluations of how positive the smile was, (e.g., Quadflieg, Vermmeulen, & Rossion, 2013), then the coders randomly chose either the smile evaluations or the trait inferences to be used in the meta-analysis.

If the study reported analyses of just the independent variable (Duchenne or non-Duchenne smile) on the dependent variable the test statistic ($t$, $F$, or $\chi^2$) was simply converted to $r$ using formulas from Rosenthal (1991).

If there were other independent variables, such as gender, included in the analysis, but the means and standard deviations for Duchenne and non-Duchenne smiles were provided, Cohen’s $d$ was calculated using the information provided and then transformed to $r$ (Rosenthal, 1991).
When calculating effect sizes in this fashion, studies that originally utilized a within subjects design were now analyzed as if they were between subjects. For example, in the case where the same group of perceivers made ratings of Duchenne and non-Duchenne smiles, a repeated measures $t$-test is the appropriate statistic to test the effect the current meta-analysis is looking for. There were many cases where this within subjects analysis was not reported by the authors of the study and the components (particularly the standard deviations of the difference scores) were not provided. In these cases if the means and standard deviations for ratings of the Duchenne smiles and non-Duchenne smiles were given then Cohen’s $d$ was calculated and this was converted to Pearson’s $r$. Extracting effect sizes from studies where within subjects analyses were appropriate yet not possible using a between measures analysis yielded a more conservative estimate of the actual effect size. The number of observations in these cases were doubled to reflect the transformation from a within subjects design to a between subjects design that theoretically used two different groups of perceivers and subsequently correct for some of this underestimation in later meta-analytic analysis.

If the data were reported in terms of signal detection analysis, the $d'$ provided was tested in a one sample $t$-test against zero as $d'$ of zero would mean there was no difference in people’s perceptions of Duchenne and non-Duchenne smiles. The effect size was then calculated from the obtained $t$ value. Similarly, if the data were reported as an accuracy score with hits and correct rejections scored as 1 and misses and false alarms coded as 0 the accuracy score was tested in a one sample $t$-test against the chance accuracy level.

Following effect size extraction all analyses were completed using the Comprehensive Meta-Analysis software package (Bornstein, Hedges, Higgins, & Rothstein, 2005). Mean effect sizes were calculated using both fixed and random effects models. Borenstein, Hedges, Higgins,
and Rothstein (2009) define fixed effects analyses as those working from the assumption that there is one true effect size for the effect being studied and any difference among studies is random sampling error, while random effects analyses come out of the perspective that a true effect size can be produced from a variable number of studies based on what population the study sampled from and the design of the study.

The file-drawer N was calculated to determine the number of null findings that would need to exist in order to negate a significant combined effect size (Rosenthal, 1979) and thus test for any publication bias. Homogeneity of the combined effect size was tested to see if there was variability between the studies that warranted completing a moderator analysis. Lastly, moderator analyses were conducted using the fixed effects contrast ($Q$) (Borenstein et al., 2009).

**Results**

Twenty-three independent effect sizes with a total $N = 1,732$ were extracted from 16 articles. Overall, Duchenne smiles were rated as more positive (looking at all types of dependent variables) than non-Duchenne smiles. The random effects mean effect size was $r = .50$ ($Z = 7.37$, $p < .001$), and the fixed effect mean effect size was $r = .49$ ($Z = 21.57$, $p < .001$). The file-drawer $n$ was equal to 2,692 indicating that a very large number of null effects would have to exist in order to negate the significant combined effect size. A test of homogeneity indicated that the effect sizes (ranging from $r = .07$ to $r = .89$) were very heterogeneous, $Q(22) = 196.03$, $p < .001$. This heterogeneity pointed to the existence of moderators.

When studies where the target was the unit of analysis were excluded there were 18 effect sizes remaining with $N = 1,453$. The random effects mean effect size was $r = .54$ ($Z = 6.96$, $p < .001$), and the fixed effect mean effect size was $r = .51$ ($Z = 20.98$, $p < .001$). A test of homogeneity indicated that the effect sizes (ranging from $r = .13$ to .89) were still extremely
heterogeneous. $Q(17) = 163.73, p < .001$. This heterogeneity pointed to moderators that exist among studies where the perceiver was the unit of analysis.

Combining the 5 studies where the target was the unit of analysis yielded a random effects mean effect size was $r = .38 (Z = 2.67, p < .01)$, and the fixed effect mean effect size was $r = .34 (Z = 5.83, p < .001)$. This group of effect sizes was much less heterogeneous $Q(4) = 23.34, p < .001$. While this significant heterogeneity still points to their being moderating variables present among these effect sizes, the small number of studies does not allow for a meaningful test of these moderators. Since this group shows lower heterogeneity, all the following moderator analyses will only include studies where the perceiver was the unit of analysis.

**Moderator Analyses**

The moderator analysis comparing unit of analysis (target or perceiver) was significant, $Q = 13.77, p < .001$. All subsequent moderator analyses presented are based on the 18 effect sizes retrieved from studies where the perceiver was the unit of analysis. Table 2 shows the contrast $Q$ for each moderator analyzed. Table 3 then breaks down the significant moderators by their subgroups and shows the mean effect size (ES), $Z$, and fixed effects $p$-value for each component. Note that independence is not assumed across moderators as each study falls into one category of each moderator. All variables analyzed (except gender) were found to significantly moderate the relationship between the Duchenne smile and positive perceptions, and when broken down each moderator’s individual components each had effect sizes that were significantly greater than zero. These analyses are explained by moderator type in the following paragraphs.
**Methodological moderators.** Effect sizes originating from between groups analyses were smaller than effect sizes originating from within group analyses. Finding that effect sizes from between groups analyses were smaller than effect sizes from within groups analyses is in line with the nature of how these effect sizes are specifically extracted. Effect sizes from studies that used a within group design had assumedly smaller error terms because of the nature of a repeated measures design. This indicates that estimating effect sizes from within groups studies using between groups analyses likely gave us an underestimate of this total effect.

When dependent variables were measured using dichotomous rather than continuous response scales, the difference between the perceptions of Duchenne and non-Duchenne smiles was greater, meaning that when perceivers were forced to categorize smiles as having a certain characteristic or not (i.e., genuine or not genuine) or the smiler as being one way or not (i.e., amused or not amused) the difference between positivity ratings for Duchenne and non-Duchenne smiles was greater than when they were able to rate the smile or smiler on a continuous scale (i.e., from not at all genuine to very genuine). When looking at the mean effect sizes for these components individually (see Table 3), both components yielded effect sizes that were greater than zero. This indicates that when given the opportunity to use a scale to make the rating, perceivers still rated Duchenne smiles more positively, but because the response format allowed for more variability, there was likely more variability in their answers.

The difference is also greater when perceivers were asked to rate attributes that were specific to the Duchenne smile, such as how genuine the smile was, rather than make trait inferences about the smiler, such as how competent the smiler was. This difference is likely due to the latter task being more complex. In order to make this judgment, first the perceiver needed to make an inference about the smile based on the presence or absence of the Duchenne marker,
and then make an inference about the smiler based on what they inferred from the smile. For example, instead of just perceiving that the Duchenne marker is present and then inferring that the smile is genuine, perceivers needed to infer that the smile was genuine and then subsequently infer that people who smile genuinely are competent or that people who smile genuinely have more positive traits in general and are thus competent. Again, when broken down by its components (Table 3), the mean effect size for ratings made about Duchenne specific attributes and unrelated traits about the smiler were both significantly greater than zero.

**Stimuli moderators.** Opposite to what was expected, the perceptual difference between Duchenne and non-Duchenne smiles was greater when the stimuli were static rather than dynamic. The mean effect size for dynamic stimuli was significantly above zero indicating that dynamic Duchenne smiles are still perceived more positively than dynamic non-Duchenne smiles, but it is likely that the added variability in dynamic stimuli led to static stimuli yielding a greater mean effect size. The photographed Duchenne smiles likely showed the smile only at peak intensity creating a more stark difference between the two smile types.

Stimuli that were elicited naturally rather than using posing paradigms produced a greater mean effect size indicating that when the target is instructed how to smile or asked to produce the expression when they were not feeling happy, there is less of a distinction (though it is still significant) between Duchenne and non-Duchenne smiles. This could be because smiles elicited naturally have additional cues, such as laughter or head movements that indicate more happiness.

Also stimuli where the Duchenne and non-Duchenne smiles were matched for intensity had a lower effect size. This means that the Duchenne marker is likely not the only cue being used to make these judgments. Perceivers are also likely relying on smile intensity because the
mean effect size was larger when Duchenne smiles were more intense than non-Duchenne smiles than when Duchenne smiles and non-Duchenne smiles were matched for intensity.

**Perceiver moderators.** The correlation between the percentage of perceivers that were female and effect size was not significant, $r(16) = .09$. This indicates that having a majority of female perceivers does not moderate the effect. Only a minority of individual differences reported testing for a gender difference, and all those that did report this analysis did not find a significant difference between males and females.

Studies with college aged perceivers had larger effect sizes than studies with perceivers under the age of 10. This is not surprising, as the three studies that used child perceivers all found that adults were significantly more sensitive to the distinction between Duchenne and non-Duchenne smiles than children.

**Discussion**

Duchenne smiles are rated more positively than non-Duchenne smiles. This finding is quite robustly in the predicted direction, and while it is theoretically important to have this part of the smiling literature in synthesized form, the most interesting findings come from a more detailed look at the moderator analyses.

Analyzing major differences in the methodology across studies was done mainly to test whether these studies with diverse methodologies could be effectively synthesized into one effect size. While the moderator analysis did show differences in effect sizes among studies that were methodologically different, Duchenne smiles were perceived as significantly more positive than non-Duchenne smiles in all methodologically distinct groups. Although each subgroup of each moderator still had a mean effect size greater than zero, there was also still significant heterogeneity among each subgroup, indicating that there would still be moderators present if
analyzed individually, but the small number of studies in each individual subgroup was too small to do this in any meaningful way.

An investigation of the stimuli specific moderators revealed that the stimuli that were more true to life resulted in a larger difference between the ratings of Duchenne and non-Duchenne smiles for the most part. The one caveat to this was the finding that the perceptual difference between Duchenne and non-Duchenne smiles was larger for static (photographic) than dynamic (video) stimuli. While the whole time course of the Duchenne smile (onset, apex, offset) has been shown to provide important information about the meaning of the smile and the person putting on the smile (Krumhuber & Kappas, 2005), it is possible that the stark difference between Duchenne and non-Duchenne smiles was more apparent when looking at photographs than the videos that contained more information that may not be relevant to the distinction.

There was a greater difference in perceivers’ ratings of naturally produced Duchenne and naturally produced non-Duchenne smiles than there was in their ratings of posed Duchenne and posed non-Duchenne smiles. This follows Krumhuber and Manstead’s (2009) finding that posed Duchenne smiles were rated as less amused and genuine than what they termed as spontaneous Duchenne smiles. It also follows from the hypothesis that the difference in perceptions of the two smiles is greater in situations that more greatly parallel real life. This is especially interesting when differentiating between how targets produced smiles in the studies that used posed stimuli, and thinking about how a person deliberately produces a Duchenne smile in real social interactions. While these findings could be generalized to say that deliberate Duchenne smiles are not perceived as positively as spontaneous Duchenne smiles, as was found by Krumhuber and Manstead, more research will need to be done with stimuli that make the distinction between deliberate Duchenne smiles and spontaneous Duchenne smiles that are elicited naturally.
Intensity was measured as a moderator by comparing studies that reported matching smile stimuli by intensity with those studies that failed to report this or reported using stimuli of differing intensities. If it is assumed that the studies that did not report matching Duchenne and non-Duchenne smiles on intensity showed perceivers Duchenne smiles that were more intense than non-Duchenne smiles, then it can be inferred that perceivers used that intensity as another cue to positivity in their ratings. Many studies have shown that there is a strong correlation between smiling intensity and presence of the Duchenne marker (Gunnery et al., 2013; Hess et al., 1989; Krumhuber and Manstead, 2009; Peace et al., 2006). These findings were further supported by edits made to the FACS manual that added additional coding criteria for coding the presence of the cheek raiser when there is a smile of high intensity present (this is further discussed in Chapter 3) (Ekman et al., 2002). Finding that smile intensity moderates how people view Duchenne and non-Duchenne smiles is strong evidence for the need to be cognizant of smile intensity both in the design and analysis of studies on Duchenne smiles as smile intensity can easily confound findings about the nature of the Duchenne smile.

While it was predicted that studies that had a larger percentage of female perceivers would show larger differences in the ratings of Duchenne and non-Duchenne smiles because females are typically more sensitive to nonverbal cues, this prediction was not supported. There have not been enough studies on the differences in perceptions of Duchenne and non-Duchenne smiles that measure gender differences to do a meta-analysis of whether females are more sensitive to this cue than males, but as the literature continues to grow this may become possible in the future. Studies that have measured the difference in the perceptions of men and women have largely found no gender effect.
Age of perceiver did show a moderating effect. Gosselin and colleagues’ (2007) research has shown that as a whole children are less able to perceptually differentiate between Duchenne and non-Duchenne smiles. These findings were confirmed in the present meta-analysis. Although the effect was still present for children at a significant level, adults were better able to differentiate between Duchenne and non-Duchenne smiles through their ratings.

The perceptual differences seen here fit with SIMS model as smiles with crow’s feet around the eyes likely draw the perceiver to look in that region (Niedenthal et al., 2010). Niedenthal et al. (2010) theorize that this eye contact encourages the perceiver to simulate the expression in their mind which then helps them decode the meaning of the smile. This model is especially informative in terms of the stimuli specific moderator analyses, as static smiles are likely mimicked or simulated easier than dynamic smiles, smiles elicited naturally may feel more real to life to perceivers, and the simulation of more intense smiles likely activates more stereotypic knowledge of what smiles mean. While Niedenthal et al. (2010) argue that the Duchenne marker can be present in smiles that are not expressing genuine happiness (though do not outright argue that the Duchenne smile can be deliberate), this meta-analysis confirms that people generally perceive smiles with the Duchenne marker present as expressing genuine happiness. So while people may use the Duchenne marker when trying to present themselves as friendly or dominant, when they are doing so they are also presenting themselves in a more positive light.

