SHE'S NOT ONE OF US: GROUP MEMBERSHIP MODERATES THE EFFECT OF FERTILITY CUES ON ATTRACTIVENESS RATINGS

A Dissertation

by

NATASHA DAVIS TIDWELL

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Anita Kim
Co-Chair of Committee,	Paul W. Eastwick
Committee Members,	Brandon J. Schmeichel
	Jeffrey Winking
Head of Department,	Douglas W. Woods

May 2014

Major Subject: Psychology

ABSTRACT

Previous research has explored several ways in which human fertility influences attraction in both men and women. One of the frequently replicated effects found in this literature is that men tend to rate vocal samples taken from women during highly fertile stages of their ovulatory cycle as more attractive than vocal samples taken during less fertile times. However, ovulation is a relatively ancient adaptation that females from many species, including humans, have maintained for several million years. Researchers have largely ignored more recent adaptations, such as symbolic ingroup preferences, that could potentially moderate these effects. The present work uses a phylogenetic lens to examine the influence of ingroup and outgroup cues on men's attraction to the voices of fertile and nonfertile women.

In Study 1, fertility and target ethnicity interacted to predict attraction, such that men found highly fertile target voices more attractive than nonfertile target voices; however, this effect reversed for female targets who exhibited foreign-accented speech. Study 2 replicated this finding and also demonstrated that a similar effect occurs in response to a subtle manipulation of the female targets' school membership (same-school versus rival school). Study 3 shows that these results generalize to an older, more diverse sample but suggests that the effect does not persist under certain subtle manipulations (i.e., a minimal group paradigm). Together, these results provide support for a phylogenetic approach to understanding human adaptation by demonstrating that humans' relatively recently evolved preferences for ingroup partners can refocus older reproductive drives. Future research should continue to pursue a potential mechanistic explanation for this effect.

ACKNOWLEDGEMENTS

I am incredibly lucky to have had two wonderful mentors through the course of my graduate career, and this project would not have been possible without their guidance. I would like to thank Paul Eastwick for his infectious passion for the field and his dedication to making my work the best it can be. I also thank Anita Kim for her unwavering support for my interests and her candid advice on matters in both the laboratory and the classroom. Both of you have contributed immeasurably to my development as a scholar, scientist, and teacher, and I am quite fortunate to consider you both colleagues.

I am very grateful for several other faculty members who have worked closely with me. First, thank you to the other two members of my dissertation committee: Brandon Schmeichel and Jeffrey Winking. The feedback you provided over the course of this project helped me to view this material from new perspectives, and this dissertation is much better because of your insights. I am also indebted to Rachel Hull, who has provided me with invaluable advice, guidance, and encouragement.

I must also thank many hard-working and talented research assistants. All of you made my research possible, and I appreciate your time and dedication in the lab. I am particularly grateful to those students who worked directly on the studies in this dissertation: Alita Andrews, Maria Brito, and Jessica Holley.

I am also thankful for the great deal of personal support I received over the past five years. To my peers, friends, and writing buddies: your support and companionship

have made my graduate experience a memorable one that I will look back on fondly. To my parents, who always have served as my cheerleaders: thank you for your unconditional love and your unlimited confidence in me.

Finally, I am forever grateful for my husband, Steve. Your sacrifices have made my goals a reality, and I could not have completed this without your love and support. I can never thank you enough for your seemingly endless patience, humor, and encouragement throughout this process.

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Over the past several decades, psychologists have examined evolutionary influences on a variety of human behaviors. Special attention has been paid to human mating preferences and experiences, and early work in this domain remains some of the most highly cited psychological research in the last 30 years (e.g., Buss, 1989). In recent years, researchers in this field have begun to focus on how human mate preferences are shaped by fertility and ovulatory cycles. Not only do women report a shift in their preferences depending on their ovulatory cycle phase, but men also show a stronger preference for women who are in a highly fertile stage over women who are less fertile (Haselton & Gildersleeve, 2011). Research using this paradigm has led to several fascinating discoveries.

However, one frequent criticism of evolutionary psychological findings in general is that they do not always account for the entire suite of mating behaviors observed in modern humans. For example, human adaptations such as pair-bonding and sexual self-control are often neglected within this literature (Eastwick, 2009). In addition, the small amount of work that has examined the role of other variables in moderating ovulatory effects has generally been limited to constructs that are directly related to the mating domain (Eastwick & Finkel, 2012; Miller & Maner, 2010a). In the current set of studies, I wish to examine a phenomenon that can provide one explanation for when these ovulatory effects should emerge and when they should not. Specifically, the current studies provide an evolutionary rationale for why symbolic ingroup membership should serve as one of these moderators.

In Study 1, I found that one type of salient ingroup cue—spoken accent—moderates college aged men's preferences for fertile women. I replicated this effect in Study 2, and I also found that school membership, another subtle cue of symbolic group membership, produces a similar effect. I then built on these findings by conducting Study 3, which tested this effect in an older, more diverse sample, incorporated a new type of ingroup cue, and examined disgust as a potential mediator. Below, I describe a brief history of the origins of ovulatory research in humans and provide a rationale for the manipulations and paradigms chosen for this particular set of studies.

Ovulatory Shifts in Mate Preferences

Early work examining the role of ovulation focused primarily on women's shifts in mate preferences. This paradigm has its roots in the strategic pluralism model (Gangestad & Simpson, 2000). Broadly, strategic pluralism posits that humans evolved to engage in a variety of different mating strategies to maximize their reproductive success (Simpson & LaPaglia, 2006). Unlike previous evolutionary psychological frameworks (e.g., Buss & Schmitt, 1993), strategic pluralism not only offers a potential explanation for mating differences between the sexes but also describes mating strategies shared by both men and women, providing an explanation for behavioral variations within the sexes. According to this view, both men and women should engage in long-term mating strategies under some circumstances but pursue short-term mating strategies in others.

Ovulatory Shifts in Women

Early researchers typically relied on strategic pluralism as an explanation for both women’s short-term and long-term sexual choices and behavior (Gangestad & Simpson, 2000). Specifically, this viewpoint contends that women should engage in strategic “trade-offs” when choosing a sexual partner. Women should evaluate the desirability of a potential male partner based on both his genetic quality and his ability to provide for her and her offspring. Depending on her own physical characteristics and the environmental context, a woman would place differing levels of importance on each of these two qualities (Simpson, Wilson, & Winterheld, 2004). For example, women who have relatively limited access to resources should be more likely to mate with a partner in order to secure the resources necessary for survival. Therefore, a woman may be more likely to bypass qualities that would be desirable in short-term mates (e.g., symmetry and high genetic quality) if a partner with those qualities is unable or unwilling to provide her with the resources she needs. Instead, she would be more likely to pursue long-term mates who will provide her with the resources needed to sustain her and her offspring, even if these potential partners do not possess relatively “good genes.” On the other hand, women who are not lacking in resources, whether they are in a plentiful environment or have already obtained resources with the help of a long-term partner, might find partners who would provide them with healthy, genetically fit offspring particularly appealing (Simpson, et al., 2004).

Building on these ideas, some theorists contend that women should show a greater desire for genetically fit sexual partners when conception is particularly likely.

That is, fertile women should show an increased preference for partners who are highly symmetrical, dominant, and masculine relative to times in which they are less fertile; mating with these partners at times of high fertility would maximize the likelihood that their offspring would inherit these males' "good genes" (Gangestad, Thornhill, & Garver-Apgar, 2005). In recent years, a rich literature has shown that women do exhibit variation in mate preferences and behaviors as a function of their ovulatory cycles. To examine these shifts in mating preferences, researchers typically track women's fertility across their 28-day menstrual cycle. Women are most fertile during the 6 days approaching ovulation, or days 9-14 of their cycle (Wilcox, Duncan, Weinberg, Trussel, & Baird, 2001). Naturally cycling women (i.e., women with regular menstrual cycles who are not using hormonal contraception) exhibit subtle behavioral and attitudinal changes in the mating domain across cycle phases.

Some of the earliest work on this topic used a scent detection paradigm to examine this pattern (Gangestad & Thornhill, 1998). In this classic study, female participants at different points in their menstrual cycle smelled t-shirts previously worn by male targets and evaluated the appeal of each scent. Results showed that as naturally cycling women approached ovulation, they demonstrated a stronger preference for the scent of men who were physically symmetrical, which is a trait associated with "good genes" (Gangestad & Thornhill, 1998; Thornhill, et al., 2003). However, this effect did not emerge for women on hormonal birth control, who showed no shift in preferences for the symmetrical men across their cycle (Gangestad & Thornhill, 1998). A more recent study provided evidence that this effect also occurs for behavioral traits associated with “good genes;” using a similar paradigm, fertile women, especially those who were single, preferred the scent of men who scored high on a self-reported dominance scale more than women who were less fertile (Havlicek, Roberts, Flegr, 2005).

Researchers have found similar results using methods other than scent detection, indicating that women’s shifts in mating preferences are based on a variety of male cues. For example, Gangestad, Garver-Apgar, Simpson, & Cousins (2007) found that women report finding certain personality traits and physical characteristics more or less attractive depending on their fertility level. Specifically, women rated traits such as physical attractiveness, muscularity, and social respectability as more attractive in a short-term mating partner when they were in a fertile phase of their cycle than when they were less fertile. Women’s fertility is also associated with an increased preference for short-term relationships with men who actually behave in a dominant manner toward other men (Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004). Also, fertile women rate male voice recordings that were manipulated to be relatively low-pitched as more attractive than high-pitched voices as short-term, but not long-term potential partners (Puts, 2005). Similarly, women who are close to ovulation tend to rate masculine male faces as more desirable than less masculine faces for short-term, but not long-term relationships, ostensibly because masculine facial features (e.g., strong jaw and brow) signify “good genes” (Jones, et al., 2008).

Women demonstrate other behavioral differences across their cycle as well. For example, previous work has found that women tend to desire and engage in sex more frequently when they are highly fertile than when they are less fertile (Hill, 1988). That is, women report having sex most frequently in days 9-14 of their menstrual cycle (Wilcox, Baird, Dunson, McConnaughey, Kesner, & Weinberg, 2004). In one laboratory study, women were instructed to draw pictures of clothing they were likely to wear to an imaginary social event that evening (Durante, Li, & Haselton, 2008). These women drew more revealing clothing when they were in a fertile stage of their cycle than when they were less fertile. Also, independent judges rated the actual clothing these same female participants wore to the study to be more revealing during times of high fertility than times of low fertility (Durante, et al., 2008). Fertility also has been associated with women's behavior in social-cognitive laboratory studies. Anderson, et al. (2010) found that in an eye tracking memory task, women close to ovulation looked at attractive men longer than women who were less fertile did, although they did not show increased memory for those men's faces over time. Overall, a great deal of evidence suggests that women's preferences and behaviors shift across their ovulatory cycle.

Ovulatory Perceptions in Men

Previous research has also examined men's attunement to women's ovulatory cycles. Although researchers have long assumed that human females' ovulatory phases are concealed (Burley, 1979), a great deal of evidence suggests that men are able to detect women's fertility status to some degree.

Researchers posit that men's ability to detect women's ovulation would be adaptive for multiple reasons. First, men's sexual encounters with ovulating women would be more likely to produce offspring than sexual encounters with less-fertile partners. Thus, the ability to detect ovulation could an evolved adaptation (Gangestad &

Thornhill, 2008). Second, some researchers conceptualize men's ability to detect ovulation as an evolved counterstrategy to those strategies employed by women (Gangestad, et al., 2005). For example, if women show a tendency to prefer sexual partners who possess "good genes" when conception is particularly likely, then women should show a stronger preference for sex with these types of partners when in their fertile period than when they are less fertile. According to the strategic pluralism perspective, if a woman is in a relationship, especially if her partner does not possess "good genes," she may be more likely to pursue extra-pair sex when fertile compared to when she is less fertile. Therefore, if a woman is especially likely to engage in extra-pair sex when conception is most likely, her long-term partner would be well-served if he could detect her fertility status and discourage her from seeking out extra-pair partners (Gangestad, et al., 2005).

Men's ability to detect ovulation in women has been shown using a variety of paradigms, many of which are quite similar to those used to assess women's mating preference shifts. Researchers have frequently explored men's ability to detect variations in women's scent across their fertility cycles, and results consistently show that men find the scent of highly fertile women more attractive than the scent of less fertile women (Thornhill, et al., 2003; Miller & Maner, 2010b). In fact, single men even show an increase in testosterone production after smelling shirts that women approaching ovulation had worn (Miller & Maner, 2010b). Male participants also prefer the appearance of women who are fertile over women who are less fertile. In this paradigm, researchers typically ask male raters to rate the attractiveness of photographs taken of women’s faces both when they are in a particularly fertile phase of their cycle and when they are in a less fertile stage. Multiple studies have shown that men rate the photographs taken during a particularly fertile phase of the target’s cycle as more attractive and appealing than the photographs taken in a less fertile phase (Puts, et al., 2013; Roberts, et al., 2004). In addition, several studies have provided evidence that that men in relationships tend to engage in more mate-guarding behaviors when their partners are in the fertile stage of their cycle (e.g., Gangestad, Thornhill, & Garver, 2002; Haselton & Gangestad, 2006; but see Pillsworth, Haselton, & Buss, 2004).

Of particular relevance to the current report, men also show preferences for the voices of women who are currently fertile relative to those who are not. For example, Pipitone and Gallup (2008) asked female participants to provide vocal recordings at four time points in order to obtain voice samples from each woman at various stages of fertility. Then, a second group of participants, both male and female, rated the samples on attractiveness. The results showed that the vocal samples were rated as increasingly attractive as their fertility levels increased. However, as in most ovulatory research, these effects were limited to vocal samples gathered from women who were naturally cycling and not on hormonal birth control. Other researchers have examined potential explanations for these vocal attractiveness effects. For example, Bryant and Haselton (2009) found that women’s vocal pitch is significantly higher on fertile days than on non-fertile days. Other work by Caruso et al. (2000) suggests that this effect is probably due to an increase in estrogen levels found in women’s vocal cords immediately preceding and during ovulation. Overall, examining vocal cues to ovulation is a rapidly growing method of evaluating males' preferences for women across the ovulatory cycle.

To date, however, research on vocal attractiveness has used samples that are typically quite homogenous. The majority of studies examining the influence of fertility on vocal attractiveness, including those cited previously, typically use college-aged, Euro-American students originating from the United States. To my knowledge, only one study has examined vocal attractiveness outside of a European or Euro-American context: As in previous Western samples, Apicella and Feinberg (2009) found that men in the Hadza, a group of hunter-gatherers in Africa, prefer women's voices that are relatively high pitched. However, this study only examined the relationship between pitch and attraction in this sample; it did not include a direct examination of the influence of women's fertility stage on vocal attractiveness. As a whole, this body of evidence has yet to take into account the influence of additional vocal factors such as accent or speech patterns that could influence participants' judgments of attraction. Therefore, of most relevance to the current studies, vocal preferences across the ovulatory cycle may not be generalizable between members of different cultural and ethnic groups.

A Phylogenetic Approach to Human Evolution

The Phylogeny of Human Mating

Recently, psychologists have been calling for a phylogenetic approach to evaluating evolutionary hypotheses (Eastwick, 2009; Fraley, Brumbaugh, & Marks, 2005; Gosling & Graybeal, 2007). Specifically, proponents of a phylogenetic perspective maintain that when examining the influence of an evolutionary adaptation, researchers should consider its time course in relation to other adaptations. That is, the order in which events occurred in our evolutionary history could potentially provide important insights into our current behaviors, and those adaptations that have evolved relatively recently may refocus the effects of older evolved features.

Those features that are relevant to mating are particularly important for the current study. According to Eastwick (2009), several sexual adaptations have "carried over" from our primate relatives and have been present for at least the past 6 million years of our evolutionary history. Two of these are sex hormones and behavioral shifts across the ovulatory cycle. For example, human female ovulatory cycles function similarly to those of both modern and ancestral primates. All primates experience ovulation in response to a periodic, internally stimulated rise in luteinizing hormone rather than in response to sexual activity (e.g., rabbits); humans also show patterns of cyclical change in other sex hormones such as estrogens and progesterone that are very similar to those experienced by other primates (Martin, 2007). Finally, human females have a menstrual cycle length that is 29.1 days on average (Chiazze, et al., 1968; Treolar, Boynton, Behn, & Brown, 1967), which is quite similar to the overall average cycle length (30 days) of all other primates, both modern and ancestral (Martin, 2007).

In addition, behavioral changes in response to ovulatory cues are present in both humans and other primates. Previous research has shown that rhesus monkeys tend to engage in sexual intercourse across the menstrual cycle but show a spike in sexual activity during the days leading up to and during ovulation (Goy, 1979; Wallen, 2001);

similar behaviors have been observed in humans (Wilcox, et al., 2004). Other research has shown that female chimpanzees become less promiscuous and generally more selective of their sexual partners around ovulation; however, this does not mean that they stop engaging in sex with males, but instead they are more likely to engage with sexual partners they find particularly appealing (Gangestad & Garver-Apgar, 2013; Stumpf & Boesch, 2005). This effect is similar in human females, which suggests that during highly fertile times of their cycles, women show greater interest in men who are symmetrical and/or dominant (Gangestad & Garver-Apgar, 2013). In males, both humans and chimpanzees exhibit a spike in testosterone levels when interacting with highly fertile females of their species (Miller & Maner, 2010b; Muller & Wrangham, 2004). Overall, human reactions to fertility cues correspond with those of other primates. This degree of consistency suggests that these processes originated in a common ancestor that we share with our primate relatives.

However, according to the phylogenetic perspective, other mating-relevant adaptations that evolved relatively recently may adjust the focus of these older systems. Because adult attachment bonds are thought to be a relatively recent adaptation in our evolutionary history (e.g., approximately 1.5 – 2 million years ago; Dixson, 2009; Fraley, et al., 2005), they should moderate the relatively older effects of ovulatory shifts. Two studies by Eastwick and Finkel support this hypothesis (2012). Specifically, they found that women who were highly bonded to their sexual partners were more likely to engage in sexual activity for intimate, emotional reasons when fertile than when they were in a less fertile stage of their cycle. Women who were not currently bonded to a partner, however, showed the opposite pattern of results. The authors concluded that attachment bonds between romantic partners shaped the women's drive to engage in sex at highly fertile times, such that strongly bonded women were even more motivated to engage in intimate sex with their long-term partners than women who reported less bondedness to their partners. Overall, this new line of research suggests that psychologists should consider the relative timeline of adaptations in order to gain a fuller understanding of the convergence of our various biological and motivational drives.

It may not be the case that only new adaptations in the domain of mating and sexuality can interact with these older systems. That is, newly evolved traits in other domains could also influence the effects of more primitive traits. In the current report, I suggest that perceptions of symbolic group membership can refocus ovulatory effects.

