UNIVERSITY OF CENTRAL OKLAHOMA

Edmond, Oklahoma

Jackson College of Graduate Studies

# Female Attraction to Male Muscle Mass Across the Menstrual Cycle

A THESIS

SUBMITTED TO THE GRADUATE FACULTY

In partial fulfillment of the requirements

for the degree of

MASTER OF ARTS IN PSYCHOLOGY

By

Ashalee C. Hurst

Edmond, Oklahoma

April 22, 2011

**Female Attraction to Male Muscle Mass Across the Menstrual Cycle**

A THESIS

APPROVED FOR THE DEPARTMENT OF PSYCHOLOGY

April 22, 2011

By _____

Robert D. Mather, Ph.D. Committee Chairperson

_____

Alicia Limke, Ph.D. Committee Member

_____

Wayne Lord, Ph.D. Committee Member

**Acknowledgements**

Thank you to my advisor, Dr. Robert Mather, for giving me the freedom to explore my interests, and whose patience and encouragement greatly contributed to the completion of this project. Thank you to Dr. Limke and Dr. Lord for serving on my thesis committee. Thank you, Ronny Brown, for revising several drawings for use in the stimulus sets. Lastly, thank you to the Office of Research & Grants at the University of Central Oklahoma for supporting this project through a grant.

## Table of Contents

## Abstract

The current project investigated female attraction to male muscle mass across the menstrual cycle. On four separate occasions in a five week period, female participants rated the attractiveness of images of male bodies. Images included four different levels of muscle mass: low muscle, medium muscle, high muscle, and extremely high muscle. It was hypothesized that females would rate the high and the extremely high muscle mass images higher in attractiveness when ovulating than when not ovulating. It was also hypothesized that females would rate the low muscle mass images low in attractiveness regardless of ovulatory status. Results revealed no significant interaction between ovulatory status and ratings of muscle mass. However, there was a significant main effect for muscle mass. Extremely high muscle images were rated significantly higher than both medium muscle images and low muscle images. High muscle images were rated significantly higher than both medium muscle images and low muscle images. Medium muscle images were rated significantly lower than both extremely high muscle images and high muscle images, but higher than low muscle images. Low muscle images were rated significantly lower than extremely high muscle images, high muscle images, and medium muscle images, each. It seems that muscle mass is not one of the indications of testosterone level that females use to evaluate mates. Additionally, females do not appear to be highly attracted to males with very low muscle mass, regardless of ovulatory status.

## Female Attraction to Male Muscle Mass Across the Menstrual Cycle

More than likely, everyone has, at some point in life, been attracted to another person without really knowing why. Attraction is a mysterious phenomenon that can develop after repeated exposure to another person or can suddenly appear the first time a person meets someone else. There is that type of attraction that people have for others with whom they share similar interests (Aronson, Wilson, & Akert, 2007). Then, there is the type of attraction that develops when two people have known each other for a long period of time (Aronson et al., 2007). There is also a more primitive type of attraction that seems to take hold of a person immediately upon exposure to another. That type of attraction is usually due to a physical attraction (Walster, Aronson, Abrahams, & Rottman, 1966). The question is: what causes that physical attraction?

Biological and psychological research has unveiled many reasons why people are physically attracted to another person. Most results from that research have one common theme: humans are attracted to individuals that are capable of producing and ensuring the survival of healthy offspring (Buss, 1987). Those findings suggest that humans have biological and psychological underpinnings guiding them to keep the species alive.

Males and females are attracted to different characteristics because in their ancestral past, males and females had different roles and different challenges to overcome (see Sugiyama, 2005). The current project focuses on female mate preferences and how challenges in females' evolutionary past may influence female mate preferences. An examination of Darwin's ideas on evolutionary theory and sexual selection is necessary to fully understand female mate preferences.

### Goals of Attraction for Both Sexes

When Darwin (1859) proposed his theory of evolution, he suggested that females play a role in the change of a species over time. This theory is called sexual selection. Females prefer certain types of mates over others, and the chosen mates' genes are carried into the future through the chosen mate's offspring. For example, male peacocks have magnificently colored tails. Although beautiful, those tails are surely targets for predators. The colorful tail could be perceived as more of a death sentence than a target of attraction, but the reality is quite the contrary. Female peacocks prefer mates with the most elaborately colored tails, so the males with elaborately colored tails produce the most offspring. Male offspring inherit colorful tails and female offspring inherit the desire to mate with males that have colorful tails. In addition to demonstrating how females shape the phenotype of the species, the former example also demonstrates how females shape the psychological processes in the species (i.e., female peacocks are attracted to male peacocks with beautifully colored tails).

Darwin (1872) also identified two different types of sexual selection. Intrasexual selection is selection that favors traits that enable individuals of the same sex to compete for mates. For example, horns, tusks, or large muscles allow males to fight, and the male that wins in a fight has a better chance to mate with the female. Males with the biggest or most effective horns, tusks, or muscles will produce offspring with large, effective horns, tusks, or muscles. Intersexual selection is selection that favors traits that are attractive to the opposite sex. For example, the male peacocks' tails do not allow the males to fight each other more effectively; however, the tails do allow the males to be identified by the females as more attractive mates.

Buss and Schmitt's (1993) Sexual Strategies Theory suggested that males and females choose specific mates to achieve goals. Mating goals are different for the sexes because throughout their evolutionary past, males and females needed to solve different adaptive

problems. Males pursuing short-term mates need to find multiple women who are sexually accessible, fertile, and uninterested in commitment. Males pursuing long-term mates have to identify females who are reproductively valuable, faithful (to ensure paternity), good at parenting, and have a willingness to commit to a long-term relationship. Females pursuing short-term mates need to find males who are willing to immediately share their resources and who have the potential to be long-term mates. Females pursuing long-term mates need males who have the ability to invest resources in them and their children in the long-term, are willing to invest those resources, have good parenting skills, are willing to commit, and can protect them against aggressors. Because ancestral males and females had different adaptive problems, they developed different psychological mechanisms. This helps explain why males and females have different mate preferences.

The primitive human urges that drive attraction are ultimately due to a want and need to produce healthy children so that human genes can survive into the future (Buss, 1987). Despite the differences in male and female mate preferences, all humans are attracted to cues to good health, which indicate good genes (Buss et al., 1990). Psychological research has illustrated several examples of these preferences in both males and females.