Together this meta-analysis provides overwhelming evidence that when a person produces a Duchenne smile, the smile, as well as the person, are rated more positively than when producing a non-Duchenne smile. Though this study does not provide evidence that people are explicitly aware that when they Duchenne smile they are perceived more positively, it gives a
substantial self-presentational motivation for people to want to deliberately produce a Duchenne smile if they are able to, and provides a solid foundation for studying how producing deliberate Duchenne smiles may affect a person’s social world.
Chapter 3: Study 2- The Duchenne Smile and Persuasion

Introduction

When discussing the ability to deliberately put on a Duchenne smile that is perceived as genuine, the words fake, manipulative, and deceptive often slip into the conversation whether it is colloquial or empirical in nature (Ekman & Friesen, 1982; Ekman, Friesen, & O’Sullivan, 1988). It is hard to talk about a deliberate facial expression that can be used to cover up negative feelings outside the context of deception and manipulation, but the expression does not have to be used deceptively or manipulatively.

There are many social situations where one may choose to put on a deliberate Duchenne smile for prosocial or benign communicative purposes. People may cover up disappointment or disliking with a Duchenne smile to avoid hurting another person’s feelings, or because although they are not feeling genuinely happy, they want to communicate that they appreciated the favor another person did for them. Deliberately putting on a Duchenne smile does not have to be done for personal gain, but can also be used to smooth over a social interaction or accurately communicate information. For example, a person may want to communicate he or she is happy to have run into a friend even though he or she is really feeling anxious because of being late for an appointment, or may wish to express sincere gratitude for a gift received in a previous week in spite of not feeling especially happy at the moment. In such a case the person can recreate the expression that would have gone with the original spontaneous happy feeling. Thus, the expression and its message may be authentic and sincere, but not coincident with the predominant affective state being experienced in the moment. In other instances, the deliberate Duchenne smile may also be synchronous with happy affect, as when a person really likes the gift and wants to make sure the gift-giver knows it.
While deception is not necessarily the motivating force behind the use of the deliberate Duchenne smile or behind the use of nonverbal behavior as self-presentation, it is likely that people who are able to deliberately put on a Duchenne smile are better able to cover up felt negative affect. If people are skilled at using nonverbal behavior as self-presentation than they will have an easier time of covering up thoughts and feelings they do not want to express (DePaulo, 1992), then deception in the form of covering up underlying emotions lends itself well to the study of the relationship between ability to deliberately produce a Duchenne smile and the social outcomes of this ability. To test this hypothesis the present study utilized a taste persuasion paradigm where participants had to express to an experimenter that they enjoyed the taste of a pleasant and unpleasant tasting juice, and that they disliked the taste of the same juices, in order to persuade the experimenter either to try or not try the juice (Feldman, Tomasian, & Coats, 1999). In using this task, I was able to look at the relationship between the choice to produce a Duchenne smile and persuasiveness in two contexts that were congruent with underlying affect (persuading the experimenter to drink the pleasant tasting juice, or not to drink the unpleasant tasting juice) and two contexts that were incongruent with underlying affect (persuading the experimenter to drink the unpleasant tasting juice, or persuading the experimenter not to drink the pleasant tasting juice). Appropriateness of the use of the Duchenne smile is crossed with affective congruence in these four tasks, as it is appropriate and seemingly helpful (at least from the persuader’s perspective) to produce a Duchenne smile when persuading to drink the juice, and inappropriate and unhelpful when persuading not to drink the juice.

Ekman et al. (1988) reported that when people are lying about feeling happy they show more non-Duchenne than Duchenne smiles, as the non-Duchenne smile is easy to fake and the Duchenne smile is supposedly near impossible. However, the abundance of evidence showing
that it is quite possible to deliberately put on a Duchenne smile (e.g., Krumhuber & Manstead, 2009; Gunnery et al., 2013) leads to the hypothesis that people who are able to deliberately produce a Duchenne smile will use the expression when trying to mask felt negative affect in order to appear positive and will therefore be more successful when persuading another person to drink the juice.

It is not possible to infer with confidence whether Duchenne smiles produced during the naturalistic behavioral tasks, such as a persuasion paradigm, are deliberate or involuntary. Mood can be measured and controlled for, so it is possible to say the person produced a Duchenne smile although they did not feel happy, but it is also plausible that a person could feel happy but still deliberately produce a Duchenne smile. In order to measure participants’ ability to put on a deliberate Duchenne smile, I employed a role-play paradigm where participants act out different emotion-specific scenarios in rapid succession and then imitate Duchenne and non-Duchenne smiles, modified from Gunnery et al. (2013). This way, participants’ ability to deliberately put on a Duchenne smile can be correlated with their use of the Duchenne smile during the persuasion task as well as with how persuasive they were during the task, although it cannot be inferred whether the Duchenne smiles produced during the persuasion task are deliberate or spontaneous.

I hypothesized that those who were able to produce the deliberate Duchenne smile during the role-play task and while imitating a Duchenne smile would be more persuasive overall, indicating that people who can produce deliberate Duchenne smiles are more nonverbally and socially skilled. I also hypothesized that participants who were able to deliberately produce a Duchenne smile would be more likely to use the Duchenne smile when persuading the experimenter to drink the different juices, and more likely not to smile when persuading the
experimenter not to drink the juices as I hypothesize they will have more expressive control in general.

The self-report measures employed in the present study were largely exploratory. I predicted that self-report expressivity measures would correlate with deliberate Duchenne smiling ability and moderate the relationship between the deliberate Duchenne smile and persuasiveness, because it is likely that people who are better at expressing their emotions can both put on a deliberate Duchenne smile, and use their expressivity skills to better persuade others. I also predicted that the negative personality measures (i.e., the Narcissistic Personality Inventory) would not correlate with the ability, and thus rule out that the ability to deliberately Duchenne smile is driven by a motivation for personal gain or deception. Lastly I predicted that the PANAS-A, a measure of trait positive and negative affect, would not correlate with deliberate Duchenne smiling as it is not predicted that people with this ability are generally happier or less happy.

Method

Participants

Eighty (70% female) Northeastern University undergraduates participated in this study. Fifty-seven participants participated for partial credit in their introductory psychology course. Twenty-three participants were recruited from a previous unpublished study on deliberate Duchenne smiling and were paid $15.00 for their participation. Two participants were excluded due to problems with videotapes leaving a total of 78 (69% female).

In the second phase of the study, 200 Northeastern undergraduate students participated as naïve viewers for partial credit in their introductory psychology course.

Tasks
**Taste persuasion paradigm.** In the taste persuasion paradigm modeled after Feldman et al. (1999), participants were videotaped while they persuaded a male experimenter who was blind to the participant’s instructions to (1) taste a pleasant tasting juice, (2) taste an unpleasant tasting juice, (3) not taste a pleasant tasting juice, or (4) not taste an unpleasant tasting juice. This meant that participants persuaded the experimenter two times in a way that was congruent with the taste of the juice and two times in a way that was opposite to how the juice tasted. This allowed for the measurement of whether participants employed a Duchenne smile to mask feelings of disgust or disliking. When participants persuaded the experimenter to drink the juice, they were instructed to sip the juice and then look up at the camera, smile, and say, “This is really good. You should try it.” When the participants were to persuade the experimenter not to drink the juice, they were instructed to sip the juice and then look up at the camera with a disgusted face and say, “This is really gross. You should not try it.”

The pleasant tasting juice was sweetened cranberry juice and the unpleasant juice was unsweetened 100% cranberry juice. The juice was given to participants in small black plastic cups so that neither the experimenter with them nor naïve viewers who watched the videotape later could identify the different juices by their slightly different color. The persuasion condition was randomized by a third party who placed each drink sample and persuasion instructions in numbered brown paper bags. The experimenter remained blind to the fact that all participants tasted two different juices while persuading to drink the juices and while persuading not to drink the juices. The participants also were never explicitly told of the experimental design, but likely deduced what it was following the completion of all four persuasion tasks.

**Duchenne role-play task.** Following the completion of the taste perception task, participants were instructed to pose a facial expression for each of seven scripted role-plays
(adapted from Gunnery et al., 2013). On four of these, participants were instructed to smile; of these, two described role-plays where the smiles would be “fake” happiness smiles (masked disappointment and masked disliking of another person), and two described role-plays where the smiles would be, in real life, “genuine” happiness smiles (happy greeting a friend and happy over a good grade). The remaining three (control) role-plays did not describe or request smiling and were intended, by their nature, to be irrelevant to the smiling theme (genuine sympathy, fake sympathy, genuine worry). The four smiling role-plays were interspersed with the three control role-plays so that no two smiling role-plays were adjacent. All participants posed the role-plays in the same order.

All expressions were directed at a video camera that was in plain sight. For each role-play the context and the participant’s intended emotional state were described to the participant, and the participant was given an appropriate sentence to say. An example of a “genuine” role-play is “You are feeling happy. You are together with your best group of friends. One of them suggests going out to a great new club. You smile and say, ‘That’s a great idea!’” In all of the smiling role-plays, participants were explicitly told to smile, but not what type of smile they should produce.

**Duchenne imitation task.** Participants were given four photographs of people smiling to imitate with their own faces. Two of the photographs were of two different people producing Duchenne smiles, and two were of two different people producing non-Duchenne smiles. All participants copied the expressions in the same order. First the non-Duchenne smile followed by both Duchenne smiles and the second non-Duchenne smile.

**Measures**
Participants completed the Social Skills Inventory (SSI; Riggio, 1986), the Positive and Negative Affect Schedule (PANAS-A; Watson, Clark, & Tellegen, 1988), the Berkeley Expressivity Questionnaire (BEP; Gross & John, 1997), the Emotional Regulation Questionnaire (ERQ; Gross & John, 2003), the Narcissistic Personality Inventory (NPI; Raskin & Hall, 1979), and the Machiavellian Personality Scale (MPS; Dahling, Whitaker, & Levy, 2009). Participants also completed a questionnaire asking them how well they thought they did on the tasks they completed during the experiment.

**Procedure**

Upon entering the lab the experimenter gave the participant a brief overview of the experiment, which included an outline of all videotape procedures. The experimenter then explained that the participant would be given four juices to taste and that the participant would have to persuade the experimenter either to taste or not taste the juice. The experimenter asked the participant if they had any allergies to fruit juice before giving them the juice to taste. Before tasting the juices the participant had no knowledge of what type of fruit juice they would be trying and that half of the drink samples would taste pleasant and half would taste unpleasant.

After tasting each juice and making their persuasive statement, participants rated how pleasant they found the juice, how likely they were to try the juice again, and how happy, content, pleasant, and cheerful they felt while persuading. All ratings were made on a scale of 1 (not at all) to 9 (extremely). The four emotion ratings were averaged into one happiness score.

After each taste, the experimenter also rated how pleasant he thought the participant found the juice to be and how likely he would be to try the juice given the opportunity, but he never actually tried any of the juices. The experimenter and participant both made their ratings at
opposite ends of a round table. In doing so, neither was looking at the others’ ratings before making their own.

The participant then completed the Duchenne role play task and the Duchenne imitation task. After completing the 3 videotaped tasks, participants completed the battery of questionnaires.

**Smile Coding**

The first smile in each participant’s four taste trials and in each smiling role-play as well as each imitation task was coded for the presence and intensity of AU 6 (orbicularis oculi) and AU 12 (zygomatic major) using the FACS guidelines that include additional techniques for coding the presence of AU 6 when AU 12 is of a high intensity because it is possible for very intense activations of AU 12 to raise the cheeks causing crow’s feet around the eyes independent of AU 6 activation. The additional techniques require the presence of a slight droop in the eyelid, slight bunching underneath the eye, or a slight drop in the outer eye brow (Ekman et al. 2002). A second certified FACS coder coded 25% of the persuasion task stimuli resulting in a kappa of .70 for coding AU 6 and .74 for coding AU 12. Coders spoke following reliability coding to discuss differences and reach agreement.

**Stimulus Tape Construction**

Participants’ four taste tasks were edited into five videotapes. Each videotape included 16 participants’ four taste trials edited together so that each participant’s first taste trial was shown before moving on to the second taste trial. Pauses were edited in between each clip to give naïve viewers adequate time to make their ratings. The taste trials remained randomized in the same order they were videotaped in. Each clip was edited to begin when the taste cup was removed
from the lips so that it was no longer occluding the facial expression and to end at the completing of the persuasion statement.

**Naïve Viewer Ratings**

Approximately 40 naïve viewers viewed each stimulus tape in groups ranging from 1-5 viewers. Naïve viewers made ratings of how likely they would be to try the juice and how pleasant they thought the juice would be. Both of these ratings were made on 9-point Likert scales from 1 (not at all) to 9 (extremely).

**Results**

**Taste Manipulation Check**

To test whether participants actually found the pleasant juice pleasant and the unpleasant juice unpleasant, I compared participants’ mean pleasantness ratings that were made on a 9-point Likert scale ranging from 1 (not at all) to 9 (extremely). The pleasant juice was rated as more pleasant ($M = 6.96$) than the unpleasant juice ($M = 2.10$), $t(78) = 26.83$, $p < .001$.

**Percentage of Smiles that Were Duchenne**

The mean percentages of smiles that were Duchenne in each task are displayed in Table 4. Replicating Gunnery et al. (2013), a sizeable minority of participants produced a Duchenne smile when role-playing both “genuine” ($M$ percentage = 45) and “fake” ($M$ percentage = 39) happiness scenarios. Also replicating Gunnery et al. (2013), these two mean percentages did not differ from each other, $t(68) = 1.13, p = .26$. This provides evidence that Duchenne smiling in the “genuine happiness” role-plays was not the spontaneous result of positive affect.²

When imitating the Duchenne smile, participants on average produced a Duchenne smile in one of the two imitations (as indicated by the mean percent of 55 shown in Table 4) and many fewer produced a Duchenne smile when imitating the non-Duchenne smile ($M$ percentage = 17).
Producing a Duchenne smile when imitating a non-Duchenne smile was not the correct action, and so this low mean percentage shows that most people were able to imitate the non-Duchenne smile correctly.

Table 4 shows that a sizeable minority of participants who smiled produced a Duchenne smile when persuading the experimenter to drink both the pleasant and unpleasant juices, and these two percentages did not differ, $t(42) = 1.16, p = .25$. This indicates that participants did not produce a Duchenne smile less when the drink was unpleasant tasting than when it was pleasant tasting although they did rate the pleasant juice as much more pleasant tasting than the unpleasant juice.

Participants’ self-reported happiness ratings were not correlated with their Duchenne smiling behavior for the pleasant tasting juice, $r(51) = .07, p = .58$, nor the unpleasant tasting juice, $r(49) = -.08, p = .57$. Since participants reported more happiness when persuading to drink the pleasant juice ($M = 5.75$) than when persuading to drink the unpleasant juice ($M = 3.30$), $t(76) = 10.75, p < .001$, it appears that participants responded to the persuasion instructions and used deliberate Duchenne smiles rather than responding with the facial expression that appropriately matched their underlying emotional state.