The Origins of Ingroups and Outgroups

The prediction that humans would be disinclined to mate with outgroup members runs counter to some current views on mating preferences. Several areas of research demonstrate that mating with genetically diverse partners is a viable strategy used by humans and other species to produce offspring that are more resistant to disease and recessive disorders compared to offspring that are produced through inbreeding with close relatives (Garver-Apgar, et al., 2006; Penn & Potts, 1999; Wedekind, et al., 1995); therefore, mating with outgroup members would be a potentially beneficial mating option. Because early humans' ingroups largely consisted of family members and other close kin, perhaps a mechanism of sexual attraction toward outgroup members would have facilitated early humans' avoidance of mating with close relatives (Lieberman, Tooby, & Cosmides, 2002). In fact, outgroup attraction might be particularly pronounced for men, who bear much less of the childbearing burden than women (Trivers, 1972). In other words, according to a genetic diversity perspective, men should find outgroup women particularly attractive at times of high fertility to reap the genetic benefits of mating with a nonfamily member. However, a great deal of evidence from the social psychological literature suggests that the human adaptation of ingroup preferences is both recent and quite strong, and thus preferences for ingroup members could largely mute or refocus some older drives and cues, particularly in the mating realm.

Evolved Preferences for Ingroup Members. The tendency for people to prefer members of their own ingroups and disfavor members of outgroups are two of the most pervasive and well-researched phenomena in social psychology. Preferences for ingroup members occur in many contexts, including competition and cooperation (Sherif, Harvey, White, Hood, & Sherif, 1961), resource allocation (Turner, Brown, & Tajfel, 1979), social networks (McPherson, Smith-Lovin, & Cook, 2001) and romantic interests (Brown, McNatt, & Cooper, 2003; Eastwick, Richeson, Son, & Finkel, 2009). Ingroup preference is often studied in the context of gender (Rudman & Goodman, 2004) and race/ethnicity (Whitt & Wilson, 2007), but researchers also find this effect when using subtle manipulations such as the minimal group paradigm (Tajfel, 1970). Overall, the human tendency to prefer ingroup members is observed across a variety of domains.

Work by Brewer (2007) suggests that that our highly developed preference for ingroup members is a relatively recent development in our evolutionary history.

Although many primates are dependent on their social groups, humans rely on their group members for survival to a greater extent than any of our other primate relatives do (Brewer & Caporael, 2006). Brewer refers to this concept as "obligatory interdependence" (Caporael & Brewer, 1995). According to this perspective, early human groups were not merely loose communities of individuals; instead, social groups enabled early humans to cope with harsh environments and were quite necessary to ensure their continued survival. In addition, evidence for ingroup preference has been found in all known human cultural contexts, which suggests that this adaptation is fairly universal (Brewer, 1979; Kurzban, Tooby, & Cosmides, 2001)

This perspective does not suggest that ingroup preferences are unique to humans. Indeed, there is a great deal of evidence that group distinction is also present in other primates, such as New World monkeys. For example, capuchin monkeys can reliably distinguish between photographs of their own family members and outgroup members (Pokorny & de Waal, 2009). However, the mechanisms that primates use to determine group membership are qualitatively distinct from those used by humans. In fact, there is no reason to suspect that primates can use any qualities other than personal familiarity to determine whether an individual is a member of their ingroup or an outgroup. A large body of evidence suggests that Homo sapiens is the only primate that displays prosocial behavior toward anonymous group members (Burkart, Hrdy, & van Schaik, 2009). That is, humans are the only primates who use symbolic cues to identify a stranger as an ingroup member. In humans, a great deal of empirical work has shown that the mere categorization of people into groups elicits favoritism toward ingroup members and derogation of outgroup members (Brewer, 1979; Kurzban, Tooby, & Cosmides, 2001). These effects are robust even when group designation is randomly determined or based on arbitrary, meaningless metrics, such as an assigned team name (e.g., Sherif, et al., 1961) or performance on a stimulus estimation task (e.g., Tajfel, 1970). Humans do not need to have previously encountered an individual in order to identify them as an outgroup member, as evidenced by the rich social psychological literature on initial stereotyping effects. Humans are the only primates that can engage in abstract thinking to this degree, and there is little evidence that even early hominids had the capacity to comprehend symbolism or analogies (Eastwick, 2009). Therefore, the ability to identify an unfamiliar target as an outgroup member based on a *symbolic* cue such as ethnicity or minimal group designations is likely a uniquely human trait and thus appeared quite recently in our lineage. Given the phylogenetic approach, the relatively new adaptation of symbolic ingroup membership could moderate the effects of the considerably older effect of ovulation on mate preferences.

Potential Limits to Outgroup Mating Motives. Current evidence suggests that in general, outgroup members elicit much stronger feelings of disgust than ingroup members, particularly in the context of potential disease transmission (Navarrete & Fessler, 2006). Although it might be beneficial in many ways for humans to mate with outgroup members, our species' adaptation to group living and subsequent preferences for ingroup members can provide a context for the motivation to avoid outgroup members, even at the cost of genetic benefit for one's offspring. Mating with an unknown, untrusted outgroup member poses the risk of introducing disease and other pathogens into one's familial group (Schaller & Park, 2011; Schaller & Murray, 2008). Therefore, one possibility is that ovulation detection is refocused under certain circumstances to coincide with obligations to the well-being of the group. That is, instead of enhancing attraction, fertility adaptations could be unrelated or even negatively associated with sexual desire when considering outgroup members as potential sexual partners. Instead of finding outgroup members appealing during times of high fertility, an underlying desire to maintain group harmony could result in an enhanced sense of fear and avoidance of outgroup members.

Some researchers have examined these ideas in women. For example, Navarrete, Fessler, Fleischman, and Geyer (2009) found evidence that White women demonstrated more bias against Black men when in the fertile stage of their menstrual cycle than when they were in a less fertile phase. McDonald, Asher, Kerr, & Navarrete (2011) found a similar result, showing that women displayed intergroup bias when presented with members of a racial group they perceived as being high in physicality or strength. They also demonstrated that this effect is not merely due to racial prejudice; fertile women showed a similar ingroup bias against highly physical targets in response to cues other than racial identification, such as minimal group designations. The suggested mechanism for this phenomenon is that of coercion-avoidance, which suggests that women are especially motivated to avoid people and situations that they perceive as dangerous when their fertility levels are high in order to avoid the possibility of sexual coercion (Broder & Hohmann, 2003; Chavanne & Gallup, 1998).

The research in this vein has thus far been limited to exploring ingroup preferences in women across the ovulatory cycle. However, I believe that this effect should not be unique to women. If preferring ingroup members is an adaptive tendency that occurs across a variety of domains, its influence should not be gender-specific in the sexual/romantic domain. Moreover, researchers examining ingroup bias do not typically report sex differences in the tendency to prefer ingroups (but see Rudman & Goodman, 2004). If anything, previous work suggests that men actually participate in intergroup conflict and competition more than women do (Pemberton, Insko, & Schlopler, 1996; Van Vugt, De Cremer, & Janssen, 2007). Obviously, men do not experience a fertile period as women do and also would not experience the same level of reproductive costs if they were sexually coerced. However, early humans who engaged in sexual behaviors with outgroup members could have faced other types of risks that are not sex-specific, such as disease transmission and violent conflict (Klavina, Buunk, & Pollet, 2011; Navarrete & Fessler, 2006). Therefore, the relatively recent development of symbolic group membership could alter the function of sexual adaptations that might lead men to engage in potentially costly mating encounters.

Because ingroup bias is a broad, relatively recent adaptation, I predict that men should demonstrate a preference for ingroup members that would parallel those previously found in women. The current report intends to explore how ingroup preferences moderate male preferences for fertile female targets. Specifically, men's preferences for women who are highly fertile should vary based on the women's group status: fertility should predict men’s attraction to female ingroup members but not female outgroup members.

The Current Research

Three studies examined the extent to which ingroup bias moderates men’s attraction to highly fertile women. All three studies used vocal samples, obtained from each female target at multiple points within her menstrual cycle, as the stimuli. In Study 1, male participants rated their attraction to same-ethnicity and other-ethnicity target voices at various states of fertility. Because race and ethnicity are extremely salient cues for ingroup status, the results of this study should approximate ingroup preferences in real life settings.

Study 2 sought to replicate the same-ethnicity preference results of Study 1 but also incorporated an experimental manipulation of target ingroup status. Specifically, male college students were told that some target voice samples were provided by an ingroup member (e.g., a woman who attends the male participants’ home university), and others were collected from an outgroup member (e.g., a woman who attends the male participants’ rival university). This manipulation has been used successfully to manipulate ingroup perceptions in previous studies (e.g., Rothgerber, 1997).

Study 3 expanded on these results in multiple ways. First, instead of using college students, this study employed an older, more diverse pool of participants to determine whether the previous effects are generalizable to a more representative population. In addition, Study 3 used a minimal-group paradigm to manipulate group status (e.g., Tajfel, 1970) in order to determine whether additional types of ingroup cues produce similar effects as found in Studies 1 and 2. Finally, this study included several new outcome variables, including measures of fear and disgust.

I made similar predictions for all three of these studies: Target ingroup status should moderate the effect of women's fertility on men's mate preferences. Specifically, I predicted that men will prefer women who are highly fertile more than those who are less fertile, but this effect will only occur when men are evaluating women they perceive to be members of their ingroup (i.e., , members of the same ethnic group, university, or minimal group). I expect that men will not prefer fertile outgroup members over less fertile outgroup members, and if men's adaptations to ovulation parallel women's (e.g., Navarette, et al., 2009), the simple effect of fertility on attraction to outgroup members may even be negative. Together, these effects can demonstrate that multiple types of ingroup cues can moderate traditional fertility effects, indicating that ingroup status can refocus males' preference for fertile sexual partners.

Finally, in order to gain a fuller understanding of the mechanism that is underlying these preferences, Study 3 also examined whether targets' ingroup status and fertility levels influence participants' evaluations of the targets in other domains such as disgust. Researchers have hypothesized that disgust toward outgroup members is an adaptation that once served to protect humans from danger, disease, and pathogens (Kurzban & Leary, 2001; Schaller & Neuberg, 2012). Similarly, humans are less likely to find members of their ingroups, such as family members, disgusting (Navarrete & Fessler, 2006; Peng, Chang, & Zhou, 2013). The effects of this adaptation persist today, and people often rate various outgroup members as more disgusting or dangerous relative to ingroup members (Cottrell & Neuberg, 2005; Rozin, Haidt, & McCauley, 2008). Therefore, disgust may play a role in overriding men's ovulatory detection mechanisms and preferences, causing them to avoid outgroup members even if the targets being evaluated are highly fertile women. Thus, I predicted that disgust should explain why men's typical preference for high fertility disappears when the target women are perceived to be outgroup members. That is, disgust will mediate the interaction of fertility and group status on men's attractiveness ratings of female targets: To the extent that targets are fertile, men will be especially likely to rate ingroup women as relatively less disgusting than outgroup targets, and this disgust rating should then predict the men's attraction ratings.

STUDY 1

One of the most salient and well-researched types of ingroup bias is the preference for one’s own racial or ethnic group. In addition, evidence suggests that humans often use vocal accents and speech patterns as cues for identifying the race/ethnicity of a speaker (Bourhis, Giles, & Lambert, 1975; Lippi-Green, 1997; Munro, 2003). Therefore, I chose to use vocal samples as the stimuli in this study.

Previous work examining vocal attractiveness effects has only examined these effects in populations that speak similar dialects of the same language. In nearly all studies (save the previously cited Apicella & Feinberg, 2009), both participants and target recordings report American English as their primary language, and all participants within each study are sampled from a similar region in the United States. Although these imposed sampling restrictions can tell us much about ovulatory preferences within a set population, a great deal of information is lost by not exploring whether fertility preferences persist when participants evaluate targets who exhibit variations in language characteristics such as vocal accents. Study 1 seeks to address this shortcoming by asking English-speaking male participants to rate the attractiveness of bilingual (English/Spanish) female target voices across the targets’ menstrual cycle.

Method

Participants

Voice targets. The voice samples used in this study were taken from those provided by a larger sample of 77 naturally cycling female undergraduate students. All of these women reported on the psychology department subject pool prescreening questionnaire that they were not “currently using any form of hormonal contraception.” Fourteen of the 77 women’s voice data were determined ineligible for use in this study for one of the following reasons: attending fewer than 3 of the 4 scheduled sessions (*n* = 7), having very irregular menstrual cycles (e.g., their cycle was “irregular” or “very infrequent”; *n* = 2), smoking cigarettes or cigars more than “a few times a month” (*n* = 3), having self-reported speech or hearing deficiencies (*n* = 2).

Of the 63 remaining participants who provided voice samples, 10 self-identified as Hispanic and reported Spanish as their primary language; I randomly selected 9 for use in this study. Similarly, I randomly selected the vocal samples of 9 of the 54 remaining women for use in this study (all of whom self-identified as Caucasian and reported English as their primary language). The average age of these 18 women was 18.55 years (*SD* = .80), and their average menstrual cycle length was 28.8 days (*SD* = 3.10).

Voice raters. Ninety-two Caucasian male participants, recruited through the psychology department subject pool for course credit, served as raters for the female vocal samples. The average age of these men was 18.94 years (*SD* = 1.00), and their reported primary language was American English.

Procedure

Female voice recordings. Participants were scheduled to attend 4 study sessions, each spaced 1 week apart. This schedule ensured that each participant would provide a vocal sample at a high-fertility, low-fertility, and two moderate-fertility points in her cycle (Pipitone & Gallup, 2008). At the initial experimental session, participants completed demographics measures assessing their age, ethnicity, and primary language.

Each of the four sessions included a questionnaire assessing participants' menstrual cycle, including whether they "currently use any form of hormonal contraception" (to verify they had not begun taking hormonal contraception since completing the prescreening items), and the date they expected to begin their next menstrual period. By obtaining this information at each study session, I was able to ensure that the fertility calculations were based on the most accurate and recent information possible.

I used these reported dates to calculate each target's conception probability using the "backward count" method. Higher values on this measure indicate an increased probability of fertility, or specifically, the participant's odds of conception given a single act of intercourse that day. I used this information to calculate conception probability as a continuous measure (range = .000-.086) using values provided by Wilcox, et al., (2001). This method has been used in multiple studies (e.g., Eastwick & Finkel, 2012; Gangestad, Garver-Apgar, Simpson, & Cousins, 2007; Haselton & Gangestad, 2006; Lieberman, Pillsworth, & Haselton, 2011; Pipitone & Gallup, 2008), and new work has found this method to be as accurate as estimates obtained from luteinizing hormone (LH) ovulation tests (Brown, Calibuso, & Roedl, 2011; Wegienka & Baird, 2005; Wood, 2012).

After completing the questionnaires, participants then provided vocal samples. Each participant read the first paragraph (consisting of 6 sentences) of the "Rainbow

Passage" in English (Fairbanks, 1960). This passage is commonly used in both clinical and research settings to evaluate fluency and speech ability because it includes a variety of phonemes used in conversational English (Baken & Orlikoff, 2000). Voice recordings were gathered using the recording feature of MediaLab software at the end of each of the four study sessions via Logitech headsets.

Male raters. All ratings by the men were provided in a single study session. Upon entering the lab, raters completed a demographics questionnaire along with the Internal and External Motivation to Respond without Prejudice scales (IMS and EMS; Plant & Devine, 1998), political conservatism, and romantic experience measures described below. Participants then were randomly assigned to 1 of the 4 stimulus groups (see below) and listened to and rated each of the 16-17 recordings (presented randomly).

Materials

Voice recordings. Six of the 18 female participants only attended 3 of their 4 scheduled sessions, giving us a total of 66 (instead of 72) vocal samples to use as stimuli. In order to prevent rater fatigue—rating 66 recordings would have taken each male participant approximately 2 hours—I divided the samples into 4 stimulus groups. This ensured that participants could complete the ratings within a 30-minute session. Each group contained either 16 or 17 recordings, each provided by a different participant (i.e., only 1 of each female participant's 4 recordings was included in each group), and each group consisted of roughly equivalent numbers of Caucasian (i.e., ingroup) and Hispanic (e.g., outgroup) vocal samples. Also, recordings within each stimulus group were selected to exhibit the same full range of fertility scores. All of the Hispanic participants exhibited foreign-accented speech (e.g., Munro, 1998; Sales, 2012) on their recordings; 45% of the Caucasian recordings exhibited no specific regional accent and the remaining 55% exhibited Texan/Southern accents, which are common among Caucasian students at the university.

IMS and EMS. The Internal and External Motivation to Respond without Prejudice scales (IMS and EMS; Plant & Devine, 1998) measured motivations of prejudice toward Blacks; I adapted this scale to assess prejudice toward Hispanics instead. This measure consisted of a 5-item subscale assessing participants' internal motivation (e.g., "Because of my personal values, I believe that using stereotypes about Hispanic people is wrong"; $\alpha = .88$ $M = 4.68$, $SD = 1.06$). and a 5-item subscale measuring participants' external motivation (e.g., "I attempt to appear nonprejudiced toward Hispanic people in order to avoid disapproval from others"; $\alpha = .88$, $M = 3.66$, $SD = 1.02$). These items were assessed using a 7-point agreement (1= *strongly disagree,* 7= *strongly disagree)* scale.

Political Conservatism. Participants completed Hennington's (1996) 12-item version of the Wilson and Patterson (1968) C-scale. Sample questions included "Do you support 'multiculturalism'?" and "Are you in favor of the death penalty?" ($\alpha = .31$ $M = 0.18$ $SD = .39$). Participants responded to each question by selecting "yes" (coded = 1), "no" (coded = -1), or "I don't know" (coded = 0).

Romantic experience. Participants also reported the number of both Hispanic ($M = 0.98$, $SD = 1.35$) and Caucasian ($M = 4.15$, $SD = 3.02$) individuals for whom they had previously experienced romantic interest and the number of both Hispanic ($M =$

0.43, *SD* =.90) and Caucasian (*M* = 3.02, *SD* =4.34) romantic partners they had in the past.

Vocal attraction. Immediately after hearing each recording, raters completed the following items using a 7-point scale: “How attractive did you find the voice you just heard?” and “How sexy did you find the voice you just heard?” (α = .94, *M* = 4.57, *SD* =1.93). The average of these two items formed the dependent variable vocal attraction.

Results and Discussion

I used a linear mixed effects model to predict the male participants’ ratings of vocal attraction from target conception probability, target ethnicity (same-ethnicity vs. other-ethnicity) and their interaction. Each participant provided 16-17 ratings, which violates the ordinary least squares assumption that observations are independent of each other; thus I permitted the intercept to vary randomly across the raters (Raudenbush & Bryk, 2002). In addition, I controlled for a categorical variable indicating to which of the four groups of vocal stimuli the participant had been assigned in all analyses.