Both sexes are attracted to individuals with symmetrical faces (Grammer & Thornhill, 1994) because facial symmetry is an indication of health. Individuals with symmetrical faces have not been exposed to disease that would alter facial symmetry and symmetrical individuals have not suffered serious trauma that would alter facial symmetry. In addition to symmetry, men prefer women with a small waist and larger hips (Singh & Young, 1995). Women with large hips are more likely than women with narrow hips to bear children. In contrast, women prefer men with a narrow waist and a broad chest and shoulders (Maisey, Vale, Cornelissen, & Tovee,

1999). Men with this body type are more likely than men with smaller chests and shoulders to be stronger and healthier. Muscle mass, such as the kind that increases chest and shoulder size, is related to testosterone levels because testosterone promotes muscle growth (Shier, Butler, & Lewis, 1999).

To summarize, males and females have different preferences for the opposite sex, but most of those preferences reflect an attraction to mates that can produce and care for offspring. It is not enough for humans to simply produce offspring. For human offspring to survive, the offspring must be taken care of physically and financially (more specifically, have access to resources such as food and shelter).

## Goals of Attraction for Females

Females are historically responsible for the physical care of their young whereas males are generally responsible for resource contribution (Buss & Schmitt, 1993). Thus, an ideal mate for a female would be one that is physically fit (can contribute healthy genes to offspring) and is also willing to commit time and resources to the woman and children. Obtaining a mate who is both fit and committed is problematic for women. The stronger, healthier men provide good genes, but they probably have access to more mates and are less willing to commit than less healthy men. The men who were less physically fit do not necessarily provide the best genes, but they probably have access to fewer mates and are more willing to commit than the healthier men. The difficulty in finding a mate that is both healthy and willing to commit may have prompted women to evolve psychological mechanisms to deal with the issue of trade-offs (see Gangestad, Thornhill, & Garver-Apgar, 2005; Trivers, 1972).

Females must choose between a genetically fit mate who is not likely to commit and a less genetically fit mate who is willing to commit. However, the decision is not always quite so

simple. If a female could mate once with a genetically fit male and get pregnant, and then enter into a long term commitment with a less genetically fit male, she could ensure that her offspring inherit good genes and also have the resources they need to survive. In other words, her offspring would be genetically fit, but she would still have a mate around to help with child rearing and resource contribution. Incredibly, females may have evolved psychological mechanisms that allow them to use their concealed ovulation to effectively succeed at that task.

Psychological mechanisms can be influenced by biological mechanisms, and one biological mechanism that may play an important role in female attraction is the menstrual cycle. Normal, healthy women have menstrual cycles that range in length from 21 to 42 days. The standard, 28-day cycle can be divided into three different phases: menses, follicular, and luteal. Menses begins on the first day of bleeding and lasts 1 to 5 days. Next is the follicular phase, which occurs from days 6 through 14. Finally, women enter the luteal phase from days 12 through 28. In this standardized cycle, ovulation occurs on day 14; thus, peak fertility occurs on days 9 through 14 (Baker & Bellis, 1995). Women can get pregnant up to six days during their cycle (Wilcox, Weinberg, & Baird, 1995), which means that during most days of the menstrual cycle, women are unable to become pregnant. Thus, women may have developed different mate preferences for different segments of their cycles (e.g., Gangestad & Thornhill, 1998). Research indicates that women are attracted to good genes when they are fertile; however, when they are not fertile, they are attracted to physical indications that a male is likely to commit (e.g., Little, Jones, & Burriss, 2007; Penton-Voak, & Perrett, 2000).

## Ovulation Status as a Predictor of Attraction

For a female to choose the right mate, she must first have a way to determine which males are genetically fit (Gangestad & Thornhill, 1998). One way to guess the probability of a

man being healthy or not is by identifying his testosterone level. Research suggests that testosterone is hard on the immune system (Roden et al., 2004); thus, a person must have a strong, healthy immune system to withstand large amounts of testosterone in the body. In ancestral times, hormone testing was not an option, so women had to develop keen senses to determine a man's fitness level. There are several tell-tell signs of high testosterone levels.

Testosterone affects the shape of a person's face. Broad jaw lines are indicative of high levels of testosterone whereas narrow jaw lines are indicative of low levels of testosterone. Ovulating women are more attracted than non-ovulating women to men with a broad jaw line (Penton-Voak & Perrett, 2000). Voice is affected by testosterone level such that lower-voiced men have higher levels of testosterone and higher-voiced men have lower levels of testosterone. Ovulating women are more attracted than non-ovulating women to lower-voiced men (Feinberg et al., 2006).

A person's scent is indicative of body symmetry. Gangstad and Thornhill (1998) asked men to wear the same shirt for two nights and then return the shirt to the experimenter. Women were asked to smell the shirts and identify which scents they preferred. Ovulating women preferred the scents of symmetrical men more than non-ovulating women did. It is unclear what chemical actually causes body symmetry, but some suggest that testosterone plays a role (Gray, Kahlenberg, Barrett, Lipson, & Ellison, 2002).

Body shape is also influenced by testosterone, and different body shapes promote different gaits. Male walkers have a larger upper-body lateral sway than female walkers (Mather & Murdoch, 1994). Female walkers sway their hips more than male walkers (Troje, 2003). To study body movements, point-lights can be attached to major joints of moving people and then body movements (such as walking) are recorded. Because the lights are all that are visible in the

display, these are called point-light displays. When women rate the attractiveness of point-light walkers, the ovulating women are more attracted to masculine point-light walkers than are non-ovulating women (Provost, Troje, & Quinsey, 2008).

Testosterone also influences a person's hip-to-waist ratio because it promotes fat deposits in the abdominal region (Rebuffescrive, 1987). This is why men tend to have a larger hip-to-waist ratio that is less curvy than women's. Women who are ovulating prefer the masculine hip-to-waist ratio more than non-ovulating women (Little, Jones & Burris, 2007).

Male displays of dominance are influenced by testosterone as well. Testosterone is correlated with male aggression (although the correlation in human males may be much weaker than generally believed; Book, Starzyk, & Quinsey, 2001), and this aggression can be used to hurt or protect female mates. When males aggress against females, the aggression negatively affects females. If, however, the aggression is used to protect a female from other aggressors, the aggression is beneficial for her. Keeping those points in mind, it is not surprising that ovulating women are attracted to male displays of social dominance (Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004).

In summary, research suggests that women prefer males with indicators of high levels of testosterone when they are ovulating compared to when they are not ovulating. This change in mate preferences across the ovulatory cycle is how women have been able to overcome the seemingly forced tradeoff between good genes and commitment. This shift in preferences is a non-conscious phenomenon. It is a psychological adaptation that women evolved to ensure the survival of their genes. Like many other evolved psychological mechanisms, this mechanism is an automatic process.