**The Duchenne Smile and Intensity**

Even when using the coding techniques for coding the Duchenne marker in intense smiles, production of the Duchenne marker was correlated with the intensity of the smile. Duchenne smiles are more intense than non-Duchenne smiles (see Table 5 for intensity correlations). It is not surprising that Duchenne smiles would be more intense because both characteristics of the smile are used to communicate more happiness. I will be reporting the
remaining results in terms of the relationship between persuasion and the Duchenne smile with the underlying knowledge that the Duchenne marker and smile intensity covary.

**Persuasion Results**

Naïve viewers’ ratings of how likely they would be to try the juice and how pleasant they thought the juice would be were highly correlated for all four taste conditions (ranging from $r = .83$ to $r = .94$) so a composite pleasantness score was created. Due to greater reliability in the larger sample of raters as compared to the single experimenter, I used the naïve viewers’ pleasantness composite as the dependent variable in all the persuasion analyses (naïve viewers’ ratings were correlated with the experimenters’ ratings, ranging from $r = .19$ to $r = .38$ across the four taste trials).

A 2 (juice type: pleasant or unpleasant) x 2 (persuasion direction: to taste or not to taste) repeated measures ANOVA revealed a main effect for juice type, $F(1, 77) = 5.18, p < .05$, indicating that the naïve viewers rated the pleasant tasting juice as likely to be more pleasant independent of whether they were viewing the participant persuade the experimenter to drink the juice or not to drink the juice, and a main effect for persuasion direction, $F(1, 77) = 397.29, p < .001$, indicating that naïve viewers rated both juices as much more likely to be pleasant when they were being told to drink them than being told not to drink them. The interaction between juice type and persuasion direction was not significant, $F(1, 77) = .68, p = .41$, meaning that naïve viewers’ pleasantness ratings were influenced equally by the taste instructions for both kinds of juice. See Table 6 for means.

**Relationship between the Duchenne Smile and Persuasion**

Duchenne smiling during the taste task and persuasion. When persuading the experimenter to drink the pleasant juice, producing a Duchenne smile rather than a non-
Duchenne smile was related to higher naïve viewers’ ratings of pleasantness, $r(52) = .33, p < .05$. Producing a Duchenne smile when persuading someone to drink an unpleasant tasting juice was not correlated with naïve viewers’ pleasantness ratings, $r(49) = -.05, p = .72$. These findings together indicate that when participants were persuading in a way that was congruent with emotional state, use of the Duchenne smile was helpful, whereas when they were persuading in a direction that was incongruent with their underlying state the Duchenne smile neither helped nor hurt. This leads one to believe that participants were engaging in some other type of nonverbal behavior, whether it was something in the face or voice, which led them to be more persuasive when they were persuading to drink the unpleasant juice because the verbal content was kept constant.

**The deliberate Duchenne smile and persuasion.** An investigation of the relationship between ability to produce a deliberate Duchenne smile and pleasantness ratings revealed that naïve viewers rated both juices as more pleasant when being persuaded by participants who produced a higher percentage of Duchenne smiles in the “genuine happiness” role-plays; see Table 4 for correlations. These findings suggest that participants who showed a greater ability to produce deliberate Duchenne smiles were more persuasive when persuading in the positive direction.

A mixed model analysis of variance was conducted with juice type (pleasant or unpleasant) and persuasion direction (persuade to taste it or persuade not to taste it) as within-subjects factors and Duchenne smiling in the “genuine happiness” role-plays (which was operationally defined as producing a Duchenne smile in either or both “genuine happiness” role-plays, vs. not producing a Duchenne smile in either role-play) as a between-subjects factor. In addition to the same main effect as described above for persuasion direction that showed that
naïve viewers rated the juice as more pleasant when participants were persuading the experimenter to drink it rather than not drink it, the ANOVA revealed a significant interaction between persuasion direction and Duchenne smiling in the “genuine happiness” role-plays, $F(1,72) = 5.95, p < .05$. The means displayed in Figure 1 showed that participants who produced at least one Duchenne smile when role-playing “genuine happiness” received higher pleasantness ratings when persuading to drink the juice and lower pleasantness ratings when persuading not to drink the juice relative to participants who did not produce any Duchenne smiles in the “genuine happiness” role-plays. This difference in pleasantness ratings indicates that participants were more persuasive when persuading in both directions when they exhibited the ability to deliberately produce a Duchenne smile. Table 7, first column, reveals this pattern in correlational form (positive correlations with deliberate Duchenne smiling in the persuade to drink conditions and negative correlations with deliberate Duchenne smiling in the persuade not to drink conditions).

When the same ANOVA was run for deliberate Duchenne smiling in the “fake happiness” role-plays, there was no interaction between persuasion direction and deliberate Duchenne smiling, $F(1, 68) = 1.34, p = .25$, and Table 7, second column, shows this as well.

There was no correlation between Duchenne smiling when imitating a Duchenne smile and persuasiveness. Duchenne smiling when imitating the non-Duchenne smile was negatively correlated with positivity ratings when persuading not to drink the pleasant tasting juice. This means that participants who produced a Duchenne smile when imitating the non-Duchenne smile received lower positivity scores. This indicates greater persuasion in the negative direction as they were persuading not to drink the pleasant tasting juice. This correlation was largely
unpredicted as participants who produced a Duchenne smile when imitating the non-Duchenne smile imitated the smile incorrectly.

**The deliberate Duchenne smile and Duchenne smiling in the taste task.** It was predicted that the relationship between the ability to produce a deliberate Duchenne smile and persuasiveness would be reduced when controlling for the use of the Duchenne smile while persuading. This prediction was supported in the pleasant juice condition. When controlling for whether or not those participants who smiled used a Duchenne smile when persuading someone to drink the pleasant tasting juice, there was no longer a marginally significant correlation between demonstrating an ability to produce a deliberate Duchenne smile and the pleasantness ratings, \( r_{\text{partial}} = .16, p = .27 \) (compared to the correlation of \( r(51) = .25, p = .07^3 \), before partialing). However, controlling for whether participants produced a Duchenne smile when persuading in the correlation between ability to produce a deliberate Duchenne smile in the “genuine happiness” role-plays and pleasantness ratings indicates that this prediction was not supported when participants were tasting the unpleasant juice because the correlation remained marginally significant, \( r_{\text{partial}} = .27, p = .06 \) as compared to \( r(79) = .25, p = .07 \), when Duchenne smiling while persuading to drink the unpleasant juice is not controlled for. This shows that when persuading to drink the unpleasant tasting juice, participants with the ability to produce a deliberate Duchenne smile were more persuasive independent of whether they used a Duchenne smile while persuading. This difference between smiling behavior in the pleasant and unpleasant juice conditions indicates that participants who can deliberately produce a Duchenne smile are more persuasive, but that they only successfully used the Duchenne smile to persuade when persuading to drink the pleasant juice.

**Individual Differences in the Use of the Duchenne Smile**
**Consistency across smiling tasks.** The correlations between the percentages of smiles that were Duchenne in all the smiling tasks where Duchenne smiling would be the appropriate response are displayed in Table 8. Replicating Gunnery et al.’s (2013) findings, participants who Duchenne smiled when role-playing “genuine happiness” were more likely to produce a Duchenne smile when role-playing “fake happiness” and when imitating a Duchenne smile. Producing a higher percentage of Duchenne smiles when role-playing “fake happiness” was marginally correlated with Duchenne smiling when imitating a Duchenne smile.

Also, participants who displayed a Duchenne smile while persuading someone to drink the pleasant tasting juice were also more likely to display a Duchenne smile while persuading someone to drink the unpleasant juice, and were more likely to produce a deliberate Duchenne smile when in the “genuine happiness” role-plays, marginally when in the “fake happiness” role-plays, and significantly when imitating a Duchenne smile. Producing a Duchenne smile when persuading someone to drink the unpleasant juice was not correlated with the ability to produce a Duchenne smile in either smiling role-play or when imitating a Duchenne smile.

**Self-reported individual difference measures and the deliberate Duchenne.** As can be seen in Table 9, ability to produce a deliberate Duchenne smile in the “genuine” and “fake happiness” role-plays was not correlated with any of the self-report measures. This supports our predictions for the Narcissistic Personality Inventory and the Machiavellian Personality Scale possibly indicating that the ability is not something that is used by people who are looking for personal gain. Our prediction about the PANAS-A were also supported indicating that people who can deliberately produce a Duchenne smile do not experience different mood states from those who cannot.
However, Duchenne smiling during the role-plays also did not correlate with any aspect of the Social Skills Inventory or the Berkeley Expressivity Questionnaire, which goes against predictions about increased expressivity and greater social skills being a commonality among those who display the ability to deliberately produce a Duchenne smile. Due to the null findings across the board it seems most likely that self-report measures are not sensitive to individual differences between people who display deliberate Duchenne smiles in this task and people who do not. Thus, these findings cannot not be interpreted in the way they were intended to be.

Producing a higher percentage of Duchenne smiles when imitating the Duchenne smile is negatively correlated with the emotional expressivity subscale of the Social Skills Inventory (SSI), but since this subscale did not correlate with any other smiling variables, it is difficult to interpret what this could mean.

Producing a higher percentage of Duchenne smiles when imitating both the Duchenne smile and non-Duchenne smile was negatively correlated with the NPI. This indicates that people who produce Duchenne smiles more when imitating smiles self-report being less narcissistic.

Producing a higher percentage of Duchenne smiles when imitating the non-Duchenne smile, which again was not the correct thing to do, was negatively correlated with the emotional sensitivity scale of the SSI, was positively correlated with the positive subscale of the PANAS, and was negatively correlated with ability to produce negative expressions, impulse strength, and overall expressivity on the Berkeley Expressivity Scale. These correlations together show that individuals who are unable to turn off the Duchenne marker when imitating a non-Duchenne smile were happier in general, but had poorer expressivity skills. It is important to note, that this was a small group of participants, with only 17% of smiles produced when imitating the non-Duchenne smile being Duchenne smiles.
All of these correlations were run a second time controlling for gender in the analysis, and all of the correlations remained significant, indicating that the effects were not an artifact of gender.

**Self-reported individual difference measures and Duchenne smiling behavior while persuading.** Duchenne smiling behavior during the persuasion tasks did show some relationships to the self-reported individual difference measures. Higher scores on the emotional sensitivity subscale of the Social Skills Inventory predicted use of the Duchenne smile when persuading someone to drink the pleasant tasting juice, and predicted decreased use of the Duchenne smile (among those who smiled) when persuading someone not to drink the pleasant juice. This indicates that people who are more emotionally sensitive used the expression in the more socially acceptable context.

Interestingly, people who produced a higher percentage of Duchenne smiles when persuading someone not to taste the unpleasant juice scored higher on the negative expressivity subscale of the Berkeley Expressivity Questionnaire, and people who produced a Duchenne smile rather than a non-Duchenne smile when persuading someone not to drink the unpleasant tasting juice scored higher on the negative subscale of the PANAS. The small group of individuals who produced a Duchenne smile while persuading the experimenter not to drink the juice are better able to express their negative emotions and report feeling more negative emotion (see Table 9 for all correlations).

**Gender differences.** There were no gender differences in the percentages of Duchenne smiles produced in any of the smiling tasks, nor in how persuasive naïve viewers rated participants to be.

**Discussion**
These findings produce further evidence that the Duchenne smile can be produced deliberately. In addition to this, the correlations among smiling tasks show that the ability to produce a deliberate Duchenne smile is an individual difference. Furthermore, these findings show that people who have the ability to produce a Duchenne smile deliberately are more persuasive, but that they may use the deliberate Duchenne smile only when they are persuading another person to do something that is not contrary to their own feelings.

These data suggest that the relationship between the ability to produce a deliberate Duchenne smile and persuasion is dependent on the context in which the person is persuading. When persuading to drink the pleasant juice, the correlation between deliberate Duchenne smiling ability in the “genuine happiness” role-plays and persuasiveness was reduced when controlling for participants’ use of the Duchenne smiling while persuading, suggesting that those persuasive smiles were deliberate. People who had the ability to deliberately produce a Duchenne smile appeared to use it in an appropriate situation to be more persuasive. In contrast, when tasting the unpleasant juice participants who had displayed the ability to produce a deliberate Duchenne smile when role-playing “genuine happiness” were more persuasive but it was not their use of the Duchenne smile in that situation that made them more persuasive. This points to a different characteristic shared by those who can deliberately Duchenne smile and those who can persuade someone to do something unpleasant by acting as though it is pleasant. Better self-presentational skills as demonstrated through nonverbal control could likely be the common trait that ties together the ability to Duchenne smile and the ability to persuade someone to drink something unpleasant.

Although I cannot say with complete certainty, evidence from self-reported happiness ratings and patterns in Duchenne smiling behavior indicate that many of the Duchenne smiles
produced during the persuasion task were in fact deliberate. Finding an equal number of Duchenne smiles produced when persuading the pleasant and unpleasant tasting juices supports this claim. The claim is further supported by the lack of correlation between participants’ happiness ratings and Duchenne smiling during the persuasion task. If these were spontaneous Duchenne smiles, then there should be higher levels of self-reported happiness among those who produce Duchenne smiles.

Smile intensity has proven to be an interesting correlate of Duchenne smile production and perception. This study, along with numerous others (e.g., Krumhuber & Manstead, 2009), shows that smile intensity and presence of the Duchenne marker naturally covary. In other words, Duchenne smiles usually occur when the person is also pulling back his or her lip corners more intensely. Studies that are entirely focused on how the Duchenne smile affects person perception are able to control for intensity by matching Duchenne and non-Duchenne smiles on intensity, and some such studies have done so as is seen in Chapter 2 (e.g., Peace, Miles, & Johnston, 2006). However, when the researcher’s interest is in the perception of smiles that are produced naturally, the connection between these two characteristics cannot be separated. By acknowledging the presence of these strong correlations, researchers can speak about the Duchenne smile and its nature in a more informed and complete way.

The correlations between the self-report individual difference measures and smiling behavior are largely uninterpretable due to the high number of null findings. While the null findings between the negative personality scales (NPI and MPS) were predicted, all of the correlations between expressivity measures and smiling behavior were also non-significant which was not predicted. Since, independent of a handful of possibly random correlations, the vast majority of these correlations were null findings, it is not meaningful to interpret the lack of
correlation between the negative personality scales and smiling behavior as supporting predictions. The finding that Duchenne smiling in the imitation tasks was negatively correlated with the Narcissistic Personality Inventory is more meaningful, but more research is needed to fully understand this relationship. Perhaps looking at the relationship between behavioral measures of negative personality traits (such as cheating or lying) and the ability to deliberately produce a Duchenne smile could shed some light on this.