Again, I hypothesized that participants would rate only the ingroup targets as particularly attractive as target fertility increased. Indeed, in accord with my hypothesis, the Target Conception Probability × Target Ethnicity interaction significantly predicted vocal attraction ratings, $\beta = -.12$, $t(1424.33) = -5.68$, $p < .001$[1]; see Figure 1. Male participants rated the same- ethnicity target voices as significantly more attractive as the targets’ fertility increased, $\beta = .17$, $t(1424.33) = 5.71$, $p < .001$. Intriguingly, participants rated the other-ethnicity targets as significantly less attractive as targets’ conception probability increased, $\beta = -.08$, $t(1424.33) = -2.41$, $p = .016$. I also examined the simple effects of target ethnicity: The raters found same-ethnicity targets more attractive than the other- ethnicity targets when the target's conception probability was low (.00), β = -.31, t(1424.33) = -10.49, $p < .001$; medium (.04), β = -.49, t(1424.33) = -20.24, $p < .001$; and high (.08), β = -.67, t(1424.33) = -14.02, $p < .001$.

I also conducted 6 additional analyses to see if the hypothesized 2-way Target Conception Probability × Target Ethnicity interaction was moderated by the other variables assessed about the men at intake (i.e., IMS, EMS, Political Conservatism, number of Caucasian romantic interests, number of Caucasian partners, number of Hispanic romantic interests, number of Hispanic partners). None of these six 3-way interactions were significant, and in each analysis, the hypothesized two-way interaction remained significant. All analyses are provided in Table 1.

Overall, results supported the hypothesis that target group status, determined by ethnicity (e.g., presence of foreign accented speech), interacted with target fertility to predict attraction. Specifically, male participants found the vocal samples of members of their own ethnic group (e.g., Caucasian targets without foreign accented speech) more attractive as the targets' fertility increased, which replicates previous findings (Pipitone & Gallup, 2008). However, these same participants rated the vocal samples of targets who did not share their ethnic group (e.g., Hispanic targets with foreign accented speech) as significantly less attractive as target fertility increased. These findings support the hypothesis that perception of ingroup status should moderate the classic fertility findings. However, these results do not explore whether other types of ingroup status could influence attractiveness ratings. Therefore, Study 2 was conducted to explore whether additional types of ingroup manipulations would interact with female targets' fertility levels to produce a similar effect.

STUDY 2

Study 2 serves as a replication of Study 1 and seeks to provide further evidence that targets' primary language moderates the effect of fertility on attraction. In addition, this study includes an additional ingroup manipulation to explore whether various types of ingroup cues produce similar effects. Because the current sample consisted of college students, I chose to manipulate participants' perceptions of the target women by identifying some targets as students from the participants' own university and others as students from a rival school.

I chose this manipulation for multiple reasons. First, I wanted to demonstrate that these moderators will occur when using common paradigms from the ingroup literature, and manipulating ingroup status in this fashion has produced ingroup bias effects in other studies (e.g., Rothgerber, 1997). Also, I wanted to ensure that the effects from Study 1 were not merely due to participants' potential inability to perceive fertility cues when listening to voices with unfamiliar accents. By using a manipulation that is independent of the targets' primary language, I can determine whether participants produce a similar pattern of ratings when exposed to other, more subtle types of ingroup cues.

Method

Participants

Voice targets. The same 66 vocal samples that were used as stimuli in Study 1 were used in this study as well. However, all 66 voice recordings were rerandomized into 4 new stimulus groups, each containing similar numbers of same-ethnicity vs. other-ethnicity samples and the full range of fertility scores.

Voice raters. Participants were 47 Caucasian males whose primary language was American English. They ranged from 18 to 22 years of age (*M* = 19.13, *SD* = 0.88). All raters were recruited through the Texas A&M subject pool.

Procedure and Materials

The ratings procedure was very similar to that of Study 1; participants first completed the IMS (α = .82 *M* = 4.86 *SD* = 1.24) and EMS (α = .84 *M* = 3.56 *SD* = 1.44) scales and the Political Conservatism Questionnaire (α = .54 *M* = -0.11 *SD* =.41). They also completed the other group experience items, reporting their number of Caucasian (*M* =3.93 *SD* =2.99) and Hispanic (*M* = 0.95 *SD* =1.61) previous romantic interests and number of Caucasian (*M* =2.91 *SD* =2.68) and Hispanic (*M* = 0.69 *SD* = 1.61) previous romantic partners. Participants then rated either 16 or 17 vocal samples on a one-item measure of vocal attraction (i.e., “How attractive did you find the voice you just heard?”; *M*= 4.95 *SD* =1.94).

I also added a new ingroup/outgroup manipulation as part of the ratings task. Participants were told that half of the voice samples they would hear were gathered from students currently attending their own university, and the other half were gathered from students attending a rival school (the University of Texas). As participants listened to each vocal sample, one of the two school logos was displayed on the computer screen, indicating whether the target was from the participant’s ingroup (same-school) or their outgroup (other-school). In reality, the voice samples had been randomly assigned to same-school or other-school status. Equivalent numbers of both same-ethnicity and other-ethnicity samples were designated as same-school and other-school within each of the 4 stimulus groups. Thus, these two ingroup/outgroup manipulations (i.e., ethnicity and school) were conceptually and practically orthogonal.

Results and Discussion

As in Study 1, I used linear mixed effects models to predict male participants' ratings of target vocal attractiveness from target conception probability, target group status (i.e., ethnicity or school), and their interaction. I again permitted the intercept to vary randomly (Raudenbush & Bryk, 2002), and I controlled for the categorical variable indicating to which of the four groups of vocal stimuli the participant had been assigned.

First, the 3-way interaction of Target Conception Probability × Target Ethnicity × Target School did not significantly predict vocal attraction, $\beta = .05$, $t(729.13)= 1.43$, $p = .153$. Thus, I then examined the two ingroup vs. outgroup effects separately.

Replicating Study 1, the Target Conception Probability × Target Ethnicity interaction significantly predicted vocal attraction ratings, $\beta = -.11$, $t(729.10) = -3.52$, $p < .001$[2]; see Figure 2). Again, as same-ethnicity targets' conception probability increased, male participants rated their voices as significantly more attractive, $\beta = .13$, $t(729.2) = 3.01$, $p =.003$. In addition, raters judged the other-ethnicity targets as significantly less attractive as their conception probability increased, $\beta = -.09$, $t(729.02) = -2.01$, $p = .045$. I also replicated the simple effects from Study 1 such that raters found same-ethnicity targets more attractive than the other-ethnicity targets when the target's conception probability was low (.00), $\beta = -.27$, $t(729.05) = -6.15$, $p < .001$; medium

(.04), β = -.43, t(729.04) = -12.14, p < .001; and high (.08) β = -.59, t(729.09) = -8.48, p < .001.

The interaction of Target Conception Probability × Target School significantly predicted vocal attraction ratings, β = -.08, t(729.13) = -2.28, p = .023[2]; see Figure 3. Male participants rated the same-school target voices as significantly more attractive as the targets' conception probability increased β = .10, t(729.04) = 2.05, p = .040. However, participants did not rate the other-school targets as significantly more or less attractive as targets' conception probability increased, β = -.06, t(729.23) = -1.21, p = .226. Raters found the same-school targets significantly more attractive than the other-school targets when targets' conception probability levels were medium (.04), β = -.08, t(729.04) = -2.01, p = .036; and high (.08), β = -.20, t(729.12) = -2.57, p = .01. However, participants did not evidence a significant effect of school when conception probability was low (.00), β = .04, t(729.08) = .78, p = .437.

As in Study 1, I also conducted 12 additional 3-way interactions examining the moderating role of the other variables assessed at intake (i.e., IMS, EMS, Political Conservatism, number of Caucasian romantic interests, number of Caucasian partners, number of Hispanic romantic interests, number of Hispanic partners). The 6 analyses that included Target Ethnicity as a predictor are detailed in Table 2; the other 6 analyses that included Target School as a predictor are detailed in Table 3. In all 12 moderational analyses, the hypothesized two-way interaction remained significant.

However, out of all 12 analyses, only one of the 3-way interactions, Caucasian Romantic Interests × Target Ethnicity × Target Conception Probability, was significant,

β = -.07, t(735.44) = 2.12, p = .035. I further examined this result by testing how the underlying 2-way interaction of Target Ethnicity × Target Conception Probability varied based on the number of participants' reported number of Caucasian romantic interests. Specifically, I standardized the variable of Caucasian Romantic Interests and examined the 2-way interaction of Target Ethnicity × Target Conception Probability at both one standard deviation above and below participants' mean reported number of Caucasian romantic interests. The interaction of Target Ethnicity × Target Conception Probability was significant at 1 SD above the mean number of Caucasian romantic interests, β = -.18, t(732.25) = -3.99, p = .000. However, this interaction was not significant at 1 SD below the mean, β = -.04, t(730.34) = -1.14, p = .254. The finding that only those Caucasian participants who reported relatively few Caucasian romantic interests would show varying preferences as a function of target fertility and ethnicity does not make theoretical sense and seems to be a spurious interaction. Therefore, although the 3-way interaction was significant, this underlying effect does not appear to be meaningful.

Both of these findings provided support for my hypothesis. First, the results of Study 1 were directly replicated, in that a new sample of male participants also rated female targets as more attractive as the targets' fertility levels increased. However, this was again only true when the targets belonged to the participants' same ethnic group. In addition, these results showed that other types of ingroup manipulations can moderate the influence of fertility on attraction. Specifically, male participants rated female targets as more attractive as target fertility increased but only for targets who were identified as members of the participant's own school (Texas A&M). These two findings support the idea that even subtle cues of ingroup status can influence the effect of women’s fertility on males’ attraction ratings.

STUDY 3

Study 3 builds on the results of Studies 1 and 2 by testing the current hypothesis in an older population and examining additional types of evaluations. First, I attempted to replicate the finding that fertility level and group status interact to predict attractiveness ratings. In addition, I also examined whether the variables of disgust and fear ratings function similarly to attractiveness ratings; I intended to explore whether disgust mediates the effect of fertility and group status on attractiveness ratings.

Research on prejudice and discrimination has long focused on the negative emotions people hold toward outgroup members. Indeed, the idea that prejudice is associated with negative affect and evaluations can be traced all the way back to Allport (1954). Many researchers have taken a sociofunctional approach to exploring this topic, which holds that humans have evolved to be heavily group-dependent (e.g., Brewer, 1999) and are particularly cognizant of the potential disadvantages inherent to this way of life. For example, harmful outcomes such as spread of disease, physical violence, or social loafing are unfortunate side effects of living among other humans (Alexander, 1974; Cottrell & Neuberg, 2005). Therefore, humans are particularly cautious of threats that outgroup members can pose to their individual well-being and thus have a tendency to attempt to accurately identify potential threats from outgroup members (Cottrell & Neuberg, 2005; Neuberg, Smith, & Asher, 2000).

Disgust is an emotional response that is associated with many types of threats to the self and is often associated with stimuli that represent a direct threat to the body (e.g., toxins or poisons). However, natural selection has expanded disgust over time to incorporate interpersonal and moral concepts including derogation of outgroup members. That is, although disgust was once solely linked to the experience of bad-tasting food, it has since been co-opted by a variety of other systems to not only protect the body from additional threats (e.g., pathogens and disease from outgroup members) but also maintain the social hierarchy (Hodson & Costello, 2007; Rozin, et al., 2008). Humans show a pronounced disgust response toward individuals they perceive as outgroup members, especially when compared to family members or friends (Navarrete & Fessler, 2006; Peng, Chang, & Zhou, 2013). A large body of work has shown that (particularly Caucasian) participants tend to report and demonstrate higher fear and disgust toward outgroup members (e.g., Cottrell & Neuberg, 2005; Mackie, Devos, & Smith, 2000; Smith, 1993). This effect is especially pronounced when participants are evaluating members of outgroups they perceive as being lower in status relative to themselves (Fiske, Cuddy, Glick, & Xu, 2002; Rozin, et al., 2008). In one revealing study, exposure to photographs of outgroup members, particularly those who are judged as low in both warmth and competence (e.g., homeless people and drug addicts), activated the left insula and right amygdala of Caucasian participants; activation of these areas is associated with disgust responses (Harris & Fiske, 2006; Schafer, Schienle, & Vaitl, 2005).

However, although a great deal of social psychological research has examined bias toward racial minority members, only 7% of the research published in the major social psychological outlets has examined bias toward Hispanic targets (Dovidio, et al., 2010). Although this effect has been explored relatively infrequently (especially compared to bias against African-American targets), the prejudice and bias Whites hold toward Hispanic targets is consistently found to be similar to that held toward Black/African-American targets. For example, Implicit Association Tasks show that college students tend to associate Hispanics with negative stereotypes, such as “ignorant” and “inept” (Weyant, 2005). In addition, recent work by March (2012) demonstrated that Caucasian participants show a pronounced eyeblink startle response when primed with photographs of Hispanic targets compared to when they were primed with Caucasian target photos. In fact, some theorists posit that because Hispanics have recently become the largest minority in the United States, White Americans may soon hold more negative perceptions and hostility toward Hispanics than they report holding toward Blacks (Blalock, 1967; Hewstone, Rubin, & Willis, 2002; Markert, 2010). This effect is theorized to be enhanced because White Americans associate Hispanics with both illegal immigration and resistance to learn the English language upon immigrating (Markert, 2010). Additional research has shown that, over the past several decades, a cohort effect has emerged such that self-reported bias against Blacks has been on the decline in the U.S.; however, prejudice against other minorities, including Hispanics, has not declined (Wilson, 1996). More recently, research by Cottrell and Neuberg has shown that Hispanic and African-American targets elicit similar patterns of both self-reported fear and disgust from Caucasian participants, which are higher than these emotional reports toward all other ethnic groups (2005).

As previously discussed, recent research has shown that fertile Caucasian women tend to show an increase in fear responses toward African-American targets (Navarrete, et al., 2009; McDonald, et al., 2011). However, because emotional markers of ingroup preferences and outgroup derogation should not be gender specific (for reasons explored above), I predicted that a comparable effect will occur for men when evaluating Hispanic targets. The hypotheses for the current study follow logically from the results of Studies 1 and 2, such that male participants will only prefer highly fertile target women to nonfertile women when they perceive the women to be members of their ingroup. However, I also predicted that group status and fertility will interact to predict disgust ratings, which should then predict participants' higher attractiveness ratings of these targets. Although I do not suspect that male participants will report increased fear toward female outgroup targets relative to female ingroup targets, I also included fear as an exploratory variable to determine whether it functions similarly to disgust. I chose to include other measures of negative affect (i.e., anger and sadness) to test whether any potential effects due to fear or disgust are produced by negative affect in general. Finally, I also included additional exploratory measures to examine whether short-term and long-term attraction function differently from a general measure of attraction.

Method

Participants

Voice targets. The same 66 vocal samples that were used as stimuli in Studies 1 and 2 were used in this study. However, I rerandomized all 66 voice recordings to create four new stimulus groups. As in the previous two studies, each stimulus group contained similar numbers of high and low fertility stimuli equally sampled from the same-ethnicity vs. other-ethnicity groups.

Voice raters. Participants for this study were adult males recruited through Amazon's Mechanical Turk and paid $0.50 for their participation. A total of 19 participants were excluded based on one or more of the following responses: short or long-term hearing loss (n = 8), problems hearing the stimuli (n = 4), reported heterosexuality less than 2 on a 1-9 point scale (n = 7); therefore, the total number of participants in this study was 82. As predicted, because participants recruited from this website are typically more diverse and older than the average college sample, this sample is more representative of the ages and characteristics of the population in the United States than the samples in Studies 1 and 2 (Buhrmester, Kwang, & Gosling, 2011). The average age of the remaining participants was 29.38 years (*SD* = 8.52), and 56 identified as Caucasian, 9 as African-American, 11 as Hispanic, 4 as Asian, 1 as South Asian/Indian, and 1 as "other." Of these participants, 1 Hispanic participant reported Spanish as his primary language; all other participants reported American English as their primary language. Unless designated otherwise, all analyses were conducted using only the 56 Caucasian male participants to mimic the analyses conducted in studies 1 and 2.

Procedure and Materials

The procedure for this study was similar to that used in Studies 1 and 2. After completing demographics measures, participants completed a minimal-group manipulation (full instructions provided in Appendix). In this task, which was adapted from the task developed by McDonald, et al. (2011), participants first read that previous research has shown that some people tend to overestimate the number of objects they have seen whereas others tend to underestimate. Then, participants viewed three individual grids of blue and yellow squares one at a time for approximately two seconds. They were then asked to estimate the percentage of blue squares that appeared in each grid. Participants were randomly assigned to a designation of overestimator or underestimator, regardless of the accuracy of their estimates. This manipulation will hereafter be referred to as "Target Minimal Group."

Then, participants were randomly assigned to one of the four stimulus groups. In each stimulus group, vocal stimuli were randomly assigned to be presented as either an overestimator or underestimator. This minimal-group manipulation ensured that participants perceived half of the stimuli they heard to be ingroup members and half to be outgroup members given their supposed estimation performance. As in Study 2, both manipulations of ethnicity and minimal-group (i.e., estimation performance) status were conceptually and practically orthogonal, such that equivalent numbers of stimuli from both ethnic groups were assigned to each condition of the minimal group manipulation.

Finally, participants rated each vocal sample on each of six dependent measures. Specifically, participants rated each stimulus on a three item measure of general attractiveness (i.e., "How attractive did you find the voice you just heard?", "How appealing did you find the voice you just heard?", "How sexy did you find the voice you just heard?"; $\alpha = .95$ $M = 5.25$, $SD = 1.96$). I also included a new four item measure of negative affect evaluating how “afraid”, “disgusted”, “angry”, and “sad” each sample made participants feel (α = .91, *M* = 2.26, *SD* = 1.79). In addition, because evolutionary researchers are often interested in the distinction between long-term and short-term attractiveness, I included two items assessing short-term attractiveness (“How attractive did you find the speaker for a short-term, purely sexual relationship (such as a one-night stand)?”; *M* = 5.48, *SD* = 2.29) and long-term attractiveness (“How attractive did you find the speaker for a long-term relationship?”; *M* = 4.84, *SD* = 2.17) for exploratory purposes.

Results and Discussion

The data analysis strategy for Study 3 is similar to those used in Studies 1 and 2. Specifically, I used linear mixed effects models to predict general attractiveness, fear, and disgust ratings. I also conducted auxiliary analyses predicting short-term attraction, long-term attraction, and a holistic measure of negative affect as dependent variables. Finally, I examined how target samples’ vocal pitch is related to both attraction and fertility. In order to ensure that any results were not driven by differences in the four stimulus groups, all analyses controlled for the participants’ randomly assigned stimulus group. The sample used in the majority of analyses consisted of the 56 Caucasian male participants.

Vocal Attractiveness

First the 3-way interaction of Target Conception Probability × Target Ethnicity × Target Minimal Group did not significantly predict vocal attraction ($\beta = -.03$, $t(705.10) = -.82$, $p = .410$). Therefore, I examined the two ingroup manipulations separately.