Social automaticity is an automatic thought, feeling, or behavior in a social situation

(Mather & Romo, 2007). It does not require conscious processing, but rather, allows complex thoughts and behaviors to simply emerge. Evolution is a driving force behind these automatic processes and because evolution is a dynamical system (i.e., an open system that changes or adapts because of interactions between the environment and the system), these evolutionary adaptations self-emerge when the context of the situation is just right (Allen & Strathern, 2003).

Most women are unaware of their ovulation status, but the preference for good genes during ovulation appears to be the norm (e.g., Feinberg et al., 2006; Gangestad & Thornhill, 1998; Gangestad et al., 2004; Little et al, 2007; Penton-Voak & Perrett, 2000; Provost et al., 2008). Thus, women's desire for good genes during fertility may be an evolved, automatic mechanism. Women who mated with fit males and committed to less fit males experienced reproductive success. Reproductive success is not only beneficial for the individual but also for the species as a whole. Thus, this psychological mechanism is an evolutionary prize for the human race.

## Ovulation Detection

An issue that affects much of the research on female mate preference is the difficulty in finding a valid and reliable tool to detect ovulation in women. A medical laboratory could perform a diagnosis to detect ovulation, but that would be quite costly when studying multiple participants. Researchers can detect ovulation by identifying levels of hormones such as estrogen, progesterone, and testosterone, either through saliva or urine samples, but this is also expensive if the researchers do not have the equipment in their own laboratories. Cost-effective options have reliability-related issues. For example, tests of the reliability of measuring peaks in luteinizing hormone (LH) from urine samples have had mixed results. Guida et al. (1999) found 100% correlations between peaks in LH and ovulation. However, McGovern (2004) found that

positive urine LH tests do not reliably predict ovulation. Despite McGovern's findings, luteinizing hormone urine assays have become a fairly common tool in psychological research (e.g., Durante, Griskevicius, Hill, Perilloux, & Li, in press; Haselton & Larson, 2011). Moreover, one study showed that the salivary ferning test had a 36.8% ovulation detection rate the day of ovulation and body temperature measurements were fairly unreliable as well (Guida et al., 1999).

Instead of identifying hormone levels, several studies use the rhythmic method, which is based on a standard 28-day model of the menstrual cycle (e.g., Gangestad et al., 2004; Gangestad & Thornhill, 1998; Little et al, 2007; Penton-Voak & Perrett, 2000). According to this method, if a woman knows the first day of her last menstruation, she can count back 14 days and assume that she was ovulating on that day. Some researchers that use this type of model (e.g., Penton-Voak & Perrett, 2000) divide women up into high fertility (days 6 through 14) and low fertility (days 0 through 5 and 15 through 28). The rhythmic method is very cost effective, but it has flaws as well. For example, many women have cycles that fall out of that "normal" 28-day range. If a woman's cycle is, say, 24 or 32 days, the rhythmic method may not accurately predict ovulation. Researchers using the rhythmic method may want to remove data for participants with longer or shorter cycles to increase their chances of pinpointing fertile days. The rhythmic method has been successfully used in research by limiting participation to normal cycling women (see Vaughn, Bradley, Byrd-Craven, & Kennison, 2010). Menstrual information (i.e., knowledge of the first day of their last menses) is then used to project high (days 6 through 14) and low (days 0 through 5 and 15 through 28) fertility days for each participant.

## Current Research Goals

If the psychological mechanism that prompts ovulating women to prefer males with high testosterone levels and non-ovulating women to prefer males with lower levels of testosterone is

truly beneficial to the human race, there should be more cases in which this phenomenon is evident. That is, further research should illustrate the same effect in which women are more attracted to signs of high testosterone levels when they are ovulating compared to when they are not ovulating.

The current study will investigate female preference for muscle mass. Because testosterone promotes muscle development (Shier et al., 1999), males with more muscle mass should have higher levels of testosterone than males with less muscle mass. In general, women tend to be more attracted to physically fit males (i.e., average to high levels of muscle mass) than unfit males (i.e., very low muscle mass or overweight) regardless of whether they are ovulating or not (Dixson, Halliwell, East, Wignarajah, & Anderson, 2003). If testosterone is really the cue that women are noticing to determine genetic fitness, the current study should find that women are more attracted to extremely high muscle mass when they are ovulating compared to when they are not ovulating. Women should be more attracted to high muscle mass when they are ovulating than when they are not ovulating. Women should be more attracted to medium muscle mass when they are not ovulating than when they are ovulating. All participants should rate the low muscle mass images equally low at all times of the ovulatory cycles because, in general, women seem to prefer a "fit" body type (Dixson et al., 2003) and the low muscle mass images may be perceived as "unfit" due to the lack of muscle.

## Method

### Participants

Thirty-three female students from introductory psychology courses at the University of Central Oklahoma consulted with the researcher for partial fulfillment of a course requirement. All 33 participants were consulted, but four were unable to participate because they did not meet

all the prerequisites for the study (i.e., three had taken hormonal contraceptives in the past three months, and one could have been pregnant). Another participant was dropped because she became pregnant in the middle of the study. Three participants arrived for the consultation but never came back for data collection. Four participants were dropped from the study for missing two of the four experimental sessions. At the end of data collection, data for 11 participants was dropped because their menstrual cycles deviated more than two days from the standard 28-day cycle (i.e., these participants had either less than 26 days or more than 30 days in their cycle). Thus, there were 10 participants used for data analysis. All participants were between the ages of 18 and 21 ($M$ = 19.60, $SD$ = 1.17). Additionally, all participants were attracted to males and identified themselves as heterosexual. None of the remaining participants had taken any type of hormonal medication within the last three months, had regular menstrual cycles, and were not pregnant.

**Materials**

**Consent and demographic forms.** Consent forms were given to participants before the onset of the study. Demographics sheets were given to participants to determine age, relationship status, and sexual orientation (see Appendix A). On the same sheet, participants listed the first day of their last menstruation and how many days there normally are between cycles (i.e., how many days there are between the start of one menstruation and the start of the next menstruation). They were also given a medication checklist of different types of hormonal medications and asked to check which ones they had taken in the past three months (see Appendix B).