Future research will further explore the connection between the deliberate Duchenne smile, use of the Duchenne smile in social situations, and how these two different behaviors can predict positive social outcomes. This will be done by testing for this relationship in different persuasion contexts that have both positive and negative affective aspects. Doing this will allow for testing the effects of affective context on the relationship between the deliberate Duchenne smile and persuasion. Also, new social outcome domains need to be explored in order to investigate how production of the deliberate Duchenne smile affects other aspects of social life, such as dating and health outcomes. One of these new domains, relationship initiation is the subject of the following chapter.
Chapter 4: Study 3- The Deliberate Duchenne Smile in Relationship Initiation

Introduction

Flirtation and courtship are largely driven by nonverbal behavior (Moore, 2010). Smiling is a strong indicator of romantic interest, but nothing is known about the role of the Duchenne smile in romantic or platonic relationship initiation. Studies that investigate the perceptions of Duchenne smiles have been done with still pictures or video stimuli (e.g., Krumhuber & Manstead, 2009), and naturalistic reactions to Duchenne smiles, in any context, have not been studied.

Research on the deliberate Duchenne smile and what motivates people to use it is very new, and the social consequences of this deliberate expression have yet to be studied outside of this dissertation. The current research will look at the relationship between being able to deliberately produce a Duchenne smile, producing a Duchenne smile within a dyadic interaction, and perceptions of liking in the context of platonic and romantic relationship initiation. The association between Duchenne smiling and impression formation processes has not been studied in face to face interactions, and this connection could be especially interesting in the context of flirting and courtship as nonverbal behaviors, including smiling, are important aspects of these processes (Guéguen, 2008; McCormick & Jones, 1989).

Guéguen (2008) studied smiling empirically in bars and found that male participants were more likely to approach a female confederate when she smiled at them when they entered the bar. This study failed to distinguish between Duchenne smiling and non- Duchenne smiling, but type of smile could logically influence how much someone thinks a person is enjoying an interaction because Duchenne smiles are perceived as showing more enjoyment than non-Duchenne smiles which lack the activation of the muscles around the eyes (Chapter 2; Frank,
Ekman, & Friesen, 1993). The current study videotaped individuals in an interaction with the potential for initiating some type of relationship. It is hypothesized that individuals who are identified as able to deliberately produce Duchenne smiles in smiling tasks will produce more Duchenne smiles in these interactions (controlling for their actual felt positive affect) and that these individuals will be better liked by their partners following the interaction.

This study will also allow for the analysis of the effects of producing a Duchenne smile in a relationship initiation context. It is hypothesized that participants who Duchenne smile more during their interactions, independent of whether they are identified as being able to deliberately make the expression, will make more favorable impressions on their partners. Just as in Chapter 3, it will not be possible to identify Duchenne smiles during the interactions as deliberate or spontaneous, but the analysis of the effects of Duchenne smiles in a relationship initiation context are still a novel addition to the smiling and attraction literatures.

**Method**

**Participants**

67 Northeastern undergraduates participated either for partial credit in Introductory Psychology or volunteered after seeing flyers around campus. In the original recruitment, potential participants needed to be single in regard to their relationship status, heterosexual, and between the ages of 18 and 24. Due to substantial problems recruiting participants in groups of four from the university’s recruitment pool, a second wave of recruitment was initiated with the only inclusion criterion being that participants needed to be between the ages of 18 and 24. Participants took part in groups of four consisting of two males and two females, groups of three with either the two males and one female or one male and two females, and groups of two with the dyad either being mixed sex or same sex. Due to the variability in the groups run, only the
first interaction that participants took part in was used in the analysis. If participants came into
the lab in groups of three, the third member was dropped from all further analyses. This reduced
the number of participants to 60 (55% female). Treatment of groups with two and three people
will be discussed further in subsequent method sections.

Tasks

Getting-acquainted paradigm. The original getting-acquainted paradigm consisted of
three conversations with the four participants paired with each other in all possible
configurations. This would have yielded the potential for each participant to talk with at least two
people of the opposite sex and possibly initiate a romantic relationship, and talk with one person
of the same sex and possibly initiate a platonic relationship. Due to recruitment problems, groups
of three and groups of two were also run as stated above. If there were three participants present
this meant that only the two participants that interacted first were included in the study. The third
participant was excluded from all analyses. The interaction lasted for four minutes. All
conversations were videotaped using two video cameras. The video cameras were positioned so
that each participant’s face could be seen in its entirety with a frontal view. Participants were
instructed that they could talk about anything they liked during the four minutes but that they
should refrain from discussing anything they would not want a stranger to know, such as their
last name or where they lived on campus.

Duchenne role play task. The same Duchenne role play task from Chapter 3 was used.

Duchenne imitation task. Participants were given two photographs of people producing
Duchenne smiles that they were asked to imitate. In one photograph the person was producing a
smile of high intensity with AU 6 and in the second photograph the smile was of moderate
intensity with AU 6. The photographs used were from Ekman et al. (2002). The experimenter
instructed the participant to look at all aspects of the person in the photograph’s face as there is important information in both the eye and mouth region. Participants were randomly assigned to imitate either the low intensity smile or the high intensity smile first.

Measures

Demographics and personal information. Participants were asked to report their age, current relationship status, length of time since their last relationship, and duration of their last relationship. Participants were also asked what their main goal in meeting new people was with the answer options of making new friends, finding someone to casually date, finding someone to be in a relationship with, and other with a blank answer option. Lastly participants were asked to rate on a scale of 1 (not at all) to 9 (very much) how interested they were in beginning a new romantic relationship, and how interested they were in starting a new friendship.

Cross-sex partner ratings. Participants who interacted with a person of the opposite sex rated what they thought of their partners as well as their perceptions of what their partners thought of them. Specifically, after each cross-sex interaction participants were asked to make the following ratings on a scale from 1 (not at all) to 9 (very much): how much did you like your partner, how attractive did you find your partner, how attracted to your partner are you, how much did your partner like you, how attractive did your partner find you, and how attracted to you was your partner. Participants were then asked to report what the first thing they noticed about their partner was, and what physical characteristic about their partner they found most attractive.

Same-sex partner ratings. Participants who interacted with a person of the same sex rated on a scale from 1 (not at all) to 9 (very much) how much they enjoyed talking with their partner, how much they liked their partner, how likely they would be to hang out with their
partner outside the experiment, how much they thought their partner enjoyed the conversation, and how much they thought their partner liked them.

A smaller number of dyads were able to be collected than anticipated. Thus, cross-sex and same sex dyads were analyzed together, and only the dependent variables they had in common were analyzed. This included how much participants liked their partner and how much they thought their partner liked them. Liking and attractiveness ratings were correlated in members of cross sex dyads, $r(36) = .43, p < .01$, which further justified only analyzing the liking ratings.

**Mood.** Following each conversation each participant circled on a rating scale from 1 (not at all) to 9 (extremely) how much they felt the following emotions: happy, disgusted, sad, nervous, content, grossed out, gloomy, anxious, cheerful, sickened, downhearted, worried, pleasant, repulsed, depressed, fearful. Happy and its three synonyms were then aggregated for each individual. The other adjectives were not used in the analysis and were there as distractors.

**Post task questionnaires.** Following both the getting-acquainted and Duchenne smiling tasks, participants completed a 60 item measure of the Big Five personality traits (NEO FFI, Costa and McCrae, 1992) and a 10 item need to belong scale (Leary, Kelly, Cottrell, & Schreindorfer, 2012). When heterosexuality was dropped as an inclusion criterion, a sexual orientation questionnaire was added that asked participants to check the most appropriate category: heterosexual, mostly heterosexual, bisexual, homosexual, do not understand the question, or other with a response blank.

**Procedure**

Upon entering the lab all participants read and signed the same consent form. Participants then completed a demographics questionnaire. The experimenter explained the getting-
acquainted paradigm to the participants as a group. Once participants were comfortable with the procedure, they were brought to a set of chairs with video cameras already set up. The experimenter adjusted the cameras so that each participant’s face was centered in the frame of one camera and then started the cameras before indicating to the participants that they could begin their conversation. The experimenter gave participants a warning when 30 seconds remained so that they could have enough time to wrap up their conversation. When there were four participants, a second set of cameras was utilized in a second room so dyads could not see or hear the others’ conversations, so that all four participants could have their dyadic interaction at the same time. If there were three participants, the third participant (whose data was not utilized) waited in a second room while the first two participants completed their interaction. Once four minutes passed the experimenter stopped both cameras and separated participants to fill out their rating and mood sheets out of sight of their interaction partner.

Following the interaction, the experimenter brought all participants back together and explained the role-play and imitation tasks briefly. The experimenter passed out the post-task questionnaires and explained that each person would complete the role-play and imitation tasks one at a time while the other participants completed the questionnaires. Participants completed these self-report questionnaires at a large round table. They were not separated for this portion as they were not making ratings about any of the partners with whom they interacted.

The role-play task followed the identical procedure as outlined in Chapter 3.

For the imitation task, the experimenter explained that the participant was now to imitate the facial expressions in two photographs in front of the video camera. The experimenter turned the camera back on and asked the person to do the first expression. After 3 s the experimenter
asked the participant to do the second expression. Following 3 s of the second expression the experimenter turned off the camera.

After each participant finished the deliberate Duchenne smiling tasks and the post-task questionnaires, they were debriefed and dismissed.

**Stimuli Creation**

As thin slices, or short excerpts of longer video clips, have been shown to validly represent an entire interaction (Ambady & Rosenthal, 1992), the four minute interactions were sliced into two 30-s clips. In order to capture participants’ greetings as well as a time when they were more comfortable in their interaction, I chose to look at the first and last 30 s of the clips. Three stimulus tapes were created. Two tapes were created for the 19 cross-sex dyads and one tape was created for the 11 same-sex dyads. It was not clear whom the participant was talking to in the majority of the clips. There were a small number of clips where the partner may have moved into the frame for a short period of time, and may have been recognized from a previous clip or may have subsequently been recognized in a following clip. Since it was only the back of the partner’s head that was in the shot identification was likely difficult. The two 30 s clips for each participant were edited together consecutively with no pause in between. There were pauses edited between individual’s combined one-min clips to allow naïve judges to make ratings before the next participant’s two clips were shown.

**Smiling Coding**

The role-play task and imitation task were coded in the identical way as in Chapter 3. These 2 30-s clips for each participant were coded for presence, onset time, offset time, and intensity of AU 6 and AU 12. Onset and offset times were then converted into durations. Proportion of the minute each participant spent smiling, proportion of the minute spent non-
Duchenne smiling, proportion of the minute each participant spent Duchenne smiling, and proportion of time smiling each participant spent Duchenne smiling were all calculated. A total number of smiles and a total number of Duchenne smiles were calculated for each participant, and the average AU 12 intensity was calculated for each participant.

**Naïve Viewer Ratings**

Seventy-five naïve viewers watched one of the three tapes (25 per tape) in groups of one to five. Naïve viewers were told that they would see two back-to-back clips of the same participant interacting with another person. They were told the two clips were edited together so they may see a quick jump in the tape where the clips were combined, but that they should wait until the end of both clips to make their ratings. The videos were shown to naïve viewers with sound off. Naïve viewers made ratings of how much they liked the participant and how attractive they found the participant.

**Dyadic Data Analysis**

Duchenne smiling in the dyadic interaction and ratings made directly following the interaction of how much participants liked their partners are not independent of their partners’ smiling and ratings. Smiling has been shown to be a frequently mimicked behavior (Niedenthal, Mermillod, Maringer, & Hess, 2010), and it is likely that how much one member of the dyad smiled affected how much the other member smiled. It is also likely that their dyadic rapport, or how smooth they experienced the conversation to be (Tickle-Degnen & Rosenthal, 1990), influenced how both members of the dyad rated liking the other member. Since these variables are not independent, specific analytic techniques needed to be used to control for the variance that existed between dyads. The Actor-Partner Interdependence Model (APIM; Kenny, 1996) was chosen because of the dyadic nature of the data.
The APIM is a model used to analyze dyadic data, and posits that when measuring two variables (X and Y) in a dyad, how each member scores on X can affect his or her score on Y (actor effects), and how the participant’s partner scores on X can also affect the participant’s score on Y (partner effects). For example, how much the participant smiles in an interaction can affect how much the participant subsequently rates liking his or her partner (actor effect), and how much the partner smiled in the interaction can affect how much the participant subsequently reports liking the partner (partner effects). Partner effects in the above example are of more interest to the current study. The first panel in Figure 2 illustrates this model in terms of how smiling can affect liking in a dyad.

The APIM allows for the analysis of both distinguishable and indistinguishable dyads. Dyads are distinguishable if there is some experimental manipulation, such as mood induction in one member of the dyad, or pre-existing factor that indicates that one participant in each dyad is the actor and one participant is the partner. For example, if one member of the dyad is shown a humorous video before participating and the other member is shown a neutral stimulus, they are distinguishable dyads as those induced to feel happy would be the actor and those induced to feel neutral would be the partner or vice versa. In the current study the members of the dyads are indistinguishable. There is nothing about one member that indicates they should be the actor and the other member should be the partner as there was no experimental manipulation of one member, and no preexisting variable that would distinguish the two members from each other. One could argue that in the cross-sex dyads, gender distinguishes the dyad members, but since there are no predicted differences between male and female members, it is customary to analyze the dyads as indistinguishable (Kenny, 2013).
When the dyad has indistinguishable members, the APIM assumes that the two actor effects and two partner effects are equal. This is illustrated in the second panel of Figure 2. Here there is only the need to measure one actor and one partner effect because there is no reason to believe that one member’s score on X would affect his or her score on Y differently than the other member’s score on X would affect his or her score on Y. In this case each member of the dyad is treated as the actor once and the partner once using a pairwise data set. A pairwise data set is a data set in which each dyad is represented twice, once with one member as the actor and the other member as the partner and once with these members switched. The pairwise data set is used because with indistinguishable dyads there is no theoretical reason why one member should be the actor and one should be the partner. Multilevel modeling was then employed in the current study to measure these actor and partner effects when the variable being measured fit the model as described below.