In a replication of Studies 1 and 2, the Target Conception Probability × Target Ethnicity interaction significantly predicted vocal attraction ratings, $\beta = -.10$, $t(698.04) = -3.38$, $p = .001$[3]; see Figure 4. Specifically, male participants rated same-ethnicity target voices as significantly more attractive as the targets' fertility increased, $\beta = .09$, $t(698.60) = 2.14$, $p = .033$. However, male participants judged the other-ethnicity target voices to be significantly less attractive as targets' conception probability increased, $\beta = -.11$, $t(705.27) = -2.66$, $p = .008$. As in Studies 1 and 2, simple effect analyses demonstrated that participants rated same-ethnicity targets as significantly more attractive than other-ethnicity targets at times of low (.00), $\beta = -.11$, $t(701.29) = -2.81$, $p = .005$; medium (.04), $\beta = -.27$, $t(699.64) = -7.24$, $p = .000$; and high (.08) $\beta = -.42$, $t(700.39) = -5.76$, $p = .000$ conception probability. All basic and auxiliary analyses for this interaction can be found in Table 4.

Next, I examined the new manipulation of minimal group, which was intended to be a conceptual replication of the school manipulation in Study 2. Counter to my hypothesis, the interaction of Target Conception Probability × Target Minimal Group did not predict vocal attraction ratings, $\beta = -.01$, $t(709.67) = -0.17$, $p = .863$; see Figure 5. However, the main effect of group status was also not significant ($\beta = .03$, $t(699.25) = .81$, $p = .419$). All basic and auxiliary analyses for this interaction can be found in Table 5. This result may suggest that the manipulation was not a strong enough cue of symbolic group membership to elicit the predicted effect.

Disgust Ratings

I also predicted that disgust ratings should function similarly to attraction ratings. That is, Target Conception Probability × Target Ethnicity should interact to predict participants' disgust ratings. However, the data did not support this hypothesis, $\beta = .02$, $t(695.20) = .64$, $p = .522$; see Figure 6. In addition, my prediction that the interaction of Target Fertility X Target Minimal Group would predict disgust ratings was also not supported, $\beta = .04$, $t(699.67) = 1.6$, $p = .106$, see Figure 7. Disgust ratings were significantly associated with attraction ratings, $\beta = -.39$, $t(716.41) = -15.59$, $p = 000$, suggesting that participants did rate highly attractive voices lower in disgust than unattractive voices. Because neither of the interactions significantly predicted disgust, the step 2 requirement for mediation was not met and thus disgust ratings cannot mediate the interaction of fertility and group status on attraction ratings (Baron & Kenny, 1986).

Fear Ratings

Because fear and disgust are often identified as two of the strongest mechanisms for prejudice against outgroup members (e.g., Schaller & Neuberg, 2012), I also examined whether fear could be an alternate explanation for the previous significant effects. However, Target Fertility X Target Ethnicity did not significantly predict fear, $\beta = .02$, $t(692.31) = 1.17$, $p = .244$, see Figure 8. Similarly, the hypothesis that the interaction of Target Fertility X Target Minimal Group predicts fear ratings was also not supported, $\beta = .02$, $t(694.76) = 1.02$, $p = .307$, see Figure 9. Fear ratings were significantly associated with attraction ratings, $\beta = -.15$, $t(704.15) = -7.24$, $p = 000$, suggesting that participants did rate highly attractive voices as eliciting less fear than unattractive voices. As with the previous analyses including disgust as an outcome variable, neither 2-way interaction significantly predicted fear; therefore, the step 2 requirement for mediation was not met (Baron & Kenny, 1986).

Exploratory Analyses

I also conducted several additional analyses to examine whether other measures of attraction are similarly predicted by targets' fertility and group status.

Short-term attraction. I examined whether the interaction of Target Conception Probability × Target Ethnicity predicts short-term attraction. This analysis was significant (β = -.06, *t*(693.80) = -2.16, *p* = .031; see Figure 10), suggesting that short-term attraction functions similar to the general measure of attraction used in the main analyses. Further analysis revealed that Caucasian male participants rated same-ethnicity targets as marginally more attractive for short-term encounters as targets' conception probability increased, β = .08, *t*(693.80) = 1.93, *p* = .055. However, participants did not show a significantly different preference for other-ethnicity targets as a function of target fertility β = -.04, *t*(701.66) = -1.13, *p* = .260. Simple effects analyses also showed that participants rated same-ethnicity targets as more attractive than other-ethnicity targets at all target conception probability categories: low (.00), β = -.11, *t*(696.51) = -3.03, *p* = .003; medium (.04), β = -.20, *t*(695.30) = -5.95, *p* = .000; and high (.08) β = -.29, *t*(696.26) = -4.35, *p* = .000. I then examined whether Target Conception Probability × Target Minimal Group predicted short-term attraction. However, this analysis was not significant: β = -.01, *t*(701.23) = -.21, *p* = .832; see Figure 11.

Long-term attraction. I also examined long-term attraction as an outcome measure. Target Conception Probability × Target Ethnicity significantly predicted vocal long-term attraction *β* = -.09, *t*(698.30) = -2.89, *p* = .004, see Figure 12**.** Specifically, as conception probability increased for same-ethnicity targets, male participants rated their voices as significantly more attractive for long-term sexual encounters, *β* = .10, *t*(698.68) = 2.46, *p* =.014. However, raters did not rate the other-ethnicity target samples as significantly different as their conception probability increased, *β* = -.07, *t*(705.83) = -1.63, *p* = .104. Participants also rated same-ethnicity targets more attractive for long-term encounters than the other-ethnicity targets when targets' conception probability was low (.00), *β* = -.08, *t*(701.24) = -2.20, *p* = .028; medium (.04), *β* = -.21, *t*(699.93) = -5.96, *p* = .000; and high (.08) *β* = -.34, *t*(700.80) = -4.82, *p* = .000. However, as in the analyses predicting short-term attraction, Target Conception Probability × Target Minimal Group interaction did not predict long-term attraction *β* = -.02, *t*(706.42) = -.60, *p* = .551; see Figure 13.

Negative affect. Target Conception Probability × Target Ethnicity interaction did not significantly predict composite negative affect ratings, *β* = .01, *t*(694.47) = .59, *p* = .553, see Figure 14. Surprisingly, however, Target Conception Probability × Target Minimal Group interaction did significantly predict composite negative affect ratings, *β* = .04, *t*(695.98) = 2.16, *p* = .031; see Figure 15. However, simple slopes analyses showed that as ingroup targets' conception probability increased, male participants did not rate the samples as eliciting relatively more negative affect, *β* = -0.03, *t*(694.20) = -1.32, *p* =.189**.** In addition, raters did not rate the outgroup targets as eliciting significantly more negative affect as their conception probability increased, $\beta = .04$, $t(702.06) = 1.78$, $p = .076$. Because the overall model was significant but the simple slope analyses were not, this indicates that although the two slopes were significantly different from one another, neither one significantly differed from zero. Therefore, this suggests that the Target Conception Probability × Target Minimal Group interaction does not predict negative affect in a particularly meaningful way.

Target pitch. It is possible that the significant results found in all three studies could be driven by vocal pitch. Previous studies have demonstrated that men tend to find relatively high pitched female voices as particularly attractive overall, and women's vocal pitch is positively related to their conception probability (Bryant & Haselton, 2009; Feinberg, et al. 2008). However, vocal pitch is an important social cue even when examined independent of ovulatory cycles. Work by Scherer has also demonstrated that higher pitch and a higher pitch frequency range are two (among several) important cues that influence perceptions of a speaker's emotional state and personality (Banse & Scherer, 1996; Scherer, 1995). Pitch can indicate different types of emotional responses depending on contextual factors. For example, highly pitched voices typically signify higher arousal, but other factors, such as valence, are used to signify joy or anger (Russel, Bachorowski, & Fernandez-Dols, 2003). Because an individual's interpretation of another person's vocal pitch can be so highly variable and context dependent, it is possible that pitch could be responsible for the present results if it varies systematically with ethnicity and conception probability in the current sample of vocal targets. Therefore, I conducted several analyses to determine whether target vocal pitch is related to a variety of outcomes. Average vocal pitch for each sample was calculated using Praat software (Boersma & Weenink, 2013).

First, I attempted to replicate a result from previous literature showing that women's vocal pitch is positively related to their conception probability (Bryant & Haselton, 2009; Feinberg, et al. 2008). Results of a correlational analysis showed that this effect was not replicated in the current sample, $\beta = .04$, $t(62.20) = -.34$, $p = .733$.

I also conducted several analyses examining whether target pitch is related to target ethnicity. First, a correlation between the two variables was not significant, $\beta = .21$, $t(16.07) = 1.07$, $p = .301$, suggesting that the targets in our sample did not systematically vary in pitch as a function of their self-identified ethnic group. I then examined whether Target Pitch × Target Ethnicity predicts attraction. This interaction also was not significant when considering Caucasian raters, $\beta = .04$, $t(699.02) = 1.20$, $p = .232$; or raters from all other ethnic groups, $\beta = .04$, $t(201.03) = .66$, $p = .511$. However, this interaction was significant for Hispanic raters, $\beta = .19$, $t(149.77) = 2.16$, $p = .033$. Because this analysis only included an n of 11 Hispanic male raters, caution must be taken when trying to interpret this preliminary result.

In summary, pitch does not seem to be responsible for the effects reported in Study 3. However, as a precaution, I reran all analyses reported for Studies 1, 2, and 3 while controlling for target pitch. Target pitch was measured using Praat software ($M = 192.44$, $SD = 16.93$; Boersma & Weenink, 2013).

In Study 1, the Target Conception Probability × Target Ethnicity interaction remained significant when controlling for target pitch, $\beta = -.13$, $t(1424.33) = -5.99$, $p <$

.001. In Study 2, the Target Conception Probability × Target Ethnicity interaction also remained significant when controlling for target pitch, $\beta = -.12$, $t(729.10) = -3.80$, $p < .001$. In addition, the Target Conception Probability × Target School interaction in Study 2 remained marginally significant when controlling for target pitch, $\beta = -.06$, $t(729.13) = -1.77$, $p = .078$. In Study 3, the Target Conception Probability × Target Ethnicity interaction also remained significant when controlling for target pitch, $\beta = -.12$, $t(697.06) = -3.79$, $p < .000$. Overall, the primary interaction effects in each of the three studies remained, suggesting that these effects occur independently of vocal pitch.

Other participant ethnicities. Because this sample included 26 participants who self-identified as being a member of a non-Caucasian ethnic group, I conducted several exploratory analyses to determine whether participant ethnicity (coded as a categorical variable; 0 = Caucasian, 1 = Hispanic, 2 = All other ethnic groups) moderates the interaction of Target Conception Probability × Target Ethnicity on general vocal attraction. The 3-way interaction of Target Conception Probability × Target Ethnicity × Participant Ethnicity did not significantly predict vocal attraction, $\beta = .03$, $t(1056.90) = 0.80$, $p = .426$. However, the 2-way interactions of Target Conception Probability × Target Ethnicity conducted separately for each participant ethnic group suggest a potentially interesting pattern. As reported in the main analyses, when the analysis only includes reports from Caucasian participants (n= 56), the result is significant, $\beta = -.10$, $t(698.04) = -3.38$, $p = .001$, see Figure 4. When the analysis only includes Hispanic participants (n = 11), the result is not significant, $\beta = .03$, $t(150.71) = .32$, $p = .747$, see Figure 16. When looking at all remaining races combined (n = 15), the result is not significant $\beta = -.08$, $t(200.59) = -1.33$, $p = .186$, see Figure 17. However, the direction of each analysis varies by participant ethnic group. Both analyses that include non-Hispanic participants show a trend such that Spanish-speaking targets are rated as less attractive as their conception probability increases. However, the analysis that includes only Hispanic participants does not show a similar trend. To further examine the differences between the Caucasian and Hispanic participant samples, I conducted an additional analysis using only the Hispanic target vocal samples. Specifically, I examined the interaction of Participant Ethnicity (Caucasian and Hispanic participants only) × Target Conception Probability on general attraction ratings of only those target samples gathered from Hispanic women. This analysis was significant, $\beta = .25$, $t(416.42) = 2.07$, $p = .039$, suggesting that the Hispanic and Caucasian participants' ratings of the Hispanic targets significantly differed as a function of target fertility. Specifically, Hispanic participants' ratings are trending such that they prefer Hispanic targets at times of high fertility relative to times of low fertility. Again, the non-Caucasian samples used in all of these analyses are quite small, so caution must be used when attempting to interpret these results; however, this pattern could potentially suggest interesting future directions for this area of research.

Overall, Study 3 clarifies several aspects of Studies 1 and 2. First, because the sample is several years older than those recruited through the psychology department subject pool, these results demonstrate that this effect occurs in a sample that more closely approximates the general population of Caucasians in the United States. Second, these results provide a better understanding of the degree of subtlety that can be used to elicit this effect. Study 3 uses a minimal-group manipulation which has no link to real life groups such as ethnicity or school/social groups that are frequently referenced throughout everyday situations; however, this manipulation did not produce a similar effect to those already found in Studies 1 and 2. This may suggest that some types of cues are too subtle to elicit the effect found when using other types of manipulations. Finally, this study provides a fresh look at the types of emotions elicited by ingroup and outgroup members across various levels of fertility. Although Studies 1, 2, and 3 all provided support for the idea that attractiveness ratings of fertile women depend in part on the targets' group status, the results of Study 3 also demonstrated that these effects are unique to general, short-term, and long-term attraction. Specifically, other ratings that are particularly relevant to group membership, such as fear and disgust, do not seem to be influenced by fertility.

SUMMARY AND CONCLUSIONS

Thus far, researchers from many interdisciplinary perspectives have uncovered a great deal of evidence suggesting that human ovulatory cycles influence mating preferences and behaviors. . However, there is still much to explore; researchers have only recently begun to identify some of the many potential moderators of the effect of fertility on male attraction. In addition, few, if any researchers have yet examined this phenomenon with a phylogenetic approach. I contend that the relatively ancient adaptation of ovulation can influence human behavior, but traits which occurred more recently in the human timeline can modify this overall effect (e.g., Eastwick, 2009; Eastwick & Finkel, 2012). Together, the current studies provide support for the idea that symbolic group membership moderates traditional ovulatory shifts. Although some previous research has examined the influence of group membership cues on ovulatory shifts in women's ratings of male targets (e.g., McDonald, et al., 2011; Navarette, et al., 2009), the current set of studies is the first to test this phenomenon in men's ratings of women.

Study 1 demonstrated the proposed effect using a very salient form of group membership, ethnicity, as evidenced by foreign accented speech. Study 2 replicated this effect but also provided evidence that it is not unique to cues of race/ethnicity; that is, exposure to forms of group membership that are not as ubiquitous, such as school logos, also produce a similar effect. Study 3 shows that this effect is generalizable to an older sample and again replicates the basic finding that target ethnicity and target fertility interact to predict men’s enhanced attraction to fertile targets who share their ethnicity. However, Study 3 showed that a very subtle manipulation of group status does not produce a similar effect, indicating a boundary condition to the previous results. Finally, although Study 3 tested a potential mechanistic explanation for the suppression of fertility preferences, the interaction of fertility and group status predicted neither disgust nor fear. Therefore, neither one serves as an underlying mediator of the basic effect.

Strengths and Limitations

These studies have several strengths. Although previous research has examined the influence of fertility probability on vocal attraction, this set of studies is the first to examine how variations in language and accents can affect vocal preferences. Also, the participants selected for these studies were relatively diverse compared to many studies within this area of research: Although Studies 1 and 2 used traditional college-aged samples, Study 3 replicated the predicted ethnicity moderation in an older sample of participants gathered from across the United States. In addition, the vocal samples used in all three studies were gathered from each vocal target over the course of four weeks, which is more intensive than the typical technique of comparing preferences of target samples taken either at high or low fertility (i.e., one of two possible time points; Feinberg et al., 2006), This method allowed for a more detailed assessment of preference variations due to fertility by collecting evaluations of each target at several different time points instead of relying on a strictly between subjects design (Pipitone & Gallup, 2008). Finally, these results demonstrate that evolved characteristics that are not inherently unique to mating can affect sexual adaptations, which provides support for the phylogenetic approach to understanding human evolution.

However, these studies do have limitations. First, although the ovulatory literature has incorporated several different designs, the current report only relied on a vocal paradigm. Future research should examine whether other types of study designs that are commonly used in studies examining ovulatory effects can elicit similar outgroup moderation effects. For example, testing whether ingroup cues moderate the effect of fertility on facial attractiveness and scent preferences could broaden the scope of this finding. Finally, although these studies used samples that varied in age, all participants originated from the United States, and most were Caucasian. Although the sample used in Study 3 was somewhat diverse, it did not include enough non-Caucasian participants to accurately assess how the findings were applicable to them. Future studies should examine whether these effects persist in non-American samples and in non-English speaking samples that are more representative of the population as a whole to determine the limits to these effects.

Future Directions

Future studies should continue testing the failed predictions in Study 3 and examining other possible mediators. For example, perhaps disgust and fear did not mediate the interaction effect of target ethnicity and target fertility on attraction because standardized, neutral vocal stimuli cannot easily elicit these types of emotional responses. Using other types of paradigms that more closely approximate genuine encounters, such as live interaction with outgroup members, could potentially help determine whether emotions such as disgust or fear matter in other types of situations. Future research should also examine other potential mediators to provide a deeper understanding of when and why group status influences fertility preferences. For example, because members of minority groups are often stereotyped in different ways and seen as varying in social status (e.g., Cottrell & Neuberg, 2005), perhaps the perceived status of potential partners can explain at least part of this effect. In addition, future studies could examine the extent to which subtle ingroup manipulations matter in situations that approximate real-life mating and relationship issues. One possible future direction is examining whether these effects emerge in a study examining interactions between male participants and naturally cycling female ingroup and outgroup members.

By examining potential moderators of traditional ovulatory effects, researchers can gain a fuller understanding of the range of circumstances in which this adaptation influences behavior and preferences. Some researchers have posited that the ovulatory adaptations that originally facilitated mating in general may since have been repurposed for use by other systems (Diamond & Wallen, 2011; Eastwick & Finkel, 2012). In men, the reproductive benefit of detecting ovulation in women is clear (Gangestad & Thornhill, 2008). However, the current finding that higher fertility is not always associated with increased attraction suggests that men’s attunement to women’s ovulation may provide them with additional information beyond a straightforward mating cue. One study has provided additional direct support for this idea, showing that men in relationships tend to show a decreased preference for potential partners who are highly fertile relative to when they are less fertile (Miller & Maner, 2010b). Future research can provide further explanations for when these cues may be useful for men in domains unrelated to mating.

In addition, these studies not only provide support for the phylogenetic approach to examining ovulatory effects but could also have potentially meaningful implications for real-world settings. Although social psychologists have long been concerned with detecting subtle forms of group derogation and ingroup preferences (e.g., Allport, 1954), relatively little work has been done to identify potential biological moderators of this effect in the mating domain. By understanding the circumstances that predict prejudice against ougroup members, researchers can potentially help prevent stereotyping and discrimination in a variety of previously overlooked areas. This line of work can provide many new questions for future researchers to explore.

ENDNOTES

[1.] This interaction remained significant controlling for fluency errors, $\beta = -.12$, $t(1424.32) = -5.75$, $p < .001$. Fluency errors were calculated as the number of mispronunciations, word omissions, or hesitations measured in each recording ($M = 1.13$, $SD = 1.08$).