**Stimulus set.** Participants were required to rate the attractiveness of pictures of male bodies on a scale of 0 to 7 (0 = very unattractive and 7 = very attractive). Four different levels of

muscle mass were depicted in the pictures: low, medium, high, and extremely high. Once a week, for four weeks (over a period of five weeks, data was only collected for four weeks because Spring Break fell within that time frame ), participants were presented with a set of four separate pictures, each depicting one of the four levels of muscle mass. There were six different sets of pictures, with each set illustrating the four levels of muscle mass. In other words, during every meeting, the participants viewed four pictures: one of low muscle mass, one of medium muscle mass, one of high muscle mass, and one of extremely high muscle mass (see Appendix C). All six sets of pictures were counterbalanced among participants and pictures within each set were also counterbalanced.

**Stimuli development.** All pictures were revised to fit the requirements of the current study. They were modeled after a previous study that used pictures of male bodies to gauge female mate preference for differing levels of muscle mass on males (Dixson et al., 2003). Six sets of pictures were drawn, and each set contained four distinct body types (i.e., low, medium, high and extremely high muscle mass).

## Design

The current study was a 2 x 4 design. The first independent variable was fertility (high vs. low). The second independent variable was level of muscle mass depicted in the pictures (low, medium, high, and extremely high). The dependent variable was the physical attractiveness ratings of the pictures of male bodies.

## Procedure

Participants arrived at their orientation meeting to discuss the requirements of the study, sign the consent form, fill out the demographic sheet, and medication checklist. Participants were also given a handout that contained birth control methods that were acceptable to use while in the

study and were unacceptable to use while in the study (see Appendix D). Next, the researcher clarified that participants should not stop taking any medications for the study. Furthermore, the researcher emphasized that information provided by participants would remain confidential throughout and after the study. At last, a schedule of meeting times was made for the participant to follow for the next five weeks.

The schedule was developed after estimating participants' most fertile and infertile days for the next five weeks. To do this, the researcher evaluated the participants' self-reported menstrual cycle information (i.e., the first day of their last menstruation and their typical cycle length), and then used that information to apply the rhythmic method. Using a standard 28-day cycle, high (days 6-14) and low (days 0-5 and 15-28) fertility days were estimated for each participant. Most women are ovulating 14 days before menses, so a calendar (along with the self-reported menstrual information) was used to determine when that exact day was for each individual participant. The researcher also noted what day of the week it fell on and made the participants' schedules so that they reported to the study on that day of the week for the next five weeks. For example, if one participant's next menses was going to occur on the 15$^{th}$ of the month, she should be ovulating on the 1$^{st}$ (which is 14 days before menses). If the 1$^{st}$ of the month fell on a Friday, the participant reported for the study every Friday for the next five weeks. This increased the chances that the participant would be ovulating at least one time during data collection.

When participants arrived for the first day of data collection, they sat at a computer and followed the directions presented on the computer monitor. They were first asked several questions (i.e., have you used any type of hormonal medication, such as oral contraceptives, in the past three months? Have you recently used "the morning after" or "Plan B" pill? When was

the first day of your last menstruation? Could you be pregnant? Have you moved recently? Do you live with any males who are not related to you and if so, how long? Do you live with any females and if so, how long? Are you in a relationship and if so, for how long?).

Next, participants were shown four separate pictures of male bodies (one picture for each body type). Pictures remained on the screen for three seconds. After three seconds, the rating scale appeared on the screen. The participants were required to rate each picture's physical attractiveness before moving on to the next picture. After completing ratings for all four pictures, the participants were dismissed. This procedure was followed once a week for the next five weeks, however, one week of data collection was skipped due to Spring Break. Thus, every participant provided data at four separate times within a five week span. On the last day of the study, participants filled out another demographic sheet. Next, they looked at one of the stimulus sets (with pictures of four different levels of muscle mass), and identified which body type was most similar to their father figure (if applicable) and which body type was most similar to their partner (if applicable). At last, participants were debriefed (see Appendix E) and asked to contact the researcher if they became pregnant within three months of study completion.

## Results

An Ovulatory Status (ovulating; not ovulating) by Muscle Mass (low; medium; high; extremely high) ANOVA was conducted on attraction ratings. Mauchly's test of sphericity was met for the Ovulatory Status by Muscle Mass interaction. However, it was not met for the effect to Muscle Mass, so Greenhouse-Geisser was used to interpret that data.

The Ovulatory Status by Muscle Mass interaction was not significant, $F(3, 27) = 1.50$, $p = .236$, partial eta squared = .14, observed power = .35. Thus, there was no significant difference in ratings of attractiveness for Low Muscle images when ovulating ($M = 2.25$, $SD =$

1.23) versus not ovulating (*M* = 1.83, *SD* = 1.59). There was no significant difference in ratings of attractiveness for Medium Muscle images when ovulating (*M* = 3.13, *SD* = 1.78) versus not ovulating (*M* = 2.59, *SD* = 1.28). There was no significant difference in ratings of attractiveness for High Muscle images when ovulating (*M* = 5.15, *SD* = 1.31) versus not ovulating (*M* = 5.47, *SD* = 1.11). There was no significant difference in ratings of attractiveness for Extremely High Muscle images when ovulating (*M* = 5.13, *SD* = 1.39) versus not ovulating (*M* = 5.62, *SD* = 1.63).

There was a main effect of Muscle Mass, $F(1.54, 13.88) = 31.66$, $p < .001$, partial eta squared = .78, observed power = 1.00. There was no significant difference between ratings of Extremely High Muscle and High Muscle images. However, Extremely High Muscle images were rated significantly higher in attractiveness than Medium Muscle images, $F(1, 9) = 22.69$, $p = .001$, partial eta squared = .72, observed power = .99. Extremely High Muscle images were also rated significantly higher in attractiveness than Low Muscle images, $F(1, 9) = 32.52$, $p < .001$, partial eta squared = .78, observed power = .99.

High Muscle images were rated significantly higher in attractiveness than Medium Muscle images, $F(1, 9) = 44.49$, $p < .001$, partial eta squared = .83, observed power = 1.00. High muscle images were also rated significantly higher in attractiveness than Low Muscle images, $F(1, 9) = 58.70$, $p < .001$, partial eta squared = .87, observed power = 1.00. Medium Muscle images were rated significantly higher in attractiveness than Low Muscle images, $F(1, 9) = 27.29$, $p = .001$, partial eta squared = .75, observed power = .99.

## Discussion

The primary hypothesis, that women prefer higher levels of muscle mass when ovulating and less muscle mass when not ovulating, was not confirmed. There was no Ovulation Status by

Muscle Mass interaction, and pairwise comparisons revealed no significant difference between women's ratings of stimuli when they were ovulating compared to when they were not ovulating. These findings suggest that muscle mass may not be one of the signs of testosterone level that women pick up on to select a mate. However, the non-significant interaction may be the result of inaccurate detection of ovulation. If data were not accurately categorized (i.e., data collected while participants were ovulating was placed in the non-ovulating category and vice-versa), a significant interaction would be unlikely to emerge.