The APIM requires that there be a theoretical causal path between the X variable and the Y variable (Kenny, 1996). This means that there has to be a clear reason why X would cause or predict Y within the model. A causal path can be made between smiling and liking in the interaction (I smiled in the interaction so I subsequently indicated that I liked my partner/ my partner smiled in the interaction so I subsequently liked my partner more), and thus the APIM will be used. When analyzing the relationship between deliberate Duchenne smiling and the smiling and liking measures in the dyadic interaction there is not a clear causal path. The relationship could go in either direction as people could be better able to produce deliberate Duchenne smiles because they use them more in spontaneous interactions or they could be more likely to produce a Duchenne smile in an interaction because they are able to put it on deliberately. Because there is not a clear causal path between the two, pairwise correlations
(Pearson product by moment correlations on a pairwise data set with N = 60) will be used to analyze the relationships between these variables. (Kenny, Kashy, & Cook, 2006)

**Results**

**Participant Characteristics**

The 60 participants were 55% female with an average age of 19.05 years (SD = 1.37). Twenty-five males and 31 females reported being heterosexual, 0 males and 1 female reported being mostly heterosexual, 1 male and 0 females reported being bisexual, and 1 male and 1 female reported being homosexual. Four male and 8 female participants reported being in a relationship. When rating interest in beginning a new romantic relationship and interest in beginning a new friendship on a scale from 1 (not at all) to 9 (very much), male participants (M = 4.93, SD = 2.04) showed more interest in beginning a new romantic relationship than females (M = 3.78, SD = 2.07), t(57) = 2.13, p < .05, and female participants (M = 7.39, SD = 1.25) showed more interest in beginning a new friendship than male participants (M = 6.56, SD = 1.25), t(58) = 2.28, p < .05. Overall, participants were more interested in starting a new friendship (M = 4.30, SD = 2.12) than a new relationship (M = 7.03, SD = 1.47), t(58) = 8.28, p < .001. Due to this, and because some participants were not open to beginning a new relationship in the cross-sex interaction because they were in a relationship or not sexually interested in members of the opposite sex, I will be discussing the results in terms of liking, but will not make any assumptions about whether the liking was romantic or platonic in nature.

**Deliberate Duchenne Smiling**

**Duchenne smiling in the role-play tasks.** For the deliberate Duchenne smiling tasks, one partner’s behavior was independent of the other partner’s behavior because these tasks were not completed in dyads. Subsequently, the deliberate Duchenne smiling behavior will be
analyzed with the participant as the unit of analysis (i.e., multilevel modeling to account for nondependence of the dyad members was not necessary). Table 10 shows the mean percentage of smiles that were Duchenne for the “genuine happiness” and “fake happiness” role plays, and both imitation trials. Replicating findings from Gunnery et al. (2013) and Chapter 3 of this dissertation, a sizeable minority of smiles produced deliberately were Duchenne, and there was no difference between the mean percentage of smiles that were Duchenne in the “genuine happiness” role-plays ($M = 40.91, SD = 37.38$) and those in the “fake happiness” role-plays ($M = 38.18, SD = 41.90$), $t(54) = .43, p = .67$. Table 10 also shows that females produced higher percentages of Duchenne smiles while role-playing “genuine happiness” and “fake happiness” but this difference is not significant for either “genuine happiness”, $t(55) = 1.15, p = .26$, or “fake happiness”, $t(53) = 1.31, p = .19$.

**Duchenne smiling in the smile imitation task.** Table 10 also displays the percentage of participants who produced a Duchenne smile when imitating the high and low intensity smiles. A mixed model ANOVA with intensity of smile being imitated (high or low) as a within subjects variable and whether they were asked to imitate the high intensity or low intensity smile first as a between subjects factor yielded a significant main effect for smile type, $F(1, 53) = 5.51, p < .05$, indicating that a higher percentage of participants produced a Duchenne smile when imitating a high intensity smile than a low intensity smile, but this main effect was qualified by a significant interaction between smile type and which smile was imitated first, $F(1, 53) = 10.06, p < .01$. Table 11 shows the interaction means which indicate that when participants were asked to produce the high intensity Duchenne smile first, they were much more likely to produce a Duchenne smile when imitating the low intensity smile. This is likely indicative of carryover effects from producing the smile of higher intensity first. However, performing the same
ANOVA looking at the intensity of the imitated smiles as the dependent variable yielded only a significant main effect, showing that participants produced a smile of higher intensity when imitating the high intensity smile ($M = 3.91$) than the low intensity smile ($M = 3.00$), $F(1, 53) = 34.29, p < .01$. The interaction between what smile was imitated first and the intensity of the imitated smiles was not significant, $F(1, 53) = 2.03, p = .16$. This indicates that participants’ imitation of low intensity smiles were not of higher intensity when they were imitated after the high intensity smiles meaning that the carryover effect was not in the intensity of the smile but in activation of the Duchenne marker. This finding is interesting in light of the strong correlations between smile intensity and activation of the Duchenne marker.

**Individual differences in deliberate Duchenne smiling.** Table 12 shows the correlations between deliberate Duchenne smiling behavior and responses on the NEO and the need to belong measure. Producing a higher percentage of smiles that were Duchenne when role-playing “genuine happiness” was correlated with the personality trait openness. Producing a higher percentage of smiles that were Duchenne when role-playing “fake happiness” was correlated negatively with scores on the need to belong scale. As in Chapter 3, correlating self-report measures with this deliberate Duchenne smiling task yielded a quite random selection of significant correlations. The positive correlation between openness and deliberate Duchenne smiling in the “genuine happiness” role-plays could be indicative of participants who are more willing to fully engage in the role-play task, and thus more likely to deliberately put on the expression that they would also produce in settings outside of the laboratory. When looking at this correlation separately for both male, $r(25) = .25, p = .21$, and female participants, $r(31) = .35, p < .05$, it is seen that the correlations only remains significant for female participants.
The negative correlation between the need to belong, which is a measure of wanting to be socially accepted, and deliberate Duchenne smiling when role-playing “fake happiness” could indicate that people who have a stronger need to fit in are less likely to produce an expression that could be judged as manipulative or deceptive in contexts that do not call for genuine expressions of happiness.

Table 13 shows the correlations among the deliberate Duchenne smiling tasks. Replicating both Gunnery et al. (2013) and Chapter 3 of this dissertation, participants who produced Duchenne smiles in one task were, for the most part, more likely to produce Duchenne smiles in the other tasks. Producing a Duchenne smile in the “genuine happiness” role-play was only correlated with producing a Duchenne smile in the “fake happiness” role-play, but producing a Duchenne smile in the “fake happiness” role-play was correlated with producing a Duchenne smile when imitating the picture of the person producing a high intensity Duchenne smile, and marginally correlated with producing a Duchenne smile when imitating a picture of a person producing a low intensity Duchenne smile. Duchenne smiling when imitating the high intensity smile was not correlated with Duchenne smiling when imitating the low intensity smile.

**Deliberate Duchenne smiling and intensity.** As seen in Chapter 3 as well as in previous research, Duchenne smiling is correlated with intensity of the expression for all tasks (see Table 14 for correlations).

**Duchenne Smiling in the Interactions**

Table 15 displays the correlations between dyad members for all smiling behavior in the interaction. These were pairwise correlations meaning that each participant’s data was entered twice, once as the actor and once as the partner. Proportion of total time spent smiling and spent Duchenne smiling are non-independent between dyad members, meaning that the amount of total
time one partner spent smiling overall, as well as Duchenne smiling, was related to the proportion of time his or her partner spent producing the same expression. The proportion of time spent smiling that one partner spent Duchenne smiling and the proportion of total time spent non-Duchenne smiling were, however, independent of his or her partner’s proportion. The pairwise correlations in Table 15 also show that how much participants liked their partner, how much participants thought their partner liked them, and how much naïve viewers liked the participant were non-independent between dyad members. These indicate that liking and smiling behavior in the interaction must be analyzed in a way that takes this non-independence into account.

Table 16 presents descriptive statistics for the smiling measures during the interaction. Due to the non-independence between partners in a dyad for two out of the three measures, proportion of the total minute spent smiling, proportion of the total minute spent non-Duchenne smiling, proportion of the total minute spent Duchenne smiling, and proportion of total time smiling spent Duchenne smiling were averaged across partners. This was done only to describe the measures.

**Deliberate Duchenne smiling and Duchenne smiling in the dyadic interaction.** The hypothesis that producing a greater number of Duchenne smiles when role-playing “genuine happiness” would be correlated with spending a larger proportion of the one-min interaction producing a Duchenne smile was supported, $t(58) = .43, p < .01$. This correlation was still significant when controlling for the proportion of the minute that the partner spent producing Duchenne smiles, $r_{partial} = .42, p < .01$, and when controlling for the participant’s felt positive affect during the interaction, $r_{partial} = .43, p < .01$. Producing a greater number of Duchenne smiles when role-playing “genuine happiness” was also correlated with the proportion of time
smiling where the smile was Duchenne, $r(58) = .31, p < .01$. This correlation was also still significant when controlling for the proportion of time smiling the partner spent Duchenne smiling, $r_{\text{partial}} = .21, p = .02$, and when controlling for the participant’s felt positive affect during the interaction, $r_{\text{partial}} = .45, p < .01$. Ability to produce a deliberate Duchenne smile when role-playing “fake happiness” and ability to imitate a Duchenne smile were not correlated with any smiling measures in the dyadic interaction. See Table 17 for a list of all these correlations.

**Duchenne smiling in the interaction and liking.** Table 18 presents the fixed effects estimates for actor and partner smiling effects on how much a participant liked his or her partner. Again the actor effect is measuring if a participant’s smiling behavior in the dyadic interaction predicts how much he or she liked his or her partner, and the partner effect is measuring if the partner’s smiling behavior predicts how much the participant likes him or her. There were no significant actor or partner smiling effects in how much a participant liked their partner, which did not support the key hypothesis that participants would like their partners more if the partners used more Duchenne smiles in the interaction. Participant attractiveness as rated by naïve viewers was correlated with partner liking, $r(58) = .48, p = .001$. This indicates that partners may have been more influenced by how attractive the participant was then by how much the participant smiled, but controlling for attractiveness in analyses did not make smiling a significant predictor of partner liking.

Table 19 presents the fixed effects estimates for actor and partner smiling effects on how much the naïve viewer liked the participant. In this case the actor effect is how much naïve viewers’ liking ratings were affected by the participant’s smiling, and partner effects are how much naïve viewers were affected by the partner’s smiling behavior that was not seen on camera. As was expected due to the nature of the rating, there were no significant partner effects. There
were significant actor effects for proportion of total time spent smiling, $t(55.17) = 3.68, p < .001$ and proportion of total time spent non-Duchenne smiling, $t(46.16) = 2.40, p = .02$, and marginal actor effects for proportion of total time spent Duchenne smiling, $t(56.66) = 1.75, p < .09$, and for proportion of time smiling spent Duchenne smiling, $t(55.12) = 1.61, p = .11$. These findings indicate that naive raters liked participants more when they smiled more in general as well as when they Duchenne smiled more in their interactions, when controlling for how much participants’ partners smiled. It was necessary to control for partner smiling because again both members of the dyad were counted as a participant.

When controlling for the variance due to proportion of the minute targets spent non-Duchenne smiling, proportion of the time smiling that was Duchenne smiling predicted naïve viewers’ liking of the target, $t(53.11) = 3.61, p = .001$. Since targets non-Duchenne smiled for a greater proportion of time than they Duchenne smiled (twice as much, see Table 16), it is likely that this type of smiling was more salient to perceivers than Duchenne smiling, and when this is controlled for, the proportion of overall time spent smiling that was Duchenne was related to greater ratings of liking.

Individual difference measures and Duchenne smiling in the dyadic interaction.

Table 20 presents the fixed effects estimates for the personality actor and partner effects on Duchenne smiling in the dyadic interaction. There was a significant negative actor effect of neuroticism on Duchenne smiling in the interaction, $t(43.14) = -2.33, p < .05$. There was also a significant actor effect for need to belong, $t(40.83) = -2.18, p < .05$, and a significant partner effect for need to belong, $t(44.44) = -3.47, p < .01$. This indicates that more neurotic participants produced Duchenne smiles for a smaller proportion of time in their interactions, and that participants produced Duchenne smiles for a smaller proportion of time both when they and
when their partners had a higher need to belong. These were the only significant actor and partner effects for the personality measures. It is important to note that there was no actor or partner effect for openness. A significant actor affect was predicted based on the correlation between openness and deliberate Duchenne smiling when role-playing “genuine happiness.”

Discussion

Study 3 investigated the relationship between the ability to produce a Duchenne smile and use of the Duchenne smile in a getting-acquainted situation as well as how use of the Duchenne smile in a first impression situation affects how well a person is liked. Study 3 expanded on Study 2 by investigating an outcome of the ability to produce a deliberate Duchenne smile and actual production of the Duchenne smile in a social situation that was not inherently deceptive or manipulative. By testing perceptions of Duchenne smile in an in vivo interaction, Study 3 also expanded on Study 1 which meta-analyzed studies of difference in perceptions of Duchenne and non-Duchenne smiles in standard nonverbal perception studies in which naïve viewers watch numerous clips of people producing Duchenne and non-Duchenne smiles.

The analysis of the deliberate Duchenne smiles replicated previous results for the deliberate Duchenne role-play task both in terms of the percentage of Duchenne smiles that were produced as well as in the strong relationship between presence of the Duchenne marker and smile intensity.

The smile imitation task differed from that used in Study 2 because participants were asked to imitate two Duchenne smiles of differing intensity. More participants produced a Duchenne smile when imitating the high intensity smile, but only when they were imitating the high intensity smile first. This provides evidence that it is easier to deliberately produce a
Duchenne smile when it is of high intensity, and that once a person has activated those muscles it is easier to do it again. Low intensity imitations that were produced second were not more intense than those produced first, indicating that low intensity Duchenne imitations were not easier to produce because participants were just smiling more intensely.

This study found that people who have the ability to deliberately produce a Duchenne smile when role-playing “genuine happiness” also Duchenne smile more in their dyadic interaction. This indicates the possibility that people who are able to deliberately produce a Duchenne smile understand the self-presentational value of being able to do so, and use the expression more when they are in a situation (i.e., meeting someone new) where they may want to self-present in the most positive way possible. Duchenne smiling when role-playing “fake happiness” was not correlated with ability to produce a Duchenne smile in the dyadic interaction. These results suggest that people have some knowledge that the “genuine happiness” scenarios mirror when they produce Duchenne smiles in their everyday interactions. If people who Duchenne smile more in general just always produce a Duchenne smile, then Duchenne smiling in the interaction would be correlated with Duchenne smiling in all four deliberate smiling tasks. This indicates that people likely use some discretion in deciding when and when not to use a Duchenne smile. The relationship between producing a higher percentage of Duchenne smiles in the “genuine happiness” role plays and spending more time producing a Duchenne smile in a social interaction is the first evidence that people likely produce deliberate Duchenne smiles in their everyday lives, and that this skill is not something that is just expressed when someone is asked to smile in a laboratory paradigm.