[2] The Target Conception Probability × Target Ethnicity interaction remained significant when controlling for fluency errors, $\beta = -.11$, $t(729.10) = -3.50$, $p < .001$. Similarly, the Target Conception Probability × Target School interaction in Study 2 remained marginally significant when controlling for fluency errors $\beta = -.06$, $t(729.12) = -1.70$, $p = .089$.

[3] This interaction remained significant when controlling for fluency errors, $\beta = -.09$, $t(697.27) = -2.94$, $p = .003$.

REFERENCES

Alexander, R. D. (1974). The evolution of social behavior. *Annual Review of Ecology and Systematics, 5,* 325-383.

Allport, G. W. (1954). *The nature of prejudice.* Reading, MA: Addison-Wesley.

Anderson, U. S., Perea, E. F., Becker, D. V., Ackerman, J. M., Shapiro, J. R. Neuberg, S. L., & Kenrick, D. T. (2010). I only have eyes for you: Ovulation redirects attention (but not memory) to attractive men. *Journal of Experimental Social Psychology, 46,* 804-808.

Apicella, C .L., & Feinberg, D. Voice pitch alters mate-choice relevant perception in hunter-gatherers. *Proceedings of the Royal Society, B,* 276, 1077-1082.

Baken, R. J., & Orlikoff, R. F. (2000). *Clinical measurement of speech and voice* (2nd ed.). San Diego, CA: Singular Publishing Group.

Banse, R. & Scherer, K. R. (1996). Acoustic profiles in vocal emotion expression. *Journal of Personality and Social Psychology, 70,* 614-636.

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173-1182.

Blalock, H. M. (1967). *Toward a theory of minority-group relations.* New York, NY: Wiley.

Boersma, P. & Weenink, D. (2013). Praat: doing phonetics by computer [Computer program]. Version 5.3.64, retrieved December 21, 2013 from http://www.praat.org/

Bourhis, R. Y., Giles, H., & Lambert, W. E. (1975). Social consequences of accommodating one's style of speech: A cross-national investigation. *International Journal of the Sociology of Language, 6,* 5-71.

Brewer, M. B. (1979). Ingroup bias in the minimal intergroup situation: A cognitive–motivational analysis. *Psychological Bulletin, 86*, 307–324.

Brewer, M. B. (2007). The importance of being *we*: Human nature and intergroup relations. *American Psychologist*, *62,* 728-738.

Brewer, M. B. (1999). The psychology of prejudice: Ingroup love or outgroup hate? *Journal of Social Issues, 55,* 429-444.

Brewer, M. B., & Caporael, L. (2006). An evolutionary perspective on social identity: Revisiting groups. In M.Schaller, J. Simpson, & D. Kenrick (Eds.), *Evolution and social psychology* (pp. 143–161). New York, NY: Psychology Press.

Broder, A. & Hohmann, N. (2003). Variations in risk taking behavior over the menstrual cycle: An improved replication. *Evolution and Human Behavior, 24,* 391-398.

Brown, S. G., Calibuso, M. J., & Roedl, A. L. (2011). Women’s sexuality, well-being, and the menstrual cycle: Methodological issues and their relationships. *Archives of Sexual Behavior, 40,* 755-765.

Brown, L. M., McNatt, P. S., & Cooper, G. D. (2003). Ingroup romantic preferences among Jewish and non-Jewish White undergraduates. *International Journal of Intercultural Relations, 27,* 335-354.

Bryant, G. A. & Haselton, M. G. (2009). Vocal cues of ovulation in human females. *Biology Letters, 5,* 12-15.

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science 6,* 3-5.

Burkart, J. M., Hrdy, S. B., & Van Schaik, C. P. (2009). Cooperative breeding and human cognitive evolution. *Evolutionary Anthropology: Issues, News, and Reviews, 18,* 175-186.

Burley, N. (1979). The evolution of concealed ovulation. *The American Naturalist, 114,* 835-858.

Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences, 12,* 1-49.

Buss, D. M., & Schmitt, D. P. (1993). Sexual strategies theory: An evolutionary perspective on human mating. *Psychological Review, 100,* 204-232.

Caporael, L. R., & Brewer, M. B. (1995). Hierarchical evolutionary theory: There is an alternative, and it's not creationism. *Psychological Inquiry, 6,* 31-34.

Caruso, S., Roccasalva, L., Sapienza, G., Zappala, M., Nuciforo, G., & Biondi, S. (2000). Laryngeal cytological aspects in women with surgically induced menopause who were treated with transdermal estrogen replacement therapy. *Fertility and Sterility, 74,* 1073−1079.

Chavanne, T. J. & Gallup, G. G. (1998). Variation in risk taking behavior among female college students as a function of the menstrual cycle. *Evolution and Human Behavior, 19,* 27-32.

Chiazze Jr., L., Brayer, F. T., Maclsco Jr., J. J., Parker, M. P., & Duffy, B. J. (1968). The length and variability of the human menstrual cycle. *Journal of the American Medical Association, 203,* 377-380.

Cottrell, C. A. & Neuberg, S. L. (2005) Emotional reactions to different groups: A sociofunctional threat-based approach to "prejudice." *Journal of Personality and Social Psychology, 88*, 770-789.

Diamond, L. M., & Wallen, K. (2011). Sexual minority women's sexual motivation around the time of ovulation. *Archives of Sexual Behavior, 40,* 237-246.

Dixson, A. F. (2009). *Sexual selection and the origins of human mating systems.* New York, NY: Oxford University Press.

Dovidio, J. F., & Gluszek, A., John, M-S, Ditlmann, R., & Lagunes, P. (2010). Understanding bias toward Latinos: Discrimination, dimensions of difference, and experience of exclusion. *Journal of Social Issues, 66*, 59-78.

Durante, K. M., Li, N. P., & Haselton, M. G. (2008). Changes in women's choice of dress across the ovulatory cycle: Naturalistic and laboratory task-based evidence. *Personality and Social Psychology Bulletin, 34,* 1451-1460.

Eastwick, P. W. (2009). Beyond the Pleistocene: Using phylogeny and constraint to inform the evolutionary psychology of human mating. *Psychological Bulletin, 135,* 794-821.

Eastwick, P. W., & Finkel, E. J. (2012). The evolutionary armistice: Attachment bonds moderate the function of ovulatory cycle adaptations. *Personality and Social Psychology Bulletin*, *38,* 174-184.

Eastwick, P. W., Richeson, J. A., Son, D., & Finkel, E. J. (2009). Is love colorblind? Political orientation and interracial romantic desire. *Personality and Social Psychology Bulletin*, *35,* 1258-1268.

Fairbanks, G. (1960). *Voice and articulation handbook.* New York: Harper and Row.

Feinberg, D. R., Jones, B. C., Law Smith, M. J., Moore, F. R., DeBruine, L. M., Cornwell, R. E., et al. (2006). Menstrual cycle, trait estrogen level, and masculinity preferences in the human voice. *Hormones and Behavior, 49,* 215-222.

Feinberg, D. R., DeBruine, L. M., Jones, B. C., & Perrett, D. I. (2008) The role of femininity and averageness of voice pitch in aesthetic judgments of women's voices. *Perception, 37,* 615-623.

Fiske, S.T., Cuddy, A.J.C., Glick, P. & Xu, J. (2002). A model of (often mixed) stereotype content: Comptence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology, 82,* 878-902.

Fraley, R. C., Brumbaugh, C. C., & Marks, M. J. (2005). The evolution and function of adult attachment: A comparative and phylogenetic analysis. *Journal of Personality and Social Psychology*, *89,* 731-746.

Gangestad, S. W. & Garver-Apgar, C. E. (2013). The nature of female sexuality: Insights into the dynamics of romantic relationships. In J. L. Simpson & L. Campbell (Eds.), *The Oxford Handbook of Close Relationships* (pp. 374-399). New York, NY: Oxford University Press.

Gangestad, S. W., Garver-Apgar, C. E., Simpson, J. A., & Cousins, A. J. (2007). Changes in women's mate preferences across the ovulatory cycle. *Journal of Personality and Social Psychology, 92*, 151-163.

Gangestad, S. W., & Simpson, J. A. (2000). The evolution of human mating: Trade-offs and strategic pluralism. *Behavioral and Brain Sciences, 23,* 573-644.

Gangestad, S. W., Simpson, J. A., Cousins, A. J., Garver-Apgar, C. E., & Christensen, P. (2004). Women's preferences for male behavioral displays change across the menstrual cycle. *Psychological Science, 15*, 203-206.

Gangestad, S. W., & Thornhill, R. (1998). Menstrual cycle variation in women's preference for the scent of symmetrical men. *Proceedings of the Royal Society of London, Series B, 265*, 927-933.

Gangestad, S. W., & Thornhill, R. (2008). Human oestrus. *Proceedings of the Royal Society B, 275,* 991-1000.

Gangestad, S. W., Thornhill, R., & Garver, C. E. (2002). Changes in women's sexual interests and their partners' mate retention tactics across the menstrual cycle:

Evidence for shifting conflicts of interest. *Proceedings of the Royal Society of London B, 269,* 975-982.

Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2005a).Adaptations to ovulation: Implications for sexual and social behavior. *Current Directions in Psychological Science*, *14,* 312-316.

Garver-Apgar, C. E., Gangestad, S. W., Thornhill, R., Miller, R. D., & Olp, J. J. (2006). Major histocompatibility complex alleles, sexual responsivity, and unfaithfulness in romantic couples. *Psychological Science, 17,* 830-835.

Gosling, S. D., & Graybeal, A. (2007). Tree thinking: A new paradigm for integrating comparative data in psychology. *Journal of General Psychology, 134,* 259-277.

Goy, R. W. (1979). Sexual compatibility in rhesus monkeys: Predicting sexual performance of oppositely sexed pairs of adults. *Ciba Foundation Symposium, 62,* 227-255

Harris, L. T., & Fiske, S. T. (2006). Dehumanizing the lowest of the low: Neuroimaging responses to extreme out-groups. *Psychological Science, 17,* 847-853.

Haselton, M. G., & Gangestad, S. W. (2006). Conditional expression of women’s desires and men’s mate guarding across the ovulatory cycle. *Hormones and Behavior, 49,* 509-518.

Haselton, M. G. & Gildersleeve, K. (2011). Can men detect ovulation? *Current Directions in Psychological Science*, 20, 87-92.

Havlicek, J., Roberts, S. C., & Flegr, J. (2005). Women's preference for dominant male odour: Effects of menstrual cycle and relationship status. *Biology Letters, 1,* 256-259.

Hennington, J. P. (1996). A 12-item scale of social conservatism. *Personality and Individual Differences, 20,* 517-519.

Hewstone, M., Rubin, M., & Willis, H. (2002). Intergroup bias. *Annual Review of Psychology, 53,* 575-604.

Hill, E.M. (*1988*) The menstrual cycle and components of human female sexual behaviour. *Journal of Social and Biological Structures, 11,* 443–455.

Hodson, G. & Costello, K. (2007). Interpersonal disgust, ideological orientations, and dehumanization as predictors of intergroup attitudes. *Psychological Science, 18,* 691- 698.

Jones, B. C., DeBruine, L. M., Perrett, D. L., Little, A. C., Feinberg, D. R., & Law Smith, M. J. (2008). Effects of menstrual cycle phase on face preferences. *Archives of Sexual Behavior, 37,* 78-84.

Klavina, L., Buunk, A. P., & Pollet, T. V. (2011). Out-group mating threat and disease threat increase implicit negative attitudes toward the out-group among men. *Frontiers in Evolutionary Psychology, 2,* 76.

Kurzban, R. & Leary, M. R. (2001). Evolutionary origins of stigmatization: The functions of social exclusion. *Psychological Bulletin, 127,* 187-208.

Kurzban, R., Tooby, J. & Cosmides, L. (2001). Can race be erased? Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences, 98*(26), 15387-15392.

Lieberman, D., Pillsworth, E. G., & Haselton, M. G. (2011). Kin affiliation across the ovulatory cycle: Females avoid fathers when fertile. *Psychological Science, 22,* 13-18.

Lieberman, D., Tooby, J., & Cosmides, L. (2002). Does morality have a biological basis? An empirical test of the factors governing moral sentiments relating to incest. *Proceedings of the Royal Society London (Biological Sciences), 270*, 819-826.

Lippi-Green, R. (1997). *English with an accent: Language, ideology, and discrimination in the United States.* London: Routledge.

Mackie, D. M., Devos, T., & Smith, E. R. (2000). Intergroup emotions: Explaining offensive action tendencies in an intergroup context. *Journal of Personality and Social Psychology, 79,* 602-616.

March, D. S. (2012). *Implicit and explicit bias against Hispanics among white female college students assessed by indirect and direct measures* (Master’s thesis). Retrieved from https://digital.library.txstate.edu/bitstream/handle/10877/4255/MARCH-THESIS.pdf?sequence=2

Markert, J. (2010). The changing face of racial discrimination: Hispanics as the dominant minority in the USA—a new application of power-threat theory. *Critical Sociology, 36,* 307-327.

Martin, R. D. (2007). The evolution of human reproduction: A primatological perspective. *Yearbook of Physical Anthropology, 50,* 59-84.

McDonald, M. M., Asher, B. D., Kerr, N. L., & Navarrete C. D. (2011). Fertility and intergroup bias in racial and minimal-group contexts: Evidence for shared architecture. *Psychological Science, 22,* 860-865.

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology, 27,* 415-444.

Miller, S. L., & Maner, J. K. (2010a). Evolution and relationship maintenance: Fertility cues lead committed men to devalue relationship alternatives. *Journal of Experimental Social Psychology, 46,* 1081-1084.

Miller, S.L., & Maner, J.K. (2010b). Scent of a woman: Men's testosterone responses to olfactory ovulation cues. *Psychological Science, 21*, 276-283.

Muller, M. N., & Wrangham, R. W. (2004). Dominance, aggression, and testosterone in wild chimpanzees: A test of the challenge hypothesis. *Animal Behaviour, 67,* 113-123.

Munro, M. J. (1998). The effects of noise on the intelligibility of foreign-accented speech. *Studies in Second Language Acquisition, 20,* 139-154.

Munro, M. J. (2003). A primer on accent discrimination in the Canadian context. *TESL Canada Journal, 20,* 38-51.

Navarrete, C. D. & Fessler, D. M. T. (2006). Disease avoidance and ethnocentrism: The effects of disease vulnerability and disgust sensitivity on intergroup attitudes. *Evolution and Human Behavior, 27,* 270-282.

Navarrete, C. D., Fessler, D. M. T., Fleischman, D. S. and Geyer, J. (2009). Race bias tracks conception risk across the menstrual cycle. *Psychological Science, 20,* 661-665

Neuberg, S. L., Smith, D. M., & Asher, T. (2000). Why people stigmatize: Toward a biocultural framework. In T. Heatherton, R. Kleck, J. G. Hull, & M. Hebl (Eds.), *The social psychology of stigma* (pp. 31-61). New York: Guilford.

Pemberton, M. B., Insko, C. A., & Schlopler, J. (1996). Memory for and experience of differential competitive behavior of individuals and groups. *Journal of Personality and Social Psychology, 71,* 953-966.

Peng, M., Chang, L., & Zhou, R. (2013). Physiological and behavioral responses to strangers compared to friends as a source of disgust. *Evolution & Human Behavior, 34,* 94-98.

Penn, D. J. & Potts, W. K. (1999). The evolution of mating preferences and major histocompatibility complex genes. *The American Naturalist, 153,* 145-164.

Pillsworth, E. G., Haselton, M. G., & Buss, D. M. (2004). Ovulatory shifts in female sexual desire. *Journal of Sex Research, 41,* 55-65.

Pipitone, R. N. & Gallup, G. G. (2008). Women's voice attractiveness varies across the menstrual cycle. *Evolution and Human Behavior, 29,* 268-274.

Plant, E. A., & Devine, P. G. (1998). Internal and external sources of motivation to respond without prejudice. *Journal of Personality and Social Psychology, 75,* 811-32.

Pokorny, J. J. & de Waal, F. B. M. (2009). Face recognition in capuchin monkeys (*Cebus paella). Journal of Comparative Psychology, 123,* 151-160.

Puts, D.A. (2005). Mating context and menstrual phase affect women's preferences for male voice pitch. *Evolution and Human Behavior 26,* 388-397.

Puts, D. A., Bailey, D. H., Cardenas, R. A., Burriss, R. P., Welling, L. L. M., Wheatley, J. R., & Dawood, K. (2013). Women's attractiveness changes with estradiol and progesterone across the ovulatory cycle. *Hormones and Behavior*, *63,* 13-19.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage.

Roberts, S. C., Havlicek, J., Flegr, J., Hruskova, M., Little, A. C., Jones, B. C.,...Petrie, M., (2004). Female facial attractiveness increases during the fertile phase of the menstrual cycle. *Proceedings of the Royal Society of London, Series B, 271,* 270-272.

Rothgerber, H. (1997). External group threat as an antecedent to perceptions in in-group and out-group homogeneity. *Journal of Personality and Social Psychology, 73,* 1206-1212.

Rozin, P., Haidt, J., & McCauley, C. R. (2008). Disgust. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), Handbook of Emotions, 3rd ed. (pp. 757-776). New York. Guilford Press.

Rudman, L. A. & Goodwin, S. A. (2004). Gender differences in automatic ingroup bias: Why do women like women more than men like men? *Journal of Personality and Social Psychology, 87,* 494-509.

Russel, J. A., Bachorowski, J. –A., & Fernandez-Dols, J. -M. (2003). Facial and vocal expressions of emotion. *Annual Review of Psychology, 54,* 329-349.

Sales, R. (2012). *Perception of foreign accented speech: The roles of familiarity and linguistic training* (Master's thesis). Retrieved from http://digital.library.unt.edu/ark:/67531/metadc115151/m2/1/high_res_d/thesis.pdf

Schafer, A., Schienle, A., & Vaitl, D. (2005). Stimulus type and design influence hemodynamic responses towards visual disgust and fear. *International Journal of Psychophysiology, 57,* 53-59.

Schaller, M. & Murray, D. R. (2008). Pathogens, personality, and culture: Disease prevalence predicts worldwide variability in sociosexuality, extraversion, and openness to experience. *Journal of Personality and Social Psychology, 95,* 212-221.

Schaller, M., & Neuberg, S. L. (2012). Danger, disease, and the nature of prejudice(s). *Advances in Experimental Social Psychology, 46*, 1-54.

Schaller, M. &Park, J. H. (2011). The behavioral immune system (and why it matters). *Current Directions in Psychological Science, 20,*99-103.

Scherer, K. R. (1995). Expression of emotion in voice and music. *Journal of Voice, 9,* 235-248.

Sherif, M., Harvey, O. J., White, B. J., Hood, W. R., Sherif, C. W. (1961). *Intergroup conflict and cooperation: The Robber's Cave experiment. Norman*, OK: University Book Exchange.

Simpson, J. A., & LaPaglia, J. (2007). An evolutionary account of strategic pluralism in human mating: Changes in mate preferences across the ovulatory cycle. In J. P. Forgas, M. G. Haselton, & W. von Hippel (Eds.), *Evolution and the social mind: Evolutionary psychology and social cognition* (pp. 161-177). New York: Psychology Press.