The data do confirm the prediction that Low Muscle images would be rated lower than all other levels of muscle mass, regardless of ovulatory status. Pairwise comparisons demonstrated that Low Muscle images received significantly lower ratings compared to all other levels of muscle mass, and this held true when ovulating ($M$ = 2.25, $SD$ = 1.23) and when not ovulating ($M$ = 1.83, $SD$ = 1.59). It seems that, regardless of ovulatory status, women are not highly attracted to males with low muscle mass.

Although correlations were not reported in the results section due to the small sample size, the correlations involving the participants' fathers' body types are interesting and worthy of discussion[1]. There were negative correlations between Father Body Type and ratings of both Medium Muscle images (while not ovulating) and High Muscle images (while not ovulating).

[1] To determine if participants' attractiveness ratings of images correlated with their father figure's body type or their current partner's body type, Pearson's correlation coefficients were calculated. First, there were no correlations between partner body type and father body type. There were also no correlations between partner body type and the attractiveness ratings of the stimuli. There was a significant negative correlation between father body type and ratings of Medium Muscle images while not ovulating ($r$ = -.855, $p$ = .002). There was also a significant negative correlation between father body type and ratings of High Muscle images while not ovulating ($r$ = -.696, $p$ = .025). There was a significant positive correlation between ratings of Medium Muscle images while ovulating and Low Muscle images while ovulating ($r$ = .916, $p$ < .001). There was a significant positive correlation between ratings of Low Muscle images while not ovulating and Low Muscle images while ovulating ($r$ = .849, $p$ = .002). There was a significant positive correlation between ratings of Low Muscle images while not ovulating and Medium Muscle images while ovulating ($r$ = .886, $p$ = .001). Finally, there was a significant positive correlation between ratings of Extremely High Muscle images while not ovulating and Extremely High Muscle images while ovulating ($r$ = .745, $p$ = .013).

Ninety percent of the participants selected a Medium Muscle image or a High Muscle image to represent their father's body type (the remaining 10% selected the Low Muscle image).

One could suggest that these negative correlations reflect an attraction to body types that are different from one's father, but only when they are not ovulating. It is unclear why a female would avoid choosing mates similar to her father when she is not ovulating. The finding would make more sense if this correlation appeared when women were ovulating. In that situation, it could demonstrate that females want to avoid mating with their fathers when fertile to avoid birth defects in offspring caused by incestuous mating. Perhaps, these correlations do provide evidence for females possessing an inherent avoidance of incestuous mating behavior, but possible measurement errors in detection of ovulation may have prevented this correlation from showing up in the ratings of Medium and High Muscle images while participants were ovulating.

## Limitations

The current study has some limitations. First, the sample size was very small (only 10 participants were included in the data analysis). With so few participants, it is likely that the sample was not representative. In addition, when sample size is low, one atypical response from a participant is highly likely to negatively influence the results.

Another limitation of the current study is the method in which ovulation was detected. As noted earlier, the rhythmic method is a fairly common tool in psychological research, but due to variability in women's ovulatory cycles, it is not always accurate. All the participants were young (18-21 years old), and several had moved six months earlier to attend school. It is possible that many of the participants had irregular cycles after moving to a new place, living with new people, entering college for the first time, etc. If their cycles were irregular, the rhythmic method may not have accurately pinpointed the days they were ovulating.

The stimuli were hand-drawn, black-and-white images that were revised to reflect all four levels of muscle mass. The results indicate that ratings of High Muscle and Extremely High Muscle images were not significantly different. Perhaps, the stimuli depicting those levels of muscle mass were too similar. An artist revised all the pictures to make sure there was clear differentiation of muscle mass between them, but pilot testing would have helped to identify whether or not images were distinct truly from one another.

## Future Directions

A follow-up study should be conducted to address the limitations of the current project, and to further investigate the possibility of women's preferences for male muscle mass changing across the menstrual cycle. Due to the inadequate sample size of the current within-subjects, repeated measures design, it may be beneficial to employ a between-subjects design (i.e., participants show up one time, rather than several times) to promote higher participant numbers.

Because there is uncertainty as to whether or not the rhythmic method accurately predicted ovulation in the current sample, future work should use another measure of ovulatory status. Over-the-counter, urine luteinizing hormone (LH) assays could be used in addition to the rhythmic method to provide a more accurate estimate of ovulatory status (Haselton & Larson, 2011).

A final suggestion for future work pertains to the stimulus set. Images should be pilot tested to ensure that all four levels of muscle mass are not only represented, but are differentiated from one another. In addition to pilot testing, it might be beneficial to develop a stimulus set from real pictures, rather than black and white drawings. A more naturalistic stimulus set may produce different responses from participants.

References

Allen, P. M., & Strathern, M. (2003). Evolution, emergence, and learning in complex systems. *Emergence, 5*(4), 8-33.

Aronson, E., Wilson, T. D., & Akert, R. M. (2007). *Social psychology* (6th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Baker, R. R., & Bellis, M. A. (1995). *Human sperm competition: Copulation, masturbation and infidelity.* London; New York: Chapman & Hall.

Book, A., Starzyk, K., & Quinsey, V. L. (2001). The relationship between testosterone and aggression: A meta-analysis. *Aggression and Violent Behavior, 6*(6), 579-599.

Buss, D. M. (1987). Love acts: The evolutionary biology of love. In R. J. Sternberg & M. F. Barnes (Eds.), *The psychology of love* (pp. 100-118). New Haven: Yale University Press.

Buss, D. M., Abbott, M., Angleitner, A., Biaggio, A., Blanco-Villasenor, A., Bruchon-Schweitzer, M.,…Yang, K. (1990). International preferences in selecting mates: A study of 37 societies. *Journal of Cross Cultural Psychology, 21*, 5-47.

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

Darwin, C. (1859). *On the origin of species.* London: John Murray.

Darwin, C. (1872). *The descent of man and selection in relation to sex*. London: John Murray.

Dixson, A. F., Halliwell, G., East, R., Wignarajah, P., & Anderson, M. (2003). Masculine somatotype and hirsuteness as determinants of sexual attractiveness to women. *Archives of Sexual Behavior, 32*, 29-39.

Durante, K. M., Griskevicius, V., Hill, S. E., Perilloux, C., & Li, N. P. (in press). Ovulation, female competition, and product choice: Hormonal influences on consumer behavior.