How much a participant or his or her partner smiled or Duchenne smiled did not predict how much they were liked by the other dyad member, but naïve viewers liked participants who
Duchenne smiled for a greater proportion of time more. Also when controlling for the proportion of time participants non-Duchenne smiled, naïve viewers liked participants more who Duchenne smiled for a greater proportion of the time they spent smiling. Naïve viewers did not have any information other than nonverbal cues when making their judgments, while in the dyadic interactions, participants had verbal and vocal cues as well. These findings suggest that when there are cues with richer information present, such as the content of what people are saying, there is less of a need to rely on nonverbal cues to make judgments.

This is potentially problematic when looking at the generalizability of the studies meta-analyzed in Study 1. Like the naïve viewers in the present study, those studies showed photographs of static smiles or short clips with little or no other context. It is possible that in a context rich environment where other information is present, the Duchenne smile does not matter as much. No other study has reported findings of perceptions on Duchenne smiles in live dyadic interactions. It is possible that this is a “file drawer” effect, meaning these studies have been completed and never published due to the null results. If Duchenne smiles are not perceived differently than non-Duchenne smiles in a naturalistic interaction, then the studies that repeatedly show that Duchenne smiles are perceived more positively than non-Duchenne smiles may not hold the same weight they were thought to.

This was the first study to investigate effects of Duchenne smiling on perceptions of people in face to face interactions, and while the study did not provide evidence for use of the Duchenne smile when making judgments of someone in an in vivo interaction, these results are still interesting when looked at in the context of starting a new relationship. When perceiving faces from across the room, as one might if looking for a potential mate at a bar or seeking out someone to have a platonic conversation with at a mixer for new students, those people who
Duchenne smile will most likely be perceived more positively and therefore a person is probably more likely to approach a person whom they see Duchenne smiling more. Once a person has approached another, how the person is able to carry on a conversation and the content of what they talk about are likely more indicative of whether they will be liked then if they raise their cheeks more when they smile.
Chapter 5: General Discussion

The Duchenne smile has long been held up as an infallible expression in both how it is produced and how it is perceived. It was infallible in its production in that it was written about as though a Duchenne smile could only spontaneously appear upon someone’s face if they were feeling genuinely happy, and if someone had the skill to produce a Duchenne smile deliberately, the person was considered an anomaly (Ekman & Davidson, 1993) and that smile was considered to have a different meaning in terms of what it communicated to perceivers (Ekman & Friesen, 1982). The Duchenne smile was infallible in its perception as all the published studies on perceptions of Duchenne smiles showed that they are seen more positively than non-Duchenne smiles, and people who are producing a Duchenne smile are perceived in a more positive light than people who are producing a non-Duchenne smile.

Recent research has begun to push back against this infallibility by showing that the Duchenne smile can be produced deliberately (Gosselin et al., 2010, Gunnery et al., 2013; Krumhuber & Manstead, 2009), and by showing that the Duchenne marker is not a universally accepted indicator of enjoyment (Thibault et al., 2012). The current dissertation continues to push back by providing further evidence that people can deliberately produce the Duchenne smile and that people with the ability to produce Duchenne smiles are more likely to use them in situations that are highly self-presentational, and by documenting that while Duchenne smiles and the people who produce them are perceived more positively than non-Duchenne smiles and people who produce non-Duchenne smiles, there are numerous caveats to this.

A meta-analysis (Study 1) of the previous literature on how the Duchenne smile is perceived differently from the non-Duchenne smile overwhelmingly showed that Duchenne smiles are perceived more positively than non-Duchenne smiles. Though this was a unanimous
finding across all of the studies combined in Study 1, results showed that there were moderating variables in the effect. Of most interest in the context of this dissertation, the meta-analysis showed that the positive perceptual bias towards Duchenne smiles was greater when the stimuli were produced naturally rather than posed, and when the stimuli were presented in static photographs rather than dynamic video clips. This showed that although Duchenne smiles produced naturally (i.e., through inducing a person to feel happy and recording their facial expression) may be perceived as more genuine or amused than those produced through posing paradigms, they are also perceived as more genuine or amused when presented in the least life-like state (still photograph) with the least amount of context beyond the presence and absence of the Duchenne marker.

Study 1 provided a strong motive for why people may want to deliberately produce a Duchenne smile: people may want to deliberately produce a Duchenne smile so they will be perceived more positively even if they are in a situation where they are not feeling genuinely happy. The logic for conducting Studies 2 and 3 was that if Duchenne smiles are perceived more positively than non-Duchenne smiles, then people who can deliberately produce Duchenne smiles and correctly utilize the Duchenne smile in social interactions should receive some type of positive social outcome. Results from these two studies show that naı̈ve viewers rated people who produce Duchenne smiles in the appropriate contexts as more persuasive and more likeable.

Results from Study 2 provided further evidence that people can deliberately produce a Duchenne smile when role-playing different social situations, and it demonstrated that while people who can deliberately produce Duchenne smiles are more persuasive they do not always use the Duchenne smile to persuade. When participants on average found what they were trying to persuade the experimenter to drink to be pleasant, they were seen as more persuasive when
they produced a Duchenne smile, but when trying to pretend they liked something they did not in
order to persuade someone else to try it, they were not more persuasive when they used the
Duchenne smile. The finding that there is a context in which use of the Duchenne smile is not
beneficial (persuading someone to do something that one actually finds unpleasant), while
largely unpredicted, is a novel addition to the Duchenne smile literature.

Study 3 also made a novel contribution by showing that the ability to deliberately
Duchenne smile is related to use of the smile in a social interaction, and through analyzing the
relationship between the Duchenne smile and person perception in real time dyadic interactions.
Doing so provided the first evidence that when production of the Duchenne smile is
accompanied by verbal and myriad other nonverbal cues, spending a greater proportion of time
producing a Duchenne smile does not lead to being rated as more likeable by an interaction
partner. This may indicate that despite the attention paid to the Duchenne smile throughout the
facial expression literature, it might not matter much in face-to-face interactions. When looking
at naïve ratings in Study 3, which complements analyses performed in Studies 1 and 2, it was
found that naïve raters liked people who spent a larger proportion of the interaction producing a
Duchenne smile than people who produced Duchenne smiles for a lesser proportion of the time.
The discrepancy in partner ratings and naïve viewer ratings is something that needs to be
explored further.

Taken together, these three studies support the idea that the Duchenne smile is a
nonverbal behavior that lends itself to self-presentation and social signaling that can be used to
serve a wide set of social functions (Niedenthal, 2010). Study 1 demonstrates that people who
produce Duchenne smiles are seen in a more positive light, while Studies 2 and 3 provide further
evidence that the Duchenne smile can in fact be produced deliberately. Ability to produce the
nonverbal behavior deliberately is a necessity if it is to be used in a self-presentational manner (DePaulo, 1992). Furthermore, Studies 2 and 3 show that when the Duchenne smile is produced there are positive social outcomes. The correlation between ability to deliberately Duchenne smile and persuasiveness in both taste tasks where the participant needed to persuade to drink the juice indicates that people who can deliberately Duchenne smile know how to present themselves in a persuasive way. In Study 3, participants with the ability to deliberately Duchenne smile displayed more Duchenne smiles in their getting acquainted interaction which did not ingratiate them to their interaction partners but was related to greater liking as rated by naïve viewers.

**Limitations and Future Directions**

The confounding nature of smile intensity is present through all three studies of this dissertation. One should not be surprised by the correlation between smile intensity and presence of the Duchenne markers, as they are both used to show more enjoyment, but this correlation is often problematic in the study of Duchenne smiling. The updates to coding techniques in the 2002 revision of the FACS manual were intended to reduce this confound by insuring that any appearance of wrinkles around the eyes is the result of the Duchenne marker being activated and not an artifact of a more intense smile (Ekman & Rosenberg, 2005). These coding techniques require that a person is able to recognize very subtle changes in facial anatomy, and the standard in the field for achieving this ability requires numerous hours of training and coding in FACS. If one requires a significant amount of training to be able to differentiate between coincidental crow’s feet that are an artifact of a big smile and crow’s feet that are the result of activation of the cheek raiser muscle, this is likely not a skill that the average naïve viewer possesses. This
leads one to believe that naïve viewers may be relying more on smile intensity than the Duchenne marker to make these judgments.

This also leads to the question of whether the Duchenne smile as an independent marker to genuine enjoyment really matters all that much. This sentiment is also mirrored in findings from Study 3 that Duchenne smiling during the interaction did not lead to being liked more by one’s partner. If this effect, that is so clearly seen in a meta-analysis of the previous literature, does not hold true when the methodology transitions from watching tapes of people smiling to making ratings after a real life interaction, does the effect generalize outside the laboratory in a meaningful way?

As this is the first study to measure how Duchenne smiling is related to perceptions ratings in face-to-face interactions, more research is needed to truly understand why this perceptual difference found in standard person perception experiments does not hold true in an in vivo paradigm. The nature of conducting these experiments inherently dissuades researchers from conducting them, as measuring behavior and attitudes in dyads is both time consuming and difficult to analyze. As could be seen clearly in the recruitment issues in Study 3, attaining a large enough sample of people to conduct the necessary analyses is very difficult. The novelty of studying how Duchenne smiles are perceived in live dyadic interactions is one of this dissertation’s greatest contributions to the literature, and future research should continue to investigate how the Duchenne smile is perceived in different dyadic interactions despite the difficulties that come with doing so.

Another limitation of the current research is its inability to measure whether Duchenne smiles are being deliberately or spontaneously produced in social interaction. Further coding of the stimuli collected from these studies could reveal subtle differences in the movements and
timing of spontaneous and deliberate expressions that could be used to distinguish between the two types of Duchenne smiles. Schmidt et al. (2006) began to do some of this work in their comparisons of spontaneous and deliberate smiles. Until there are ways to systematically code for whether a Duchenne smile is produced deliberately rather than spontaneously in natural interaction, there is no foolproof way of investigating how deliberately producing a Duchenne smile in a social interaction can benefit the person smiling. While it is unclear whether the Duchenne smiles produced in the social interactions in this dissertation are deliberate, the current work has provided further validation of Gunnery et al.’s (2013) deliberate Duchenne smile measure, and these data are able to speak to the relationship between the outcomes experienced in the social interaction and possessing that ability to deliberately produce a Duchenne smile.

**Conclusion**

This dissertation first examined how Duchenne smiles are perceived differently than non-Duchenne smiles in a meta-analysis of the previous literature showing that Duchenne smiles. Results showed that people tend to perceive Duchenne smiles as more positive (whether it be more genuine, amused, or authentic) than non-Duchenne smiles, and that people seen producing Duchenne smiles are perceived as possessing more positive traits than those seen producing non-Duchenne smiles. Second, this dissertation advanced the study of the Duchenne smile, and specifically the deliberate Duchenne smile, by examining the consequences of being able to deliberately produce a Duchenne smile and actually producing a Duchenne smile in two different social contexts. Results showed that people who can deliberately produce a Duchenne smile are more persuasive and that their persuasiveness is only related to their use of the Duchenne smile when actually persuading if they are persuading someone to do something truthfully. Lastly, this dissertation showed that people who Duchenne smile more are liked better by a group of naïve
viewers, but only if the Duchenne smile is one of a few cues that are given to differentiate between targets.

To conclude, when trying to make an impression (whether persuading or meeting someone for the first time) people with the ability to deliberately produce a Duchenne smile use the Duchenne smile more, but not when the context involves direct deception. This indicates the use of the Duchenne smile for self-presentational purposes. In addition, when perceivers have very sparse cues to use in making a judgment in addition to a smile, those perceivers rely heavily on the absence or presence of the Duchenne marker or the intensity of the smile to make the judgment. It seems, though, that when involved in a face-to-face interaction, what a person says may matter more than how the person smiles.
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Footnotes

1 Ability to pose the Duchenne smile is never cited as evidence for the deliberate Duchenne smile until Krumhuber and Manstead (2009).

2 Twenty-three of the participants in the present study had also completed the deliberate Duchenne role-play task in a previous unpublished study conducted in 2011. Their performance on the task the year earlier was correlated with the performance in the present study. Duchenne smiling across all smiling role-plays was correlated from Time 1 to Time 2, $r(20) = .62, p < .01$. However, this consistency was apparent only for Duchenne smiling in the “genuine happiness” role-plays, $r(19) = .61, p < .01$. Duchenne smiling in the “fake happiness” role-plays was not correlated between the two years, $r(19) = .25, p = .25$.