Simpson, J. A., Wilson, C. L., & Winterheld, H. A. (2004). Sociosexuality and romantic relationships. In J. H. Harvey, A. Wenzel, & S. Sprecher (Eds.), *Handbook of Sexuality in Close Relationships*. (pp. 87-112). Mahwah, NJ: Erlbaum.

Smith, E. R. (1993). Social identity and social emotions: Toward new conceptualizations of prejudice. In D. M. Mackie & D. L. Hamilton (Eds.), *Affect, cognition, and stereotyping: Interactive processes in group perception* (pp. 297-315). San Diego, CA: Academic Press.

Stumpf, R. M., & Boesch, C. (2005). Does promiscuous mating preclude female choice? Female sexual strategies in chimpanzees (Pan troglodytes verus). *Behavioral Ecology and Sociobiology*, *57,* 511-524.

Tajfel, H. (1970). Experiments in intergroup discrimination. *Scientific American, 223,* 96-102.

Thornhill, R., Gangestad, S. W., Miller, R., Scheyd, G., McCollough, J. K., & Franklin, M. (2003). Major histocompatibility complex genes, symmetry, and body scent attractiveness in men and women. *Behavioral Ecology, 14,* 668-678.

Treolar, A. E., Boynton, R. E., Behn, B. G., & Brown, B. W. (1967). Variation of the human menstrual cycle through reproductive life. *International Journal of Fertility, 12,* 77-120.

Trivers, R. L. (1972).Parental investment and sexual selection. In B. Campbell (Ed.) *Sexual selection and the descent of man* (pp. 136-179). Chicago, IL: Aldine.

Turner, J. C., Brown, R. J., & Tajfel, H. (1979). Social comparison and group interest in ingroup favouritism. *European Journal of Social Psychology, 9,* 187-204.

Van Vugt, M., De Cremer, D., & Janssen, D. P. (2007). Gender differences in cooperation and competition: The male warrior hypothesis. *Psychological Science, 18* 19-23.

Wallen, K. (2001). Sex and context: Hormones and primate sexual motivation. *Hormones and Behavior, 40,* 339-357.

Wedekind, C., Seebeck, T., Bettens, F., & Paepke, A. J. (1995). MHC-dependent mate preferences in humans. *Proceedings: Biological Sciences, 260,* 245-249.

Wegienka, G. & Baird, D. D. (2005). A comparison of recalled date of last menstrual period with a menstrual diary. *Journal of Women's Health, 14,* 248-252.

Weyant, J. M. (2005). Implicit stereotyping of Hispanics: Development and validity of a Hispanic version of the Implicit Association Test. *Hispanic Journal of Behavioral Sciences, 27,* 355-363.

Whitt, S. & Wilson, R. K. (2007). The dictator game, fairness, and ethnicity in postwar Bosnia. *American Journal of Political Science, 51,* 655-668.

Wilcox, A. J., Baird, D. D., Dunson, D. B., McConnaughey, D. R., Kesner, J. S., & Weinberg, C. R. (2004). On the frequency of intercourse around ovulation: Evidence for biological influences. *Human Reproduction, 19,* 1539-1543.

Wilcox, A. J., Duncan, D. B., Weinberg, C. R., Trussell, J., & Baird, D. D. (2001). Likelihood of conception with a single act of intercourse: Providing benchmark rates for assessment of post-coital contraceptives. *Contraception*, *63*, 211-215.

Wilson, T. C. (1996). Cohort and prejudice: Whites' attitudes toward Blacks, Hispanics, Jews, and Asians. *Public Opinion Quarterly*, *60,* 253-274.

Wilson, G. D., and Patterson J. (1968). A new measure of conservatism. *British Journal of Social and Clinical Psychology, 7,* 264-269.

Wood, W., Kressel, L., Joshi, P., & Louie, B. (2012, January). *Critical perspectives on menstrual cycle effects*. Paper presented at the Society for Personality and Social Psychology, San Diego, CA.

APPENDIX A

FIGURES

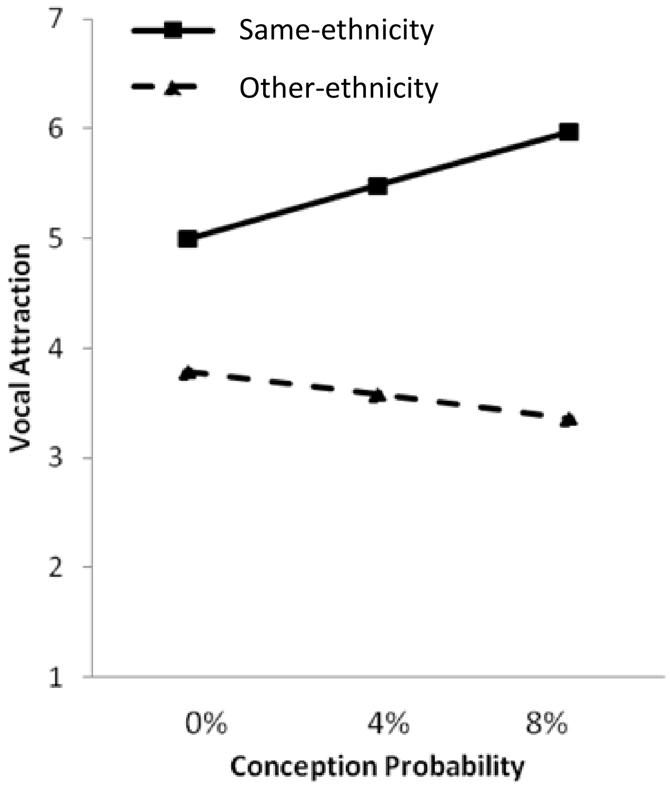

Figure 1. Vocal attractiveness ratings as a function of targets' ethnicity and probability of conception in Study 1.

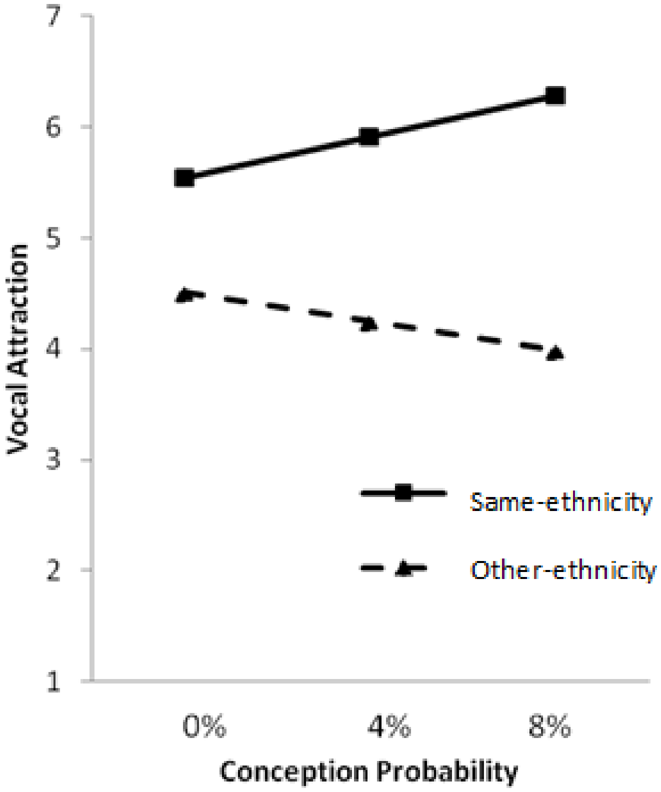

Figure 2. Vocal attractiveness ratings as a function of targets' ethnicity and probability of conception in Study 2.

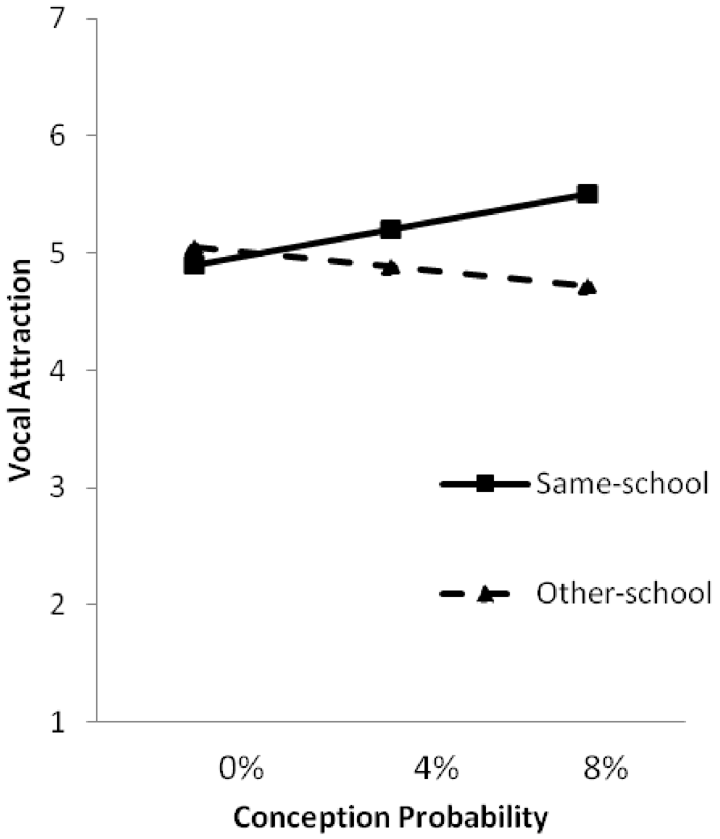

Figure 3. Vocal attractiveness ratings as a function of targets' school and probability of conception in Study 2.

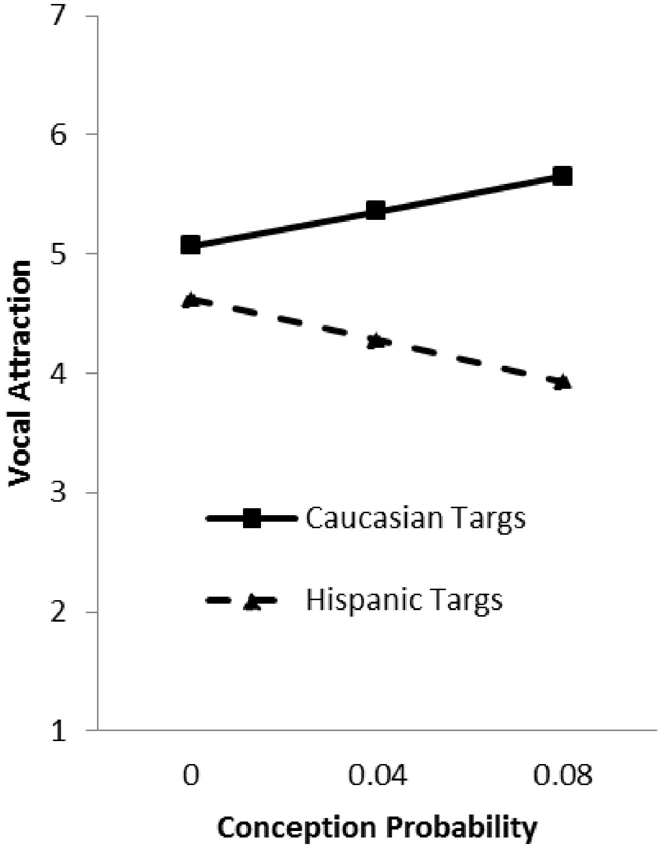

Figure 4: Vocal attractiveness ratings as a function of targets’ ethnicity and probability of conception in Study 3.

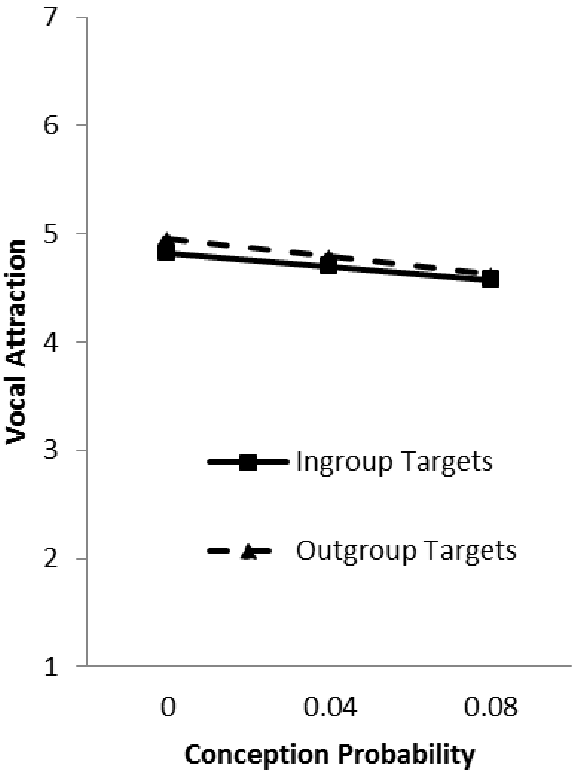

Figure 5: Vocal attractiveness ratings as a function of targets' minimal group status and probability of conception in Study 3.

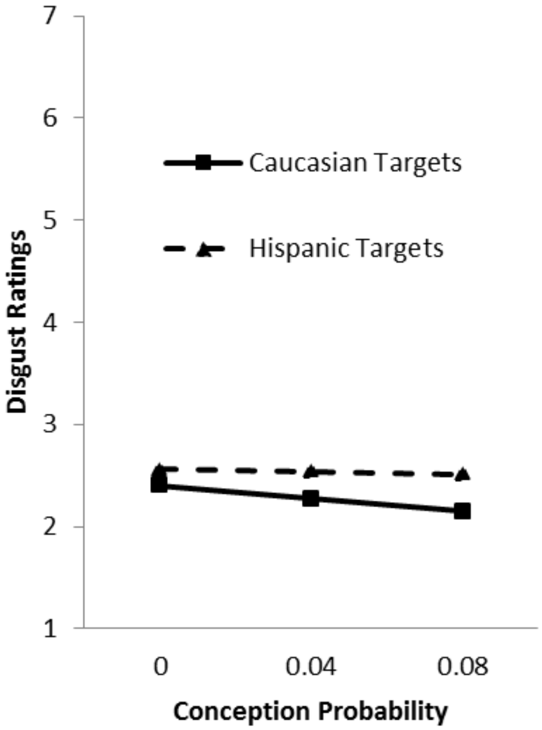

Figure 6: Disgust ratings as a function of targets' ethnicity and probability of conception in Study 3.

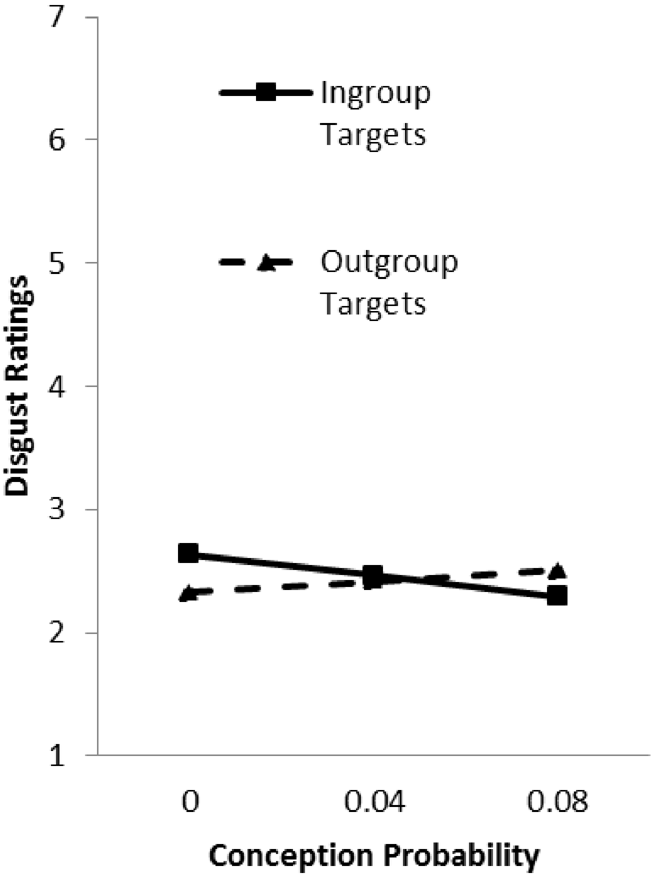

Figure 7: Disgust ratings as a function of targets' minimal group status and probability of conception in Study 3.

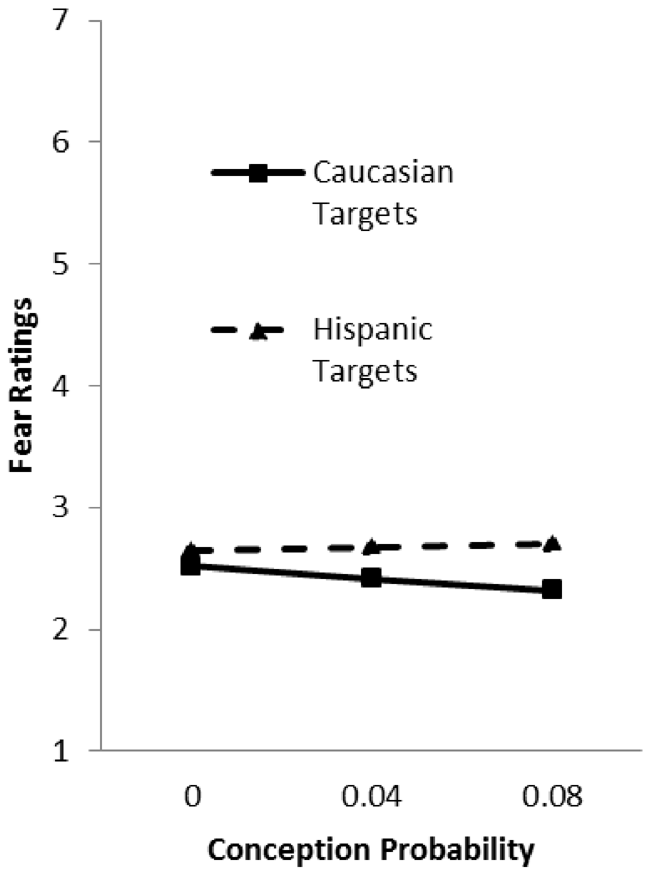

Figure 8: Fear ratings as a function of targets' ethnicity and probability of conception in Study 3.