*Journal of Consumer Research.*

Feinberg, D. R., Jones, B. C., Law-Smith, M. J., Moore, F. R., DeBruine, L. M., Cornwell, R. E., Hillier, S. G., Perret, D. I. (2006). Menstrual cycle, trait estrogen level, and masculinity preferences in the human voice. *Hormones and Behavior, 49*(2), 215-222.

Gangestad, S. W., Simpson, J. A., Cousins, A. J., Garver-Apgar, C. E., & Christensen, P. N. (2004). Women's preferences for male behavioral displays change across the menstrual cycle. *Psychological Science, 15,* 203-207.

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

Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2005). Adaptations to ovulation. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 344-371). Hoboken, N.J.: John Wiley & Sons.

Grammer, K., & Thornhill, R. (1994). Human (*Homo sapiens)* facial attractiveness and sexual selection: The role of symmetry and averageness. *Journal of Comparative Psychology, 108,* 233-242.

Gray, P. B., Kahlenberg, S. M., Barrett, E. S., Lipson, S. F., & Ellison, P. T. (2002). Marriage and fatherhood are associated with lower testosterone in males. *Evolution and Human Behavior, 23,* 193-201.

Guida, M, Tommaselli, G. A., Palomba, S., Pellicano, M., Moccia, G., Di Carlo, C., Nappi, C. (1999). Efficacy of methods for determining ovulation in a natural family planning program. *Fertility and Sterility, 72*(5), 900-904.

Haselton, M. G., & Larson, C. M. (2011). *The evolution of women's mating psychology: conflicts between adaptations facilitating pair-bonds and adaptations threatening them.* Presented

at the Maintaining Romantic Relationships: Evolution, Hormones, and Implicit Cognition symposium at the 12th Annual Society for Personality and Social Psychology Conference, San Antonio, TX.

Little, A. C., Jones, B. C., Burriss, R. P. (2007). Preferences for masculinity in male bodies change across the menstrual cycle. *Hormones and Behavior, 51,* 633-639.

Maisey, D. S., Vale, E. L. E., Cornelissen, P. L., Tovee, M. J. (1999). Characteristics of male attractiveness for women. *Lancet, 353,* 1500.

Mather, R. D., & Romo, A. (2007). *Automaticity and cognitive control in social behavior*. Southlake, TX: Fountainhead.

Mather, G., & Murdoch, L. (1994). Gender discrimination in biological motion displays based on dynamic cues. *Proceedings of the Royal Society B, 258,* 273-279.

McGovern, P. G. (2004). The unreliability of home urine luteinizing hormone test kits has important implications for clinical practice. *Fertility and Sterility, 82*(5), 1300.

Penton-Voak, I. S., & Chen, J. Y. (2004). High salivary testosterone in linked to masculine male facial appearance in humans. *Evolution and Human Behavior, 25,* 229-241.

Penton-Voak, I. S., & Perrett, D. I. (2000). Female preferences for male faces changes cyclically: Further evidence. *Evolution and Human Behavior, 21*, 39-48.

Provost, M. P., Troje, N. F., Quinsey, V. L. (2008). Short-term mating strategies and attraction to masculinity in point-light walkers. *Evolution and Human Behavior, 29,* 65-69.

Rebuffescrive, M. (1987). Regional adipose-tissue metabolism in men and in women during menstrual-cycle, pregnancy, lactation, and menopause. *International Journal of Obesity, 11*, 1.

Roden, A. C., Moser, M. T., Tri, S. D., Mercader, M., Kuntz, S. M., Dong, H., Hurwitz, A. A.,

McKean, D. J., Celis, E., Leibovich, B. S., Allison, J. P., & Kwon, E. D. (2004). Augmentation of T cell levels and responses induced by androgen deprivation. *Journal of Immunology, 173*, 6098-6108.Shier, D., Butler, J., & Lewis, R. (1999). Hole's human anatomy and physiology (8th ed.). Boston: WCB/McGraw-Hill.

Singh, D., & Young, R. K. (1995). Body weight, waist-to-hip ratio, breasts, and hips: Role in judgments of female attractiveness and desirability for relationships. *Ethology and Sociobiology, 16*, 483-507.

Sugiyama, L. S. (2005). Physical attractiveness in adaptationist perspective. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 292-343). Hoboken, N.J.: John Wiley & Sons.

Trivers, R. L. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man: 1871–1971* (pp. 136–179). Chicago: Aldine.

Troje, N. F. (2003). Cat walk and western hero: Motion is expressive. *IGSN Report*, 40-43.

Walster, E., Aronson, V., Abrahams, D., & Rottman, L. (1966). Importance of physical attractiveness in dating behavior. *Journal of Personality and Social Psychology, 5*, 508-516.

Wilcox, A. J., Weingerg, C. R., & Baird, B. D. (1995). Timing of sexual intercourse in relation to ovulation. *New England Journal of Medicine, 333*, 1517-1521.

Appendix A

Demographic sheet

How old are you?

_____

What is your relationships status? Please check an option below.

_____Single

_____In a relationship

_____Married

_____Other. Please specify on line below

_____

If you are in a relationship, how long have you been with your partner?

_____

Do you have any children?

_____Yes

_____ No

How long were your parents together?

_____ Years _____ Months

What is your sexual orientation? Please check an option below.

_____Heterosexual

_____Lesbian

_____Bisexual

_____Other. Please specify below

_____

Are you physically attracted to men?

_____

Have you moved recently?

_____

Do you live with any males who are not related to you and if so, how long?

_____

Do you live with any females and if so, how long?

_____

When was the first day of your last menstruation?

_____

How many days are there between your periods? In other words, how many days are there between the start of one menstruation and the start of the next menstruation?

_____

Have you used any type of hormonal medication, such as hormonal contraceptives, in the past three months?

_____

Have you recently used “the morning after” or “Plan B” pill?

_____

Could you be pregnant?

_____

Appendix B

Medication Checklist

Please place an "X" next to every form of medication you have used in the past three months. If you are unsure if a medication contains hormones, please write down the name of the medication at the bottom of this page and tell the researcher about it.