3 These correlations differ from the correlations between persuasion and deliberate Duchenne smiling in the previous section, because they only include people who smiled while persuading. Thus the N dropped in both cases.
### Table 1

*Characteristics of Studies Incorporated in the Meta-Analysis*

<table>
<thead>
<tr>
<th>First Author</th>
<th>Year</th>
<th>N</th>
<th>ES</th>
<th>A</th>
<th>Stimuli</th>
<th>DV Type</th>
<th>Actual DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambadar</td>
<td>2008</td>
<td>42</td>
<td>.50</td>
<td>B, T</td>
<td>Nat, Dyn, UI</td>
<td>DS, Dich</td>
<td>Amused</td>
</tr>
<tr>
<td>Bernstein</td>
<td>2010</td>
<td>125</td>
<td>.20</td>
<td>B, P</td>
<td>Pos, Dyn, MI</td>
<td>TS, Cont</td>
<td>How much participant wanted to work with smile</td>
</tr>
<tr>
<td>Bernstein</td>
<td>2008</td>
<td>10</td>
<td>.89</td>
<td>W, P</td>
<td>Pos, Dyn, MI</td>
<td>DS, Dich</td>
<td>Genuine smile/ Fake smile</td>
</tr>
<tr>
<td>Frank</td>
<td>1993</td>
<td>80</td>
<td>.71</td>
<td>W, P</td>
<td>Nat, Stat, MI</td>
<td>DS, Dich</td>
<td>Enjoyment smile/ Social Smile</td>
</tr>
<tr>
<td>Giudice</td>
<td>2007</td>
<td>80</td>
<td>.41</td>
<td>W, P</td>
<td>Pos, Stat, MI</td>
<td>DS, Dich</td>
<td>Really happy/ Pretending to be happy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>.71</td>
<td>W, P</td>
<td>Pos, Stat, MI</td>
<td>DS, Dich</td>
<td>Really happy/ Pretending to be happy</td>
</tr>
<tr>
<td>Gosselin</td>
<td>2002</td>
<td>30</td>
<td>.08</td>
<td>B, P</td>
<td>Pos, Dyn, UI</td>
<td>DS, Dich</td>
<td>Really happy/ Pretending to be happy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>.59</td>
<td>B, P</td>
<td>Pos, Dyn, UI</td>
<td>DS, Dich</td>
<td>Really happy/ Pretending to be happy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55</td>
<td>.32</td>
<td>B, P</td>
<td>Pos, Dyn, UI</td>
<td>DS, Dich</td>
<td>Really happy/ Pretending to be happy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>.67</td>
<td>B, P</td>
<td>Pos, Dyn, UI</td>
<td>DS, Dich</td>
<td>Really happy/ Pretending to be happy</td>
</tr>
<tr>
<td>First Author</td>
<td>Year</td>
<td>N</td>
<td>ES</td>
<td>A</td>
<td>Stimuli</td>
<td>DV Type</td>
<td>Actual DV</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
<td>----</td>
<td>----</td>
<td>--------</td>
<td>------------</td>
<td>-----------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Gunnery</td>
<td>UR</td>
<td>51</td>
<td>.15</td>
<td>B, T</td>
<td>Nat, Dyn, UI</td>
<td>TS, Cont</td>
<td>Persuasiveness</td>
</tr>
<tr>
<td>Gunnery</td>
<td>2013</td>
<td>84</td>
<td>.20</td>
<td>B, T</td>
<td>Pos, Dyn, UI</td>
<td>DS, Cont</td>
<td>Genuine happiness/ Fake happiness</td>
</tr>
<tr>
<td>Krumhuber</td>
<td>2009</td>
<td>53</td>
<td>.66</td>
<td>B, P</td>
<td>Nat, Dyn, MI</td>
<td>DS, Cont</td>
<td>Genuine and Amused</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60</td>
<td>.45</td>
<td>B, P</td>
<td>Pos, Both, MI</td>
<td>DS, Cont</td>
<td>Genuine and Amused</td>
</tr>
<tr>
<td>Mehu</td>
<td>2007</td>
<td>58</td>
<td>.17</td>
<td>B, T</td>
<td>Nat, Stat, UI</td>
<td>TS, Cont</td>
<td>Attractiveness, generosity, trustworthiness, health, agreeableness,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>conscientiousness, extroversion, neuroticism, and openness</td>
</tr>
<tr>
<td>Peace</td>
<td>2006</td>
<td>39</td>
<td>.66</td>
<td>W, P</td>
<td>Pos, Stat, MI</td>
<td>TS, Cont</td>
<td>Positive ratings of t-shirt worn by smiler</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>.39</td>
<td>W, P</td>
<td>Pos, Stat, MI</td>
<td>TS, Dich</td>
<td>Positive ratings of t-shirt worn by smiler</td>
</tr>
<tr>
<td>Quadflieg</td>
<td>2013</td>
<td>48</td>
<td>.13</td>
<td>W, P</td>
<td>Pos, Stat, MI</td>
<td>TS, Cont</td>
<td>Attractiveness, dominance, intelligence, and Trustworthiness</td>
</tr>
<tr>
<td>First Author</td>
<td>Year</td>
<td>N</td>
<td>ES</td>
<td>A</td>
<td>Stimuli</td>
<td>DV Type</td>
<td>Actual DV</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
<td>----</td>
<td>----</td>
<td>-------</td>
<td>-------------</td>
<td>-------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Sacco</td>
<td>2009</td>
<td>148</td>
<td>.80</td>
<td>W, P</td>
<td>Pos, Dyn, UI</td>
<td>DS, Dich</td>
<td>Genuine smile/ Deceptive smile</td>
</tr>
<tr>
<td>Slessor</td>
<td>2010</td>
<td>39</td>
<td>.66</td>
<td>B, P</td>
<td>Pos, Stat, UI</td>
<td>DS, Dich</td>
<td>Happy/ Not happy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35</td>
<td>.59</td>
<td>B, P</td>
<td>Pos, Stat, UI</td>
<td>DS, Dich</td>
<td>Happy/ Not happy</td>
</tr>
<tr>
<td>Surakka</td>
<td>1998</td>
<td>24</td>
<td>.34</td>
<td>W, P</td>
<td>Pos, Stat, UI</td>
<td>DS, Cont</td>
<td>Pleasure</td>
</tr>
<tr>
<td>Woodzicka</td>
<td>2008</td>
<td>44</td>
<td>.75</td>
<td>W, T</td>
<td>Nat, Dyn, UI</td>
<td>TS, Cont</td>
<td>Hireability and Competence</td>
</tr>
</tbody>
</table>

Note. ES= Effect Size, A = analysis specific variables, DV = dependent variable type, W = within subjects, B = between subjects, T = target unit of analysis, P = perceiver unit of analysis, TS = trait specific, DS = Duchenne smile specific, Cont = Continuous variable, Dich = dichotomous variable, Pos = Posed Stimuli, Nat = natural stimuli, Stat = static stimuli, Dyn = dynamic Stimuli, MI= matched intensity, UI = unmatched intensity
Table 2

*Contrast Q for each Moderator in Study 1*

<table>
<thead>
<tr>
<th>Moderator</th>
<th>Q</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Methodological</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between vs. within subjects analysis</td>
<td>34.01</td>
<td>.001</td>
</tr>
<tr>
<td>Continuous vs. dichotomous measure</td>
<td>38.60</td>
<td>.001</td>
</tr>
<tr>
<td>D Specific vs. trait inference DV</td>
<td>62.63</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Stimuli</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static vs. dynamic</td>
<td>6.04</td>
<td>.05</td>
</tr>
<tr>
<td>Posed vs. natural</td>
<td>15.31</td>
<td>.001</td>
</tr>
<tr>
<td>Intensity matched</td>
<td>13.27</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Perceiver</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceiver gender</td>
<td>13.57</td>
<td>.001</td>
</tr>
<tr>
<td>Perceiver age</td>
<td>18.69</td>
<td>.001</td>
</tr>
</tbody>
</table>

*Note.* Q values are $\chi^2$ based on 1 df. D = Duchenne Specific
Table 3

*Mean Weighted ES and Z’s for Components of Significant Moderator Tests in Study 1*

<table>
<thead>
<tr>
<th>Moderator Components</th>
<th>$M_{ES}$</th>
<th>$k$</th>
<th>$Z$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analysis Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within</td>
<td>.65</td>
<td>9</td>
<td>17.34</td>
<td>.001</td>
</tr>
<tr>
<td>Between</td>
<td>.42</td>
<td>9</td>
<td>13.17</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Positivity Measure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D specific</td>
<td>.59</td>
<td>14</td>
<td>22.11</td>
<td>.001</td>
</tr>
<tr>
<td>Trait inference</td>
<td>.20</td>
<td>4</td>
<td>3.73</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Rating Type</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Continuous</td>
<td>.60</td>
<td>12</td>
<td>20.12</td>
<td>.001</td>
</tr>
<tr>
<td>Dichotomous</td>
<td>.35</td>
<td>6</td>
<td>8.60</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Stimulus Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static</td>
<td>.57</td>
<td>10</td>
<td>14.64</td>
<td>.001</td>
</tr>
<tr>
<td>Dynamic</td>
<td>.47</td>
<td>8</td>
<td>14.32</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Smile Elicitation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posed</td>
<td>.48</td>
<td>16</td>
<td>18.18</td>
<td>.001</td>
</tr>
<tr>
<td>Natural</td>
<td>.68</td>
<td>2</td>
<td>11.18</td>
<td>.001</td>
</tr>
</tbody>
</table>
Table 3 Continued

<table>
<thead>
<tr>
<th>Moderator Components</th>
<th>$M_{ES}$</th>
<th>$k$</th>
<th>$Z$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intensity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matched</td>
<td>.45</td>
<td>10</td>
<td>13.64</td>
<td>.001</td>
</tr>
<tr>
<td>Unmatched/unclear</td>
<td>.59</td>
<td>8</td>
<td>16.35</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Age of Perceiver</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 10</td>
<td>.29</td>
<td>3</td>
<td>4.70</td>
<td>.001</td>
</tr>
<tr>
<td>College aged</td>
<td>.55</td>
<td>14</td>
<td>20.17</td>
<td>.001</td>
</tr>
</tbody>
</table>

*Note. $M_{ES}$ = mean weighted effect size, $k =$ number of studies, $t =$ the simple random effects test against 0. Positive mean weighted effect sizes indicate that $D$ smiles were rated more positively than $ND$ smiles.*
Table 4

Mean Percentage of Smiles that Were Duchenne Across All Smiling Tasks

<table>
<thead>
<tr>
<th>Task</th>
<th>Mean %</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genuine smile role-play</td>
<td>45</td>
<td>43</td>
<td>74</td>
</tr>
<tr>
<td>Fake smile role-play</td>
<td>39</td>
<td>42</td>
<td>70</td>
</tr>
<tr>
<td>Imitating Duchenne smiles</td>
<td>55</td>
<td>41</td>
<td>77</td>
</tr>
<tr>
<td>Imitating non-Duchenne smiles</td>
<td>17</td>
<td>34</td>
<td>75</td>
</tr>
<tr>
<td>Persuading to drink pleasant juice</td>
<td>33</td>
<td>48</td>
<td>54</td>
</tr>
<tr>
<td>Persuading to drink unpleasant juice</td>
<td>29</td>
<td>46</td>
<td>51</td>
</tr>
<tr>
<td>Persuading not to drink pleasant juice</td>
<td>7</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>Persuading not to drink unpleasant juice</td>
<td>33</td>
<td>48</td>
<td>21</td>
</tr>
</tbody>
</table>

Note. N is the number of participants out of the total N of 78 who smiled in each task. Participants who did not smile (i.e., ignored the task instructions in the persuade yes conditions) are not included.
Table 5

*Correlations between Occurrence of Duchenne Smile and Smile Intensity Ratings in Each Task Where a Duchenne Smile Was Appropriate*

<table>
<thead>
<tr>
<th>Task</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Genuine happiness” role-play</td>
<td>.60**</td>
</tr>
<tr>
<td>“Fake happiness” role-play</td>
<td>.47**</td>
</tr>
<tr>
<td>Imitating Duchenne</td>
<td>.51**</td>
</tr>
<tr>
<td>Persuading to drink the pleasant juice</td>
<td>.63**</td>
</tr>
<tr>
<td>Persuading to drink the unpleasant juice</td>
<td>.51**</td>
</tr>
</tbody>
</table>

** ** p < .01
Table 6

**Naïve Viewers’ Mean Pleasantness Ratings**

<table>
<thead>
<tr>
<th>Juice type</th>
<th>Taste</th>
<th>Don’t taste</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant</td>
<td>5.51 (1.02)</td>
<td>2.50 (.79)</td>
<td>4.01 (.56)</td>
</tr>
<tr>
<td>Unpleasant</td>
<td>5.27 (1.18)</td>
<td>2.38 (.83)</td>
<td>3.83 (.70)</td>
</tr>
<tr>
<td>Mean</td>
<td>5.39 (.96)</td>
<td>2.44 (.69)</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Standard deviations are in parentheses.*
Table 7

*Correlations between Pleasantness Ratings in the Four Taste Conditions and Deliberate Duchenne Smiling in the Role-Plays and Imitation Tasks*

<table>
<thead>
<tr>
<th>Persuasion condition</th>
<th>“GH” r-p</th>
<th>“FH” r-p</th>
<th>DImt</th>
<th>NDImt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant Persuade Yes</td>
<td>.23*</td>
<td>.05</td>
<td>.10</td>
<td>-.08</td>
</tr>
<tr>
<td>Pleasant Persuade No</td>
<td>-.12</td>
<td>.05</td>
<td>-.16</td>
<td>-.33**</td>
</tr>
<tr>
<td>Unpleasant Persuade Yes</td>
<td>.24*</td>
<td>.03</td>
<td>.13</td>
<td>-.07</td>
</tr>
<tr>
<td>Unpleasant Persuade No</td>
<td>-.19</td>
<td>-.16</td>
<td>-.02</td>
<td>-.21</td>
</tr>
</tbody>
</table>

*Note.* “GH” r-p = “genuine happiness” role-play; “FH” r-p = “fake happiness” role-play; DImt = imitating Duchenne smile, NDImt = imitating non-Duchenne.

* *p < .05*
Table 8

*Correlations between Duchenne Smiling across the Deliberate Duchenne Smiling Tasks and the Persuasion Tasks*

<table>
<thead>
<tr>
<th>Tasks</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. “Genuine happiness” role-play</td>
<td>--</td>
<td>.37**</td>
<td>.34**</td>
<td>.34*</td>
<td>.21</td>
</tr>
<tr>
<td>2. “Fake happiness” role-play</td>
<td>--</td>
<td>.27+</td>
<td>.24+</td>
<td>.18</td>
<td></td>
</tr>
<tr>
<td>3. Imitating Duchenne smile</td>
<td>--</td>
<td></td>
<td>.36**</td>
<td>.19</td>
<td></td>
</tr>
<tr>
<td>4. Persuading to drink pleasant juice</td>
<td>--</td>
<td></td>
<td></td>
<td>.40**</td>
<td></td>
</tr>
<tr>
<td>5. Persuading to drink unpleasant juice</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ $p < .01$  * $p < .05$  ** $p < .01$
Table 9

*Correlations between Duchenne Smiling in Smiling Tasks and Self-Report Measures*