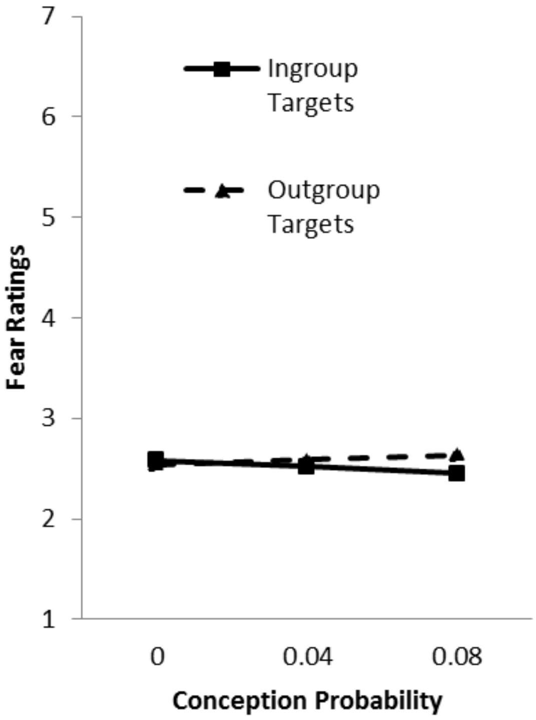

Figure 9: Fear ratings as a function of targets' minimal group status and probability of conception in Study 3.

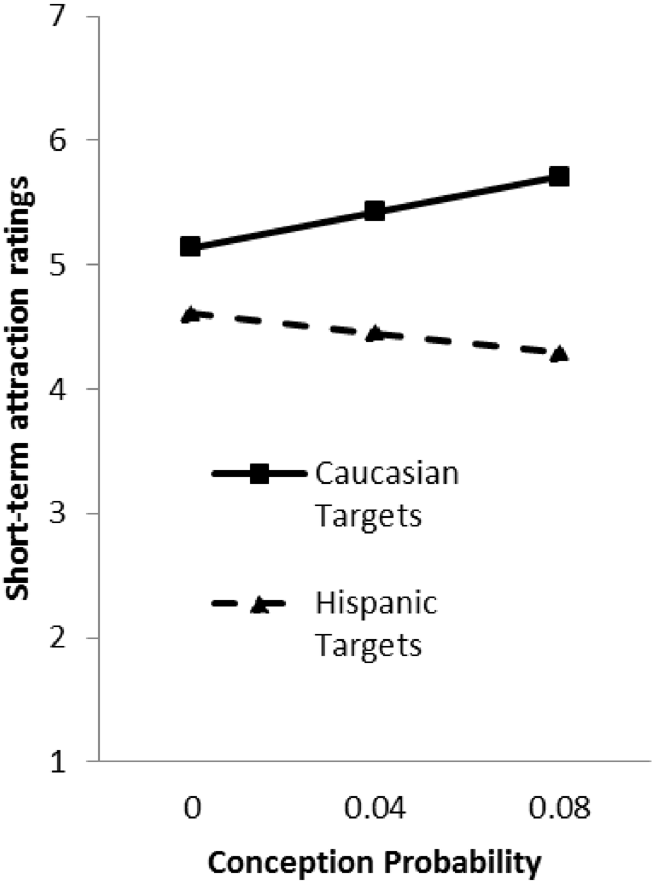

Figure 10: Short-term attraction ratings as a function of targets' ethnicity and probability of conception in Study 3.

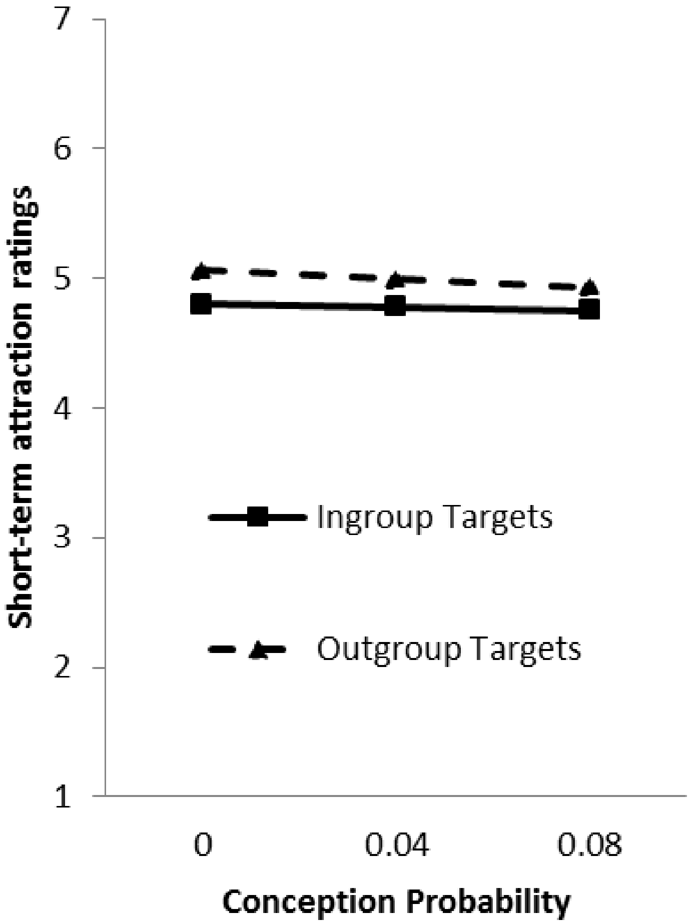

Figure 11: Short-term attraction ratings as a function of targets' minimal group status and probability of conception in Study 3.

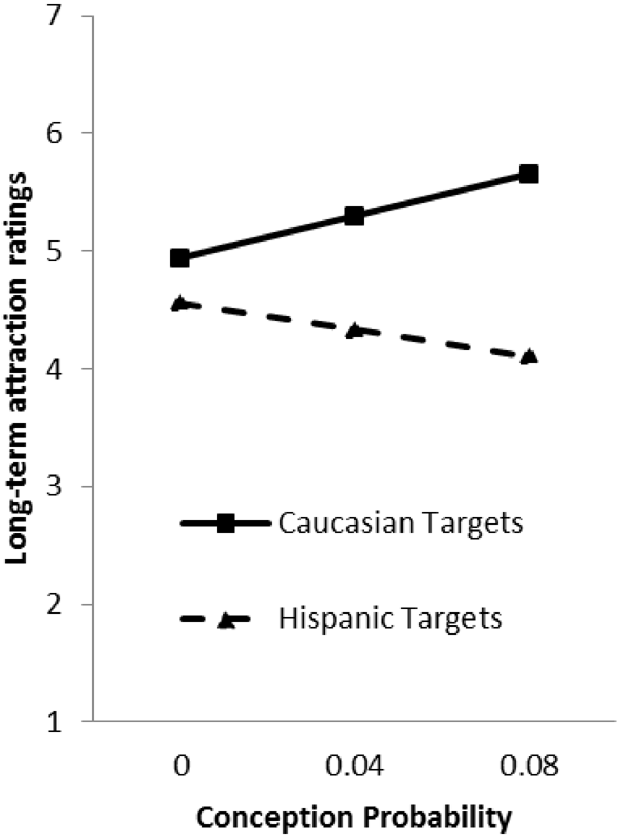

Figure 12: Long-term attraction ratings as a function of targets' ethnicity and probability of conception in Study 3.

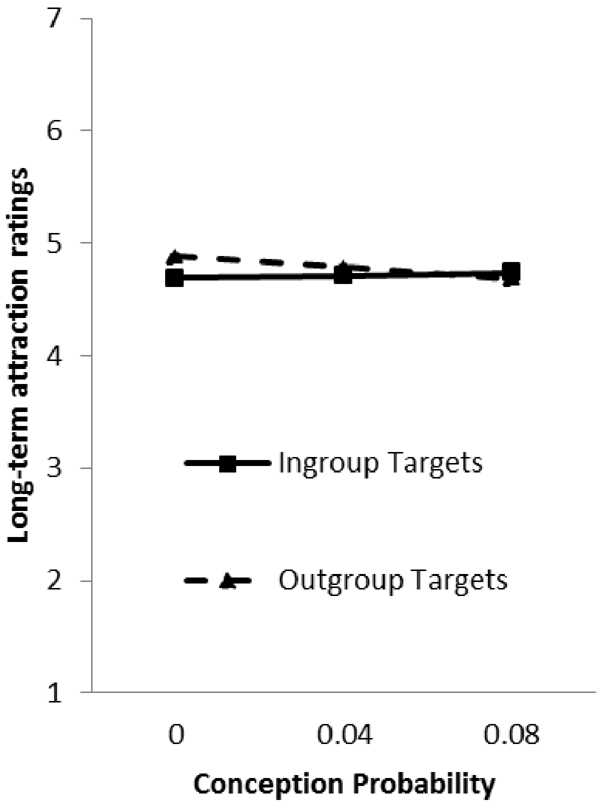

Figure 13: Long-term attraction ratings as a function of targets' minimal group status and probability of conception in Study 3.

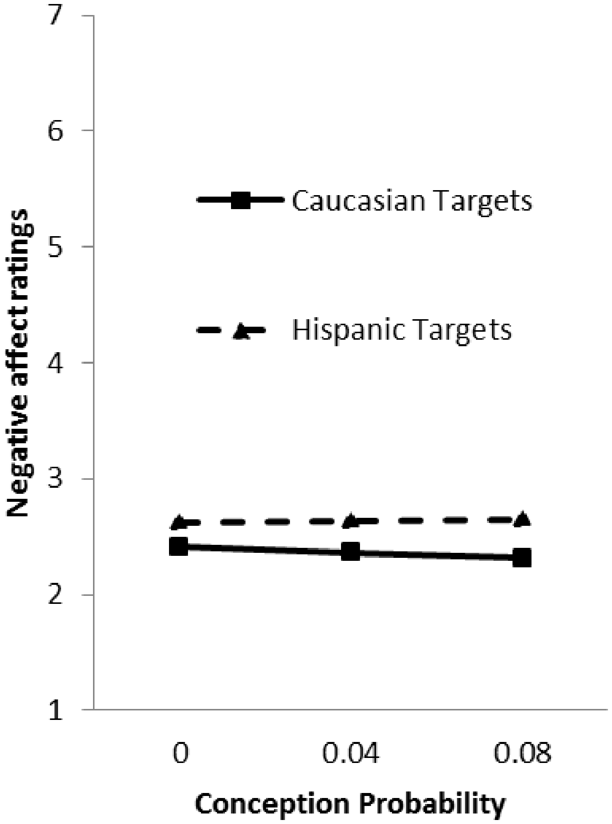

Figure 14: Negative affect ratings as a function of targets' ethnicity and probability of conception in Study 3.

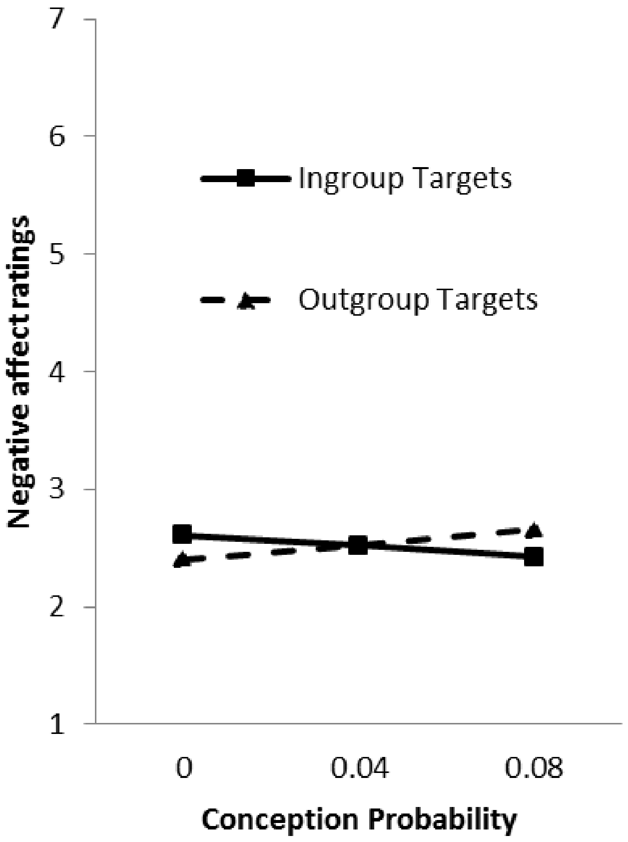

Figure 15: Negative affect ratings as a function of targets' minimal group status and probability of conception in Study 3.

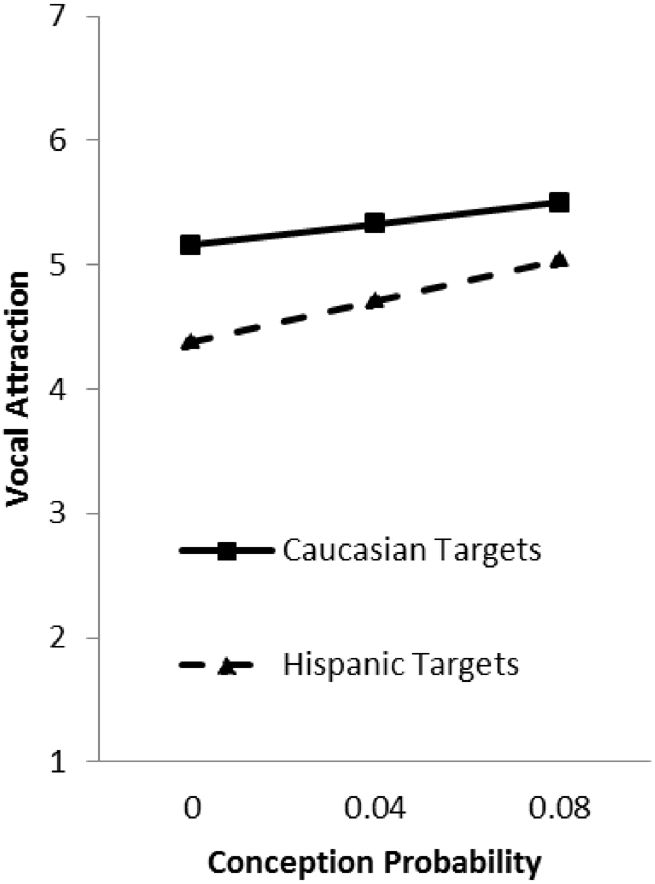

Figure 16: Hispanic participants' attraction ratings as a function of targets' ethnicity and probability of conception in Study 3.

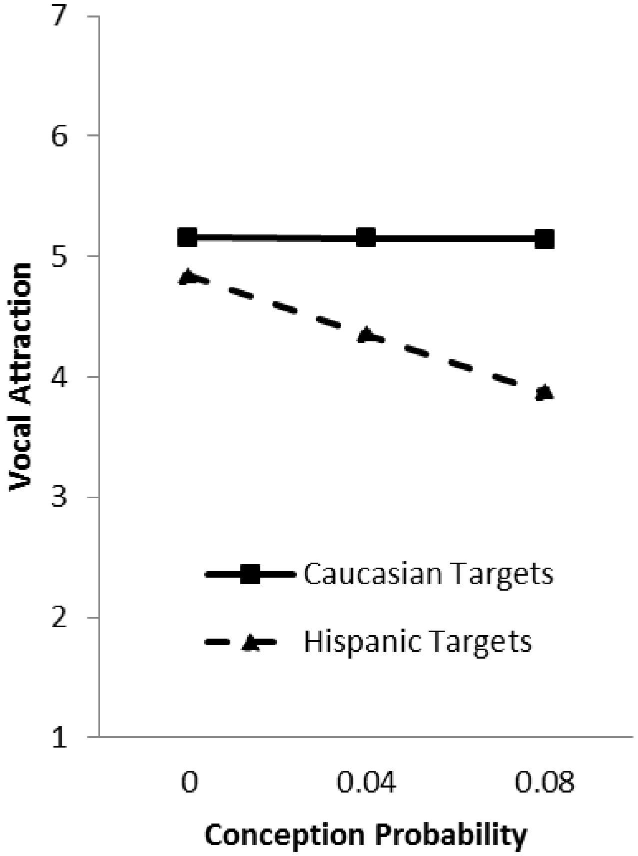

Figure 17: Non-Caucasian, non-Hispanic participants' attraction ratings as a function of targets' ethnicity and probability of conception in Study 3.

APPENDIX B

TABLES

Table 1

Regression Analyses from Study 1.

Analysis Type	β	SE	df	t	p
Basic Analysis					
Intercept	-.05	.07	94.73	-0.61	.541
Target Fertility	.05	.02	1424.33	2.20	.028
Target Ethnicity	-.43	.02	1424.33	-19.83	.000
Fertility X Ethnicity	-.12	.02	1424.33	-5.68	.000
Controlling for Pitch					
Intercept	-.04	.07	94.81	-0.55	.582
Target Fertility	.05	.02	1424.33	2.17	.031
Target Ethnicity	-.44	.02	1424.33	-20.02	.000
Fertility X Ethnicity	-.13	.02	1424.33	-5.99	.000
Controlling for Fluency Errors					
Intercept	-.02	.07	95.23	-0.25	.803
Target Fertility	.01	.02	1424.32	0.63	.530
Target Ethnicity	-.40	.02	1424.32	-17.86	.000
Fertility X Ethnicity	-.12	.02	1424.32	-5.75	.000
Controlling for Fluency Errors and Pitch					
Intercept	-.01	.07	95.32	-0.18	.861
Target Fertility	.01	.02	1424.32	0.56	.577
Target Ethnicity	-.41	.02	1424.32	-18.17	.000
Fertility X Ethnicity	-.13	.02	1424.32	-6.10	.000
Moderator: IMS					
Intercept	-.05	.07	94.75	-0.74	.459
Target Fertility	.05	.02	1424.28	2.17	.030
Target Ethnicity	-.43	.02	1424.28	-19.97	.000
IMS	.08	.04	91.97	2.14	.035
Fertility X Ethnicity	-.12	.02	1424.28	-5.72	.000
IMS X Fertility	-.04	.02	1426.45	-1.66	.097
IMS X Ethnicity	.10	.02	1426.20	4.56	.000

TABLE 1 CONTINUED

Analysis Type	β	SE	df	t	p
IMS X Fertility X Ethnicity	.01	.02	1435.44	0.34	.731
Moderator: EMS					
Intercept	-.06	.07	94.74	-0.82	.413
Target Fertility	.05	.02	1424.33	2.19	.029
Target Ethnicity	-.43	.02	1424.33	-19.84	.000
EMS	.05	.04	92.41	1.30	.198
Fertility X Ethnicity	-.12	.02	1424.33	-5.69	.000
EMS X Fertility	-.01	.02	1426.42	-0.53	.600
EMS X Ethnicity	.02	.02	1425.92	0.87	.385
EMS X Fertility X Ethnicity	.02	.02	1434.47	1.11	.269
Moderator: Political Conservatism					
Intercept	-.05	.07	94.91	-0.70	.486
Target Fertility	.05	.02	1424.36	2.21	.028
Target Ethnicity	-.43	.02	1424.37	-19.88	.000
Conservatism	-.09	.04	93.02	-2.56	.012
Fertility X Ethnicity	-.12	.02	1424.36	-5.69	.000
Conservatism X Fertility	.01	.02	1426.95	0.42	.678
Conservatism X Ethnicity	-.05	.02	1425.68	-2.53	.012
Conservatism X Fertility X Ethnicity	.02	.02	1434.95	0.73	.465
Moderator: Hispanic Interests					
Intercept	-.06	.07	94.93	-0.84	.405
Target Fertility	.05	.02	1424.28	2.21	.027
Target Ethnicity	-.43	.02	1424.28	-19.87	.000
Hispanic Interests	.11	.04	93.11	3.21	.002
Fertility X Ethnicity	-.12	.02	1424.28	-5.70	.000
Hispanic Interests X Fertility	-.01	.02	1426.96	-0.69	.489
Hispanic Interests X Ethnicity	.04	.02	1425.54	1.80	.072
Hispanic Interests X Fertility X Ethnicity	.03	.02	1434.77	1.53	.127

TABLE 1 CONTINUED

Analysis Type	*β*	SE	df	t	p
Moderator: Hispanic Partners					
Intercept	-.05	.07	94.71	-0.65	.517
Target Fertility	.05	.02	1424.33	2.16	.031
Target Ethnicity	-.43	.02	1424.32	-19.84	.000
Hispanic Partners	.01	.04	94.35	0.29	.774
Fertility X Ethnicity	-.12	.02	1424.33	-5.70	.000
Hispanic Partners X Fertility	-.01	.02	1427.21	-0.25	.805
Hispanic Partners X Ethnicity	.01	.02	1424.76	0.44	.657
Hispanic Partners X Fertility X Ethnicity	.03	.02	1429.52	1.52	.129
Moderator: Caucasian Interests					
Intercept	-.06	.07	92.74	-0.87	.387
Target Fertility	.04	.02	1393.12	1.95	.052
Target Ethnicity	-.42	.02	1393.11	-19.49	.000
Caucasian Interests	.09	.04	89.53	2.59	.011
Fertility X Ethnicity	-.13	.02	1393.11	-5.76	.000
Caucasian Interests X Fertility	-.03	.02	1395.40	-1.27	.203
Caucasian Interests X Ethnicity	-.03	.02	1395.16	-1.23	.220
Caucasian Interests X Fertility X Ethnicity	.03	.02	1405.41	1.30	.195
Moderator: Caucasian Partners					
Intercept	-.06	.08	92.57	-0.72	.475
Target Fertility	.04	.02	1394.28	1.89	.059
Target Ethnicity	-.43	.02	1394.28	-19.50	.000
Caucasian Partners	.01	.04	92.61	0.29	.775
Fertility X Ethnicity	-.13	.02	1394.28	-5.76	.000
Caucasian Partners X Fertility	.01	.02	1395.01	0.55	.580
Caucasian Partners X Ethnicity	-.02	.02	1394.53	-0.78	.438
Caucasian Partners X Fertility X Ethnicity	-.02	.02	1396.36	- 1.06	.289

Note. All analyses within this table include General Attraction as the dependent measure.

Table 2

Study 2 Regression Analyses Including Target Ethnicity as the Ingroup Manipulation.

Analysis Type	β	SE	df	t	p
Basic Analysis					
Intercept	.06	.10	48.41	0.56	.578
Target Fertility	.02	.03	729.10	0.61	.544
Target Ethnicity	-.39	.03	729.02	-12.23	.000
Fertility X Ethnicity	-.11	.03	729.10	-3.52	.000
Controlling for Pitch					
Intercept	.06	.10	48.43	0.60	.550
Target Fertility	.02	.03	729.10	0.55	.586
Target Ethnicity	-.41	.03	729.02	-12.48	.000
Fertility X Ethnicity	-.12	.03	729.10	-3.79	.000
Controlling for Fluency Errors					
Intercept	.08	.10	48.58	0.77	.443
Target Fertility	-.15	.03	729.10	-0.47	.637
Target Ethnicity	-.35	.03	729.02	-10.90	.000
Fertility X Ethnicity	-.11	.03	729.10	-3.50	.000
Controlling for Fluency Errors and Pitch					
Intercept	.09	.10	48.60	0.83	.413
Target Fertility	-.02	.03	729.10	-0.57	.571
Target Ethnicity	-.37	.03	729.02	-11.23	.000
Fertility X Ethnicity	-.12	.03	729.10	-3.80	.000
Moderator: IMS					
Intercept	.07	.11	48.36	0.61	.548
Target Fertility	.02	.03	729.10	0.60	.546
Target Ethnicity	-.39	.03	729.02	-12.30	.000
IMS	.02	.05	48.17	0.37	.713
Fertility X Ethnicity	-.11	.03	729.10	-3.55	.000
IMS X Fertility	-.03	.03	730.28	-0.84	.401
IMS X Ethnicity	.02	.03	729.90	0.63	.528
IMS X Fertility X Ethnicity	-.06	.03	734.09	1.90	.058

TABLE 2 CONTINUED

Analysis Type	*β*	SE	df	t	p
Basic Analysis					
Intercept	.05	.10	48.48	0.47	.638
Target Fertility	.02	.03	729.13	0.61	.544
Target Ethnicity	-.39	.03	729.04	-12.23	.000
EMS	-.06	.04	47.46	-1.28	.209
Fertility X Ethnicity	-.11	.03	729.13	-3.52	.000
EMS X Fertility	.02	.03	729.77	0.55	.584
EMS X Ethnicity	-.02	.03	730.95	-0.67	.506
EMS X Fertility X Ethnicity	.00	.03	732.82	0.07	.947
Moderator: Political Conservatism					
Intercept	.05	.10	48.43	0.51	.613
Target Fertility	.02	.03	729.12	0.61	.540
Target Ethnicity	-.39	.03	729.03	-12.25	.000
Conservatism	-.03	.05	47.54	-0.58	.565
Fertility X Ethnicity	-.11	.03	729.12	-3.53	.000
Conservatism X Fertility	.02	.03	730.51	0.80	.427
Conservatism X Ethnicity	-.01	.03	730.19	-0.36	.719
Conservatism X Fertility X Ethnicity	-.03	.03	734.94	-0.87	.385
Moderator: Hispanic Interests					
Intercept	.06	.10	48.49	0.62	.536
Target Fertility	.02	.03	729.04	0.57	.566
Target Ethnicity	-.39	.03	729.94	-12.25	.000
Hispanic Interests	.11	.05	47.69	2.20	.033
Fertility X Ethnicity	-.11	.03	729.03	-3.55	.000
Hispanic Interests X Fertility	-.02	.03	729.42	-0.67	.502
Hispanic Interests X Ethnicity	-.03	.03	729.91	-0.81	.417
Hispanic Interests X Fertility X Ethnicity	-.03	.03	732.92	-0.96	.337
Moderator: Hispanic Partners					
Intercept	.05	.10	48.37	0.49	.624
Target Fertility	.02	.03	729.07	0.55	.582
Target Ethnicity	-.39	.03	728.99	-12.28	.000

TABLE 2 CONTINUED

Analysis Type	*β*	SE	df	t	p
Hispanic Partners	.03	.05	48.80	0.63	.533
Fertility X Ethnicity	-.11	.03	729.07	-3.57	.000
Hispanic Partners X Fertility	.02	.03	730.46	0.67	.501
Hispanic Partners X Ethnicity	.06	.03	729.20	1.78	.076
Hispanic Partners X Fertility X Ethnicity	.03	.03	731.77	0.84	.401
Moderator: Caucasian Interests					
Intercept	.05	.10	48.40	0.53	.601
Target Fertility	.02	.03	729.10	0.63	.529
Target Ethnicity	-.39	.03	729.02	-12.28	.000
Caucasian Interests	.02	.05	47.68	0.33	.740
Fertility X Ethnicity	-.11	.03	729.10	-3.55	.000
Caucasian Interests X Fertility	.02	.03	730.66	0.50	.620
Caucasian Interests X Ethnicity	-.04	.03	730.34	-1.14	.254
Caucasian Interests X Fertility X Ethnicity	.07	.03	735.44	2.12	.035
Moderator: Caucasian Partners					
Intercept	.06	.11	47.38	0.57	.571
Target Fertility	.02	.03	714.07	0.56	.575
Target Ethnicity	-.39	.03	713.99	-12.06	.000
Caucasian Partners	-.03	.05	47.01	-0.63	.535
Fertility X Ethnicity	-.11	.03	714.07	-3.46	.001
Caucasian Partners X Fertility	.01	.03	715.53	0.45	.655
Caucasian Partners X Ethnicity	-.02	.03	714.95	-0.55	.581
Caucasian Partners X Fertility X Ethnicity	.03	.03	719.13	1.02	.308

Note. All analyses within this table include General Attraction as the dependent measure.

Table 3

Study 2 Regression Analyses Including Target School as the Ingroup Manipulation.

Analysis Type	*β*	SE	df	t	p
Basic Analysis					
Intercept	.04	.10	48.55	0.34	.738
Target Fertility	.02	.03	729.12	0.69	.493
Target School	-.05	.04	729.02	-1.48	.138
Fertility X School	-.08	.04	729.13	-2.28	.023
Controlling for Pitch					
Intercept	.04	.10	48.56	0.34	.737
Target Fertility	.02	.03	729.12	0.69	.494
Target School	-.05	.04	729.02	-1.49	.138
Fertility X School	-.08	.04	729.14	-2.26	.024
Controlling for Fluency Errors					
Intercept	.07	.10	48.73	0.69	.496
Target Fertility	-.03	.03	729.12	-0.89	.372
Target School	-.02	.03	729.02	-0.48	.632
Fertility X School	-.06	.03	729.12	-1.70	.089
Controlling for Fluency Errors and Pitch					
Intercept	.07	.10	48.75	0.69	.493
Target Fertility	-.03	.03	729.12	-0.90	.368
Target School	-.02	.03	729.02	-0.56	.579
Fertility X School	-.06	.04	729.13	-1.77	.078
Moderator: IMS					
Intercept	.05	.11	48.67	0.46	.651
Target Fertility	.02	.03	729.13	0.70	.484
Target School	-.05	.04	729.04	-1.50	.135
IMS	.02	.05	49.38	0.42	.678
Fertility X School	-.08	.04	729.20	-2.32	.021
IMS X Fertility	-.01	.03	733.15	-0.24	.808
IMS X School	-.04	.04	730.22	-1.14	.254
IMS X Fertility X School	-.03	.03	769.87	-0.86	.391

TABLE 3 CONTINUED

Analysis Type	*β*	SE	df	t	p
Moderator: EMS					
Intercept	.03	.10	48.58	0.25	.803
Target Fertility	.02	.03	729.11	0.68	.498
Target School	-.05	.04	728.10	-1.48	.139
EMS	-.06	.05	47.45	-1.26	.213
Fertility X School	-.08	.04	729.11	-2.27	.023
EMS X Fertility	.02	.03	729.53	0.55	.584
EMS X School	-.01	.04	730.08	-0.17	.867
EMS X Fertility X School	-.02	.04	767.46	-0.52	.607
Moderator: Political Conservatism					
Intercept	.03	.10	48.58	0.30	.768
Target Fertility	.03	.03	729.34	0.81	.419
Target School	-.05	.04	729.05	-1.56	.120
Conservatism	-.03	.05	47.74	-0.63	.530
Fertility X School	-.08	.04	729.17	-2.37	.018
Conservatism X Fertility	.03	.03	730.08	0.84	.401
Conservatism X School	.02	.03	729.97	0.46	.643
Conservatism X Fertility X School	-.07	.03	759.54	-1.91	.057
Moderator: Hispanic Interests					
Intercept	.04	.10	48.63	0.40	.690
Target Fertility	.02	.03	729.02	0.72	.474
Target School	-.05	.03	728.90	-1.50	.135
Hispanic Interests	.12	.05	48.57	2.51	.015
Fertility X School	-.08	.04	729.02	-2.26	.024
Hispanic Interests X Fertility	.01	.04	730.75	0.19	.852
Hispanic Interests X School	.00	.04	729.76	0.03	.977
Hispanic Interests X Fertility X School	-.07	.04	748.65	-1.89	.059
Moderator: Hispanic Partners					
Intercept	.03	.11	48.26	0.30	.767
Target Fertility	.02	.03	728.81	0.70	.485
Target School	-.05	.04	728.70	-1.50	.135

TABLE 3 CONTINUED

Analysis Type	β	SE	df	t	p
Hispanic Partners	.02	.05	52.80	0.42	.675
Fertility X School	-.08	.04	728.81	-2.29	.022
Hispanic Partners X Fertility	-.00	.04	740.87	-0.06	.953
Hispanic Partners X School	.03	.04	729.05	0.89	.372
Hispanic Partners X Fertility X School	.04	.04	775.77	1.09	.280
Moderator: Caucasian Interests					
Intercept	.03	.10	48.57	0.31	.761
Target Fertility	.02	.03	729.14	0.71	.477
Target School	-.05	.04	729.04	-1.49	.136
Caucasian Interests	.02	.05	48.32	0.42	.675
Fertility X School	-.08	.04	729.15	-2.28	.023
Caucasian Interests X Fertility	.02	.03	731.82	0.49	.625
Caucasian Interests X School	-.03	.04	730.56	-0.93	.350
Caucasian Interests X Fertility X School	-.03	.03	754.43	-0.92	.361
Moderator: Caucasian Partners					
Intercept	.04	.11	47.49	0.35	.728
Target Fertility	.02	.03	714.14	0.61	.540
Target School	-.05	.04	713.96	-1.53	.126
Caucasian Partners	-.03	.05	47.64	-0.61	.547
Fertility X School	-.08	.04	714.08	-2.28	.023
Caucasian Partners X Fertility	.01	.03	717.35	0.31	.761
Caucasian Partners X School	.04	.04	715.09	1.03	.303
Caucasian Partners X Fertility X School	.00	.04	757.30	0.07	.943

Note. All analyses within this table include General Attraction as the dependent measure.

Table 4

Study 3 Regression Analyses Including Target Ethnicity as the Ingroup Manipulation.

Analysis Type	*β*	SE	df	t	p
Basic Analysis					
Intercept	-.13	.16	47.06	-0.85	.397
Target Fertility	-.01	.03	699.36	-0.30	.762
Target Ethnicity	-.20	.03	696.76	-6.47	.000
Fertility X Ethnicity	-.10	.03	698.04	-3.38	.001
Controlling for Pitch					
Intercept	-.12	.03	697.06	-3.79	.000
Target Fertility	-.01	.03	698.35	-0.20	.844
Target Ethnicity	-.22	.03	695.47	-6.95	.000
Fertility X Ethnicity	-.12	.03	697.06	-3.79	.000
Controlling for Fluency Errors					
Intercept	-.15	.16	74.45	-0.98	.331
Target Fertility	-.05	.03	698.89	-1.40	.162
Target Ethnicity	-.17	.03	696.63	-5.18	.000
Fertility X Ethnicity	-.09	.03	697.27	-2.94	.003
Controlling for Fluency Errors and Pitch					
Intercept	-.14	.16	47.62	-0.91	.368
Target Fertility	-.04	.03	697.94	-1.32	.188
Target Ethnicity	-.18	.03	695.48	-5.67	.000
Fertility X Ethnicity	-.10	.03	696.35	-3.36	.001

Note. All analyses within this table include General Attraction as the dependent measure.

Table 5

Study 3 Regression Analyses Including Target Minimal Group as the Ingroup Manipulation.

Analysis Type	*β*	SE	df	t	p
Basic Analysis					
Intercept	-.01	.03	709.67	-0.17	.863
Target Fertility	-.04	.03	706.41	-1.39	.165
Target Group	.03	.03	699.25	0.08	.419
Fertility X Group	-.01	.03	709.67	-0.17	.863
Controlling for Pitch					
Intercept	-.14	.16	47.32	-0.88	.381
Target Fertility	-.05	.03	699.73	-1.50	.135
Target Group	.03	.03	697.71	0.82	.414
Fertility X Group	-.01	.03	707.64	-0.24	.810
Controlling for Fluency Errors					
Intercept	-.17	.16	47.69	-1.10	.277
Target Fertility	-.09	.03	700.32	-2.91	.004
Target Group	.03	.03	697.72	0.97	.332
Fertility X Group	-.01	.03	707.59	-0.35	.727
Controlling for Fluency Errors and Pitch					
Intercept	-.17	.16	47.79	-1.07	.289
Target Fertility	-.09	.03	699.38	-2.96	.003
Target Group	.03	.03	696.83	0.95	.341
Fertility X Group	-.01	.03	706.57	-0.38	.703

Note. All analyses within this table include General Attraction as the dependent measure.

APPENDIX C

STUDY 3 MATERIALS

Voice Stimuli Recording Script (Portion of Rainbow Passage; Fairbanks, 1960):

When the sunlight strikes raindrops in the air, they act as a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

Instructions for Minimal Group Task

You will be able to advance to the next page after enough time has elapsed.The next portion of the study is concerned with how people make quantitative judgments. Past studies have shown that when given the task of estimating how many objects they have seen, different people tend to consistently OVERESTIMATE or UNDERESTIMATE the correct number. While psychologists do not place any value judgments on whether it is better to be an overestimator or an underestimator, past research has shown that whether one is an overestimator or an underestimator does reveal something fundamental about the psychological characteristics and personality of the person. Different kinds of stimuli are used to detect a person's tendency toward over- or underestimation. One standard type of procedure is the color estimation task. In this procedure, which we will be using today, a grid containing blocks of two different colors will be shown for two seconds and then taken away. When the stimulus is removed, you will be asked to estimate, as accurately as you can, the percentage of blocks you saw on the grid that was BLUE. You will be asked to complete multiple trials of this task.

Under/overestimator designation text:

Based on your responses to the grids, you are an OVERESTIMATOR (UNDERESTIMATOR). Estimation tendencies are an interesting and important personality attribute, although it's not 'better' to be one way or the other. You will learn more about what this means in a later part of the study.

Rater instructions on vocal evaluation task:

Please put on your headphones and do not remove them until instructed to do so. Also, please ensure that your sound is turned on. For the next portion of the study, you will be asked to listen carefully to approximately 20 audio clips gathered from previous participants in a similar study. Each of these participants were either OVERESTIMATORS or UNDERESTIMATORS in the color estimation task you just completed. The name of the category they fall into will be displayed as the clip plays. Please click the "play" button on the next page to begin listening to the first clip. Once you have listened to the entire clip, please click continue to view the first question.

Primary Dependent Measures:

How attractive did you find the voice you just heard?

1	2	3	4	5	6	7	8	9
Extremely Unattractive							Extremely attractive	

How appealing did you find the voice you just heard?

1	2	3	4	5	6	7	8	9
Extremely Unappealing							Extremely Appealing	

How sexy did you find the voice you just heard?

1	2	3	4	5	6	7	8	9
Extremely Unsexy							Extremely Sexy	

Please use the scale below to indicate the extent to which you agree with the following statements:

1 2 3 4 5 6 7 8 9
Strongly Strongly
Disagree Agree

1. This person’s voice made me feel disgusted
2. This person’s voice made me feel scared

<u>Exploratory Dependent Measures</u>

How attractive did you find the speaker for a short-term, purely sexual relationship (such as a one-night stand)?

1 2 3 4 5 6 7 8 9
Extremely Extremely
Unattractive Attractive

How attractive did you find the speaker for a long-term relationship?

1 2 3 4 5 6 7 8 9
Extremely Extremely
Unattractive Attractive