____Birth Control Pills

____Birth Control Injections (Depo-Provera, Lunelle)

____Vaginal Rings (NuvaRing)

____Birth Control Patches

____Intrauterine Device (IUDs)

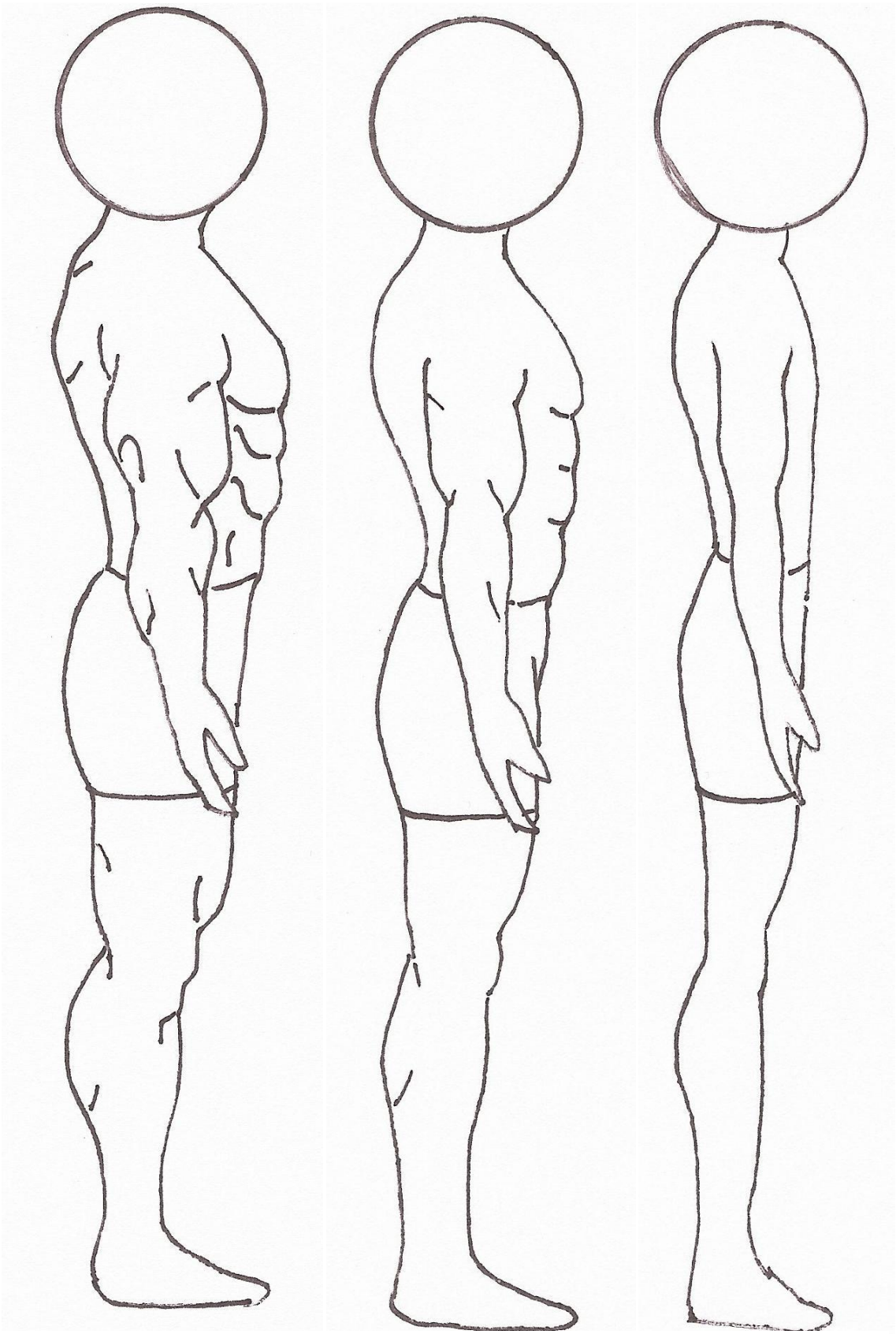
____Implants

____Any other type of medication that contains hormones (e.g., for hormonal imbalance)

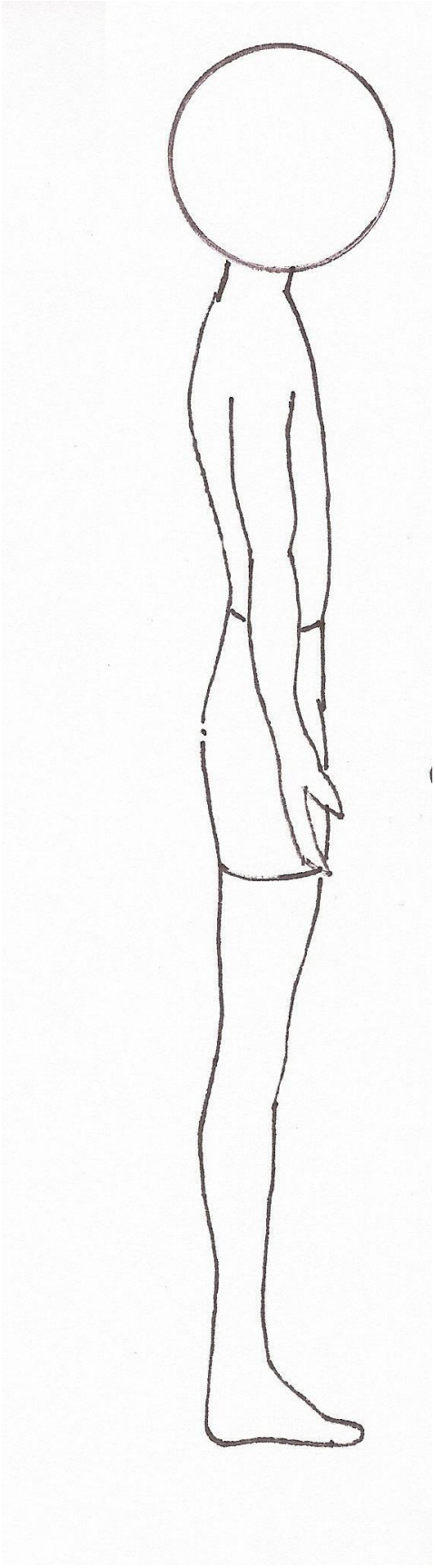
*If you checked "Any other type of medication…" please list the medication below.

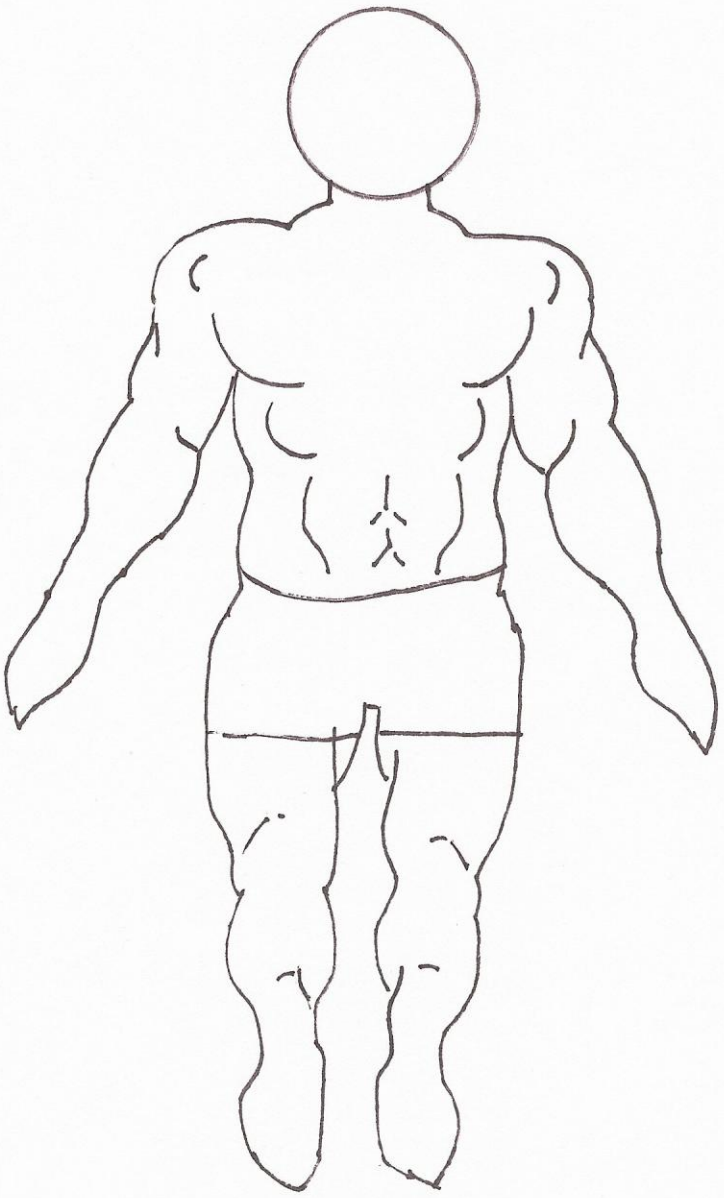
_____

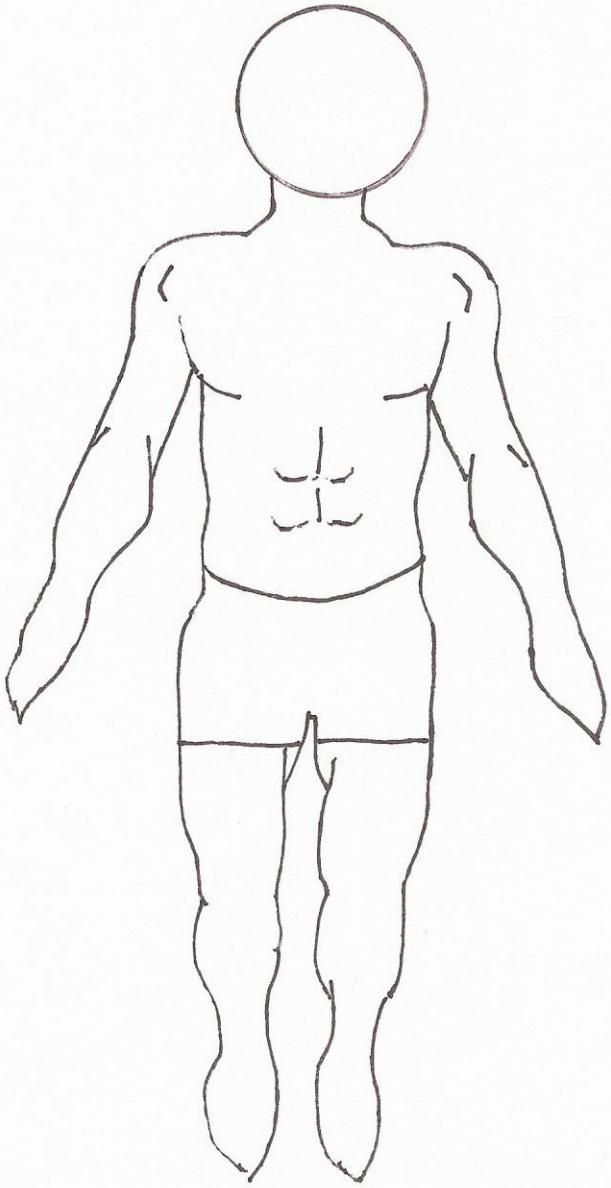
Appendix C
Stimuli

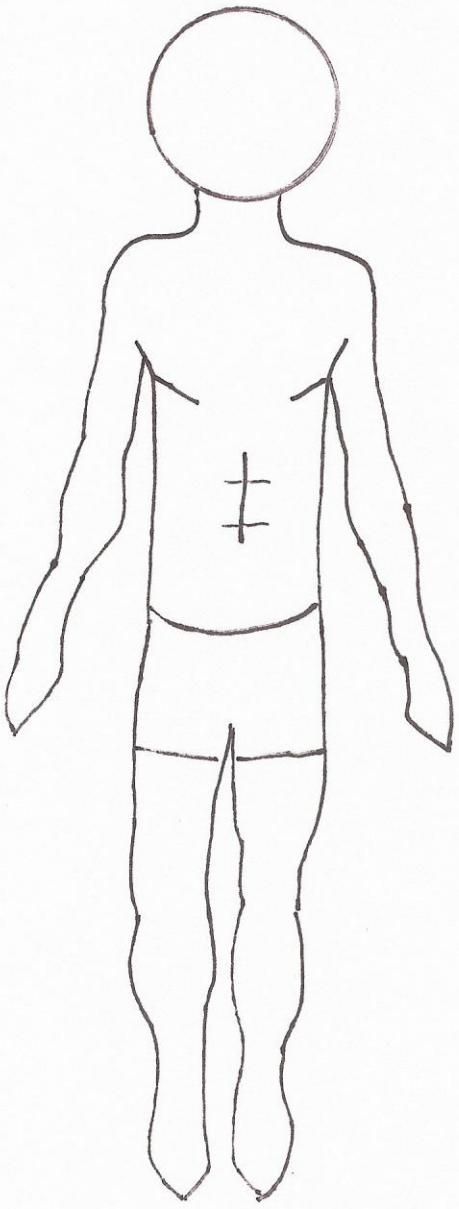