<table>
<thead>
<tr>
<th></th>
<th>UPY</th>
<th>UPN</th>
<th>PY</th>
<th>PN</th>
<th>&quot;GH&quot; R-P</th>
<th>&quot;FH&quot; R-P</th>
<th>DImt</th>
<th>NDImt</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI Emotional Expressivity</td>
<td>.06</td>
<td>.06</td>
<td>-.15</td>
<td>.27</td>
<td>.02</td>
<td>.17</td>
<td>-.35*</td>
<td>-.20</td>
</tr>
<tr>
<td>SSI Emotional Sensitivity</td>
<td>-.05</td>
<td>.02</td>
<td>.15</td>
<td>-.56*</td>
<td>.00</td>
<td>-.08</td>
<td>-.12</td>
<td>-.23*</td>
</tr>
<tr>
<td>SSI Emotional Clarity</td>
<td>-.08</td>
<td>-.24</td>
<td>-.14</td>
<td>-.27</td>
<td>-.01</td>
<td>-.17</td>
<td>-.02</td>
<td>.11</td>
</tr>
<tr>
<td>PANAS Positive</td>
<td>-.08</td>
<td>.04</td>
<td>.08</td>
<td>.20</td>
<td>.11</td>
<td>.09</td>
<td>-.11</td>
<td>.28*</td>
</tr>
<tr>
<td>PANAS Negative</td>
<td>-.01</td>
<td>.34</td>
<td>.07</td>
<td>-.01</td>
<td>.09</td>
<td>.06</td>
<td>.11</td>
<td>.05</td>
</tr>
<tr>
<td>BEQ Negative Expressivity</td>
<td>-.17</td>
<td>.12</td>
<td>.04</td>
<td>.65**</td>
<td>.02</td>
<td>-.20</td>
<td>-.05</td>
<td>-.26*</td>
</tr>
<tr>
<td>BEQ Positive Expressivity</td>
<td>-.01</td>
<td>.32</td>
<td>-.03</td>
<td>.44</td>
<td>.08</td>
<td>-.08</td>
<td>-.09</td>
<td>-.16</td>
</tr>
<tr>
<td>BEQ Impulse Strength</td>
<td>.03</td>
<td>-.01</td>
<td>.04</td>
<td>.09</td>
<td>-.13</td>
<td>-.18</td>
<td>-.12</td>
<td>-.28*</td>
</tr>
<tr>
<td>BEQ Total</td>
<td>-.08</td>
<td>.17</td>
<td>.03</td>
<td>.52*</td>
<td>-.03</td>
<td>-.20</td>
<td>-.11</td>
<td>-.31**</td>
</tr>
<tr>
<td>MPS</td>
<td>-.10</td>
<td>.05</td>
<td>-.07</td>
<td>-.33</td>
<td>.00</td>
<td>-.04</td>
<td>.03</td>
<td>-.09</td>
</tr>
</tbody>
</table>
Table 9 Continued

<table>
<thead>
<tr>
<th>NPI</th>
<th>UPY</th>
<th>UPN</th>
<th>PY</th>
<th>PN</th>
<th>“GH” R-P</th>
<th>“FH” R-P</th>
<th>DImt</th>
<th>NDImt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.04</td>
<td>-.23</td>
<td>-.05</td>
<td>-.38</td>
<td>-.11</td>
<td>-.07</td>
<td>.24*</td>
<td>.26*</td>
</tr>
</tbody>
</table>

*Note. UPY = Taste unpleasant, persuade yes; UPN = Taste unpleasant, persuade no; PY = Drink Pleasant, Persuade Yes; PN = Drink pleasant, persuade no; “GH” R-P = “Genuine Happiness” role-play; “FH” R-P= “Fake Happiness” role-play; DImt = Imitating Duchenne smile; NDImt = Imitating non-Duchenne smile; SSI = Social Skills Inventory; PANAS = Positive and Negative Affect Schedule, BEQ = Berkeley Expressivity Questionnaire; ERQ = Emotion Regulation Questionaire; SSM = Social Self Monitoring Scale; MPS = Machievellian Personality Questionnaire; NPI = Narcissistic Personality Questionnaire

Significant correlations are bolded

* p < .05; **p < .01
Table 10

*Mean Percentage of Total Smiles that were Duchenne Smiles in the Deliberate Duchenne Smiling Tasks*

<table>
<thead>
<tr>
<th>Task</th>
<th>Mean %</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Genuine happiness” role-play</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>34</td>
<td>37</td>
<td>25</td>
</tr>
<tr>
<td>Females</td>
<td>45</td>
<td>37</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>37</td>
<td>57</td>
</tr>
<tr>
<td>“Fake- happiness” role-play</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>30</td>
<td>38</td>
<td>25</td>
</tr>
<tr>
<td>Females</td>
<td>45</td>
<td>44</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>42</td>
<td>55</td>
</tr>
<tr>
<td>High intensity imitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>48</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>Females</td>
<td>53</td>
<td>51</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td>50</td>
<td>57</td>
</tr>
<tr>
<td>Low intensity imitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>29</td>
<td>46</td>
<td>24</td>
</tr>
<tr>
<td>Females</td>
<td>34</td>
<td>48</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>47</td>
<td>56</td>
</tr>
</tbody>
</table>
Table 11

*Average Number of Duchenne Smiles Produced when Imitating a Duchenne Smile by Intensity of Smile and Order of Imitation*

<table>
<thead>
<tr>
<th></th>
<th>High intensity</th>
<th>Low intensity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High first</td>
<td>.41</td>
<td>.48</td>
<td>.45</td>
</tr>
<tr>
<td>Low first</td>
<td>.62</td>
<td>.15</td>
<td>.39</td>
</tr>
<tr>
<td>Total</td>
<td>.52</td>
<td>.32</td>
<td></td>
</tr>
</tbody>
</table>
Table 12

*Correlations between Deliberate Duchenne Smiling Tasks and Individual Difference Measures*

<table>
<thead>
<tr>
<th>Task</th>
<th>Extro</th>
<th>Agree</th>
<th>Neuro</th>
<th>Open</th>
<th>Consc</th>
<th>NTB</th>
</tr>
</thead>
<tbody>
<tr>
<td>“G-H” role-play</td>
<td>-.05</td>
<td>.19</td>
<td>-.00</td>
<td>.31*</td>
<td>-.15</td>
<td>-.18</td>
</tr>
<tr>
<td>“F-H” role-play</td>
<td>-.00</td>
<td>.06</td>
<td>-.04</td>
<td>.12</td>
<td>-.04</td>
<td>-.27*</td>
</tr>
<tr>
<td>High intensity imitation</td>
<td>.21</td>
<td>.09</td>
<td>-.00</td>
<td>.24*</td>
<td>.10</td>
<td>-.24*</td>
</tr>
<tr>
<td>Low intensity imitation</td>
<td>-.11</td>
<td>.15</td>
<td>.11</td>
<td>.01</td>
<td>-.02</td>
<td>.05</td>
</tr>
</tbody>
</table>

*Note.* “G-H” = “genuine happiness”, “F-H” = “fake happiness”, Extro = extroversion, Agree = agreeableness, Neuro = neuroticism, Open = Open to experience, Consc = conscientiousness, NTB = need to belong

* p < .10, * p < .05
Table 13

*Correlations among Deliberate Duchenne Smiling Tasks*

<table>
<thead>
<tr>
<th>Task</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. “G-H” role-play</td>
<td>--</td>
<td>.31*</td>
<td>.17</td>
<td>.12</td>
</tr>
<tr>
<td>2. “F-H” role-play</td>
<td>--</td>
<td>.32*</td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td>3. High intensity imitation</td>
<td>--</td>
<td></td>
<td>.07</td>
<td></td>
</tr>
<tr>
<td>4. Low intensity imitation</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. “G-H” = “genuine happiness”, “F-H” = “fake happiness”

* p < .05
Table 14

*Correlations between Deliberate Duchenne Smiling Tasks and Smile Intensity for the Same Task*

<table>
<thead>
<tr>
<th>Task</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>“G-H” role-play</td>
<td>.31*</td>
</tr>
<tr>
<td>“F-H” role-play</td>
<td>.48**</td>
</tr>
<tr>
<td>High intensity imitation</td>
<td>.32*</td>
</tr>
<tr>
<td>Low intensity imitation</td>
<td>.36**</td>
</tr>
</tbody>
</table>

*Note.* “G-H” = “genuine happiness”, “F-H” = “fake happiness”

* * * p < .05, ** * p < .01
Table 15

*Pairwise Correlations for Variables Measured from the Dyadic Interaction*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pairwise Correlation</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duchenne smile variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prop time smiling</td>
<td>.27</td>
<td>.04</td>
</tr>
<tr>
<td>Prop time n-D smiling</td>
<td>-.11</td>
<td>.43</td>
</tr>
<tr>
<td>Prop time D smiling</td>
<td>.31</td>
<td>.02</td>
</tr>
<tr>
<td>Prop time of smiles with D</td>
<td>.05</td>
<td>.70</td>
</tr>
<tr>
<td><strong>Participant variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liked Partner</td>
<td>.50</td>
<td>.001</td>
</tr>
<tr>
<td>Partner liked me</td>
<td>.41</td>
<td>.001</td>
</tr>
<tr>
<td>Happiness Self-Report</td>
<td>.30</td>
<td>.03</td>
</tr>
<tr>
<td><strong>Naïve viewer variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liked Participant</td>
<td>.40</td>
<td>.005</td>
</tr>
</tbody>
</table>

*Note. Prop = proportion, D = Duchenne, N = 60 for all correlations*
Table 16

*Descriptive Statistics for Smiling Behavior in Interactions Averaged Across Partners*

<table>
<thead>
<tr>
<th>Smile Measure</th>
<th>Min</th>
<th>Max</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prop time smiling</td>
<td>.21</td>
<td>.98</td>
<td>.62</td>
<td>.20</td>
</tr>
<tr>
<td>Prop time n-D smiling</td>
<td>.10</td>
<td>.67</td>
<td>.41</td>
<td>.14</td>
</tr>
<tr>
<td>Prop time D smiling</td>
<td>.02</td>
<td>.59</td>
<td>.21</td>
<td>.14</td>
</tr>
<tr>
<td>Prop time of smiles with D</td>
<td>.02</td>
<td>.60</td>
<td>.32</td>
<td>.15</td>
</tr>
</tbody>
</table>

*Note.* N = 30 for all measures

D = Duchenne, n-D = non-Duchenne, Min = minimum, Max = maximum
Table 17

*Correlations between Deliberate Duchenne Smile Measures and Smile Measures in the Dyadic Interaction*

<table>
<thead>
<tr>
<th>Smile Measure</th>
<th>G-H” role-play</th>
<th>“F-H” role-play</th>
<th>H-I Imitation</th>
<th>L-I Imitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prop time smiling</td>
<td>.18</td>
<td>.21</td>
<td>-.02</td>
<td>.21</td>
</tr>
<tr>
<td>Prop time D smiling</td>
<td>.43**</td>
<td>.22</td>
<td>.02</td>
<td>.19</td>
</tr>
<tr>
<td>Prop time of smiles with D</td>
<td>.42**</td>
<td>.17</td>
<td>.13</td>
<td>.14</td>
</tr>
</tbody>
</table>

*Note.* “G-H” = “genuine happiness”, “F-H” = “fake happiness”, H-I = high intensity, L-I = low intensity, Prop = proportion, D = Duchenne

**p < .01**
Table 18

*Fixed Effects Estimates for Actor and Partner Smiling Effects on How Much a Participant Liked His or Her Partner*

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>t</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prop time smiling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>-.10</td>
<td>-.14</td>
<td>52.50</td>
<td>.89</td>
</tr>
<tr>
<td>Partner</td>
<td>-.21</td>
<td>-.28</td>
<td>52.50</td>
<td>.78</td>
</tr>
<tr>
<td><strong>Prop time D smiling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>.03</td>
<td>.02</td>
<td>54.39</td>
<td>.98</td>
</tr>
<tr>
<td>Partner</td>
<td>.59</td>
<td>.55</td>
<td>54.39</td>
<td>.59</td>
</tr>
<tr>
<td><strong>Prop time of smiles with D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>.28</td>
<td>.310</td>
<td>46.09</td>
<td>.76</td>
</tr>
<tr>
<td>Partner</td>
<td>1.04</td>
<td>1.14</td>
<td>46.09</td>
<td>.26</td>
</tr>
</tbody>
</table>

*Note.* Degrees of freedom are fractional because they are calculated with the Satterthwaite (1946) approximation (Kenny et al., 2006).
Table 19

Fixed Effects Estimates for Actor and Partner Smiling Effects on How Much Naïve Viewers Liked Participants

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>t</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prop time smiling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>.98</td>
<td>3.67</td>
<td>55.17</td>
<td>.001</td>
</tr>
<tr>
<td>Partner</td>
<td>-.05</td>
<td>-.20</td>
<td>55.17</td>
<td>.84</td>
</tr>
<tr>
<td>Prop time D smiling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>.74</td>
<td>1.75</td>
<td>55.66</td>
<td>.09</td>
</tr>
<tr>
<td>Partner</td>
<td>.14</td>
<td>.55</td>
<td>55.66</td>
<td>.74</td>
</tr>
<tr>
<td>Prop time of smiles with D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>.57</td>
<td>1.61</td>
<td>51.52</td>
<td>.11</td>
</tr>
<tr>
<td>Partner</td>
<td>.24</td>
<td>.68</td>
<td>51.52</td>
<td>.50</td>
</tr>
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</table>

Note. Degrees of freedom are fractional because they are calculated with the Satterthwaite (1946) approximation (Kenny et al., 2006).
<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>t</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extroversion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>-.02</td>
<td>-.70</td>
<td>54.54</td>
<td>.49</td>
</tr>
<tr>
<td>Partner</td>
<td>-.02</td>
<td>-.44</td>
<td>56.34</td>
<td>.66</td>
</tr>
<tr>
<td><strong>Agreeableness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>.02</td>
<td>.53</td>
<td>38.97</td>
<td>.60</td>
</tr>
<tr>
<td>Partner</td>
<td>-.04</td>
<td>-1.06</td>
<td>43.57</td>
<td>.30</td>
</tr>
<tr>
<td><strong>Neuroticism</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>-.06</td>
<td>-2.33</td>
<td>42.14</td>
<td>.02</td>
</tr>
<tr>
<td>Partner</td>
<td>-.03</td>
<td>-1.27</td>
<td>50.58</td>
<td>.21</td>
</tr>
<tr>
<td><strong>Openness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>-.03</td>
<td>-.77</td>
<td>54.84</td>
<td>.44</td>
</tr>
<tr>
<td>Partner</td>
<td>-.04</td>
<td>-.98</td>
<td>54.66</td>
<td>.33</td>
</tr>
<tr>
<td><strong>Conscientiousness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>.02</td>
<td>-.56</td>
<td>51.64</td>
<td>.57</td>
</tr>
<tr>
<td>Partner</td>
<td>-.01</td>
<td>-.37</td>
<td>56.92</td>
<td>.72</td>
</tr>
</tbody>
</table>
Table 20 cont.

<table>
<thead>
<tr>
<th>Estimate</th>
<th>t</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need to belong</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actor</td>
<td>-.05</td>
<td>-2.18</td>
<td>40.83</td>
</tr>
<tr>
<td>Partner</td>
<td>-.08</td>
<td>-3.47</td>
<td>44.44</td>
</tr>
</tbody>
</table>

Note. Degrees of freedom are fractional because they are calculated with the Satterthwaite (1946) approximation (Kenny et al., 2006).
Figure 1. Mean pleasantness ratings by persuasion direction and whether or not the participant produced a Duchenne smile when role-playing “genuine happiness.”
Figure 2. The Actor-Partner Interdependence Model. The top panel shows the APIM for distinguishable dyads. The bottom panel shows the APIM for indistinguishable dyads, like those in the current study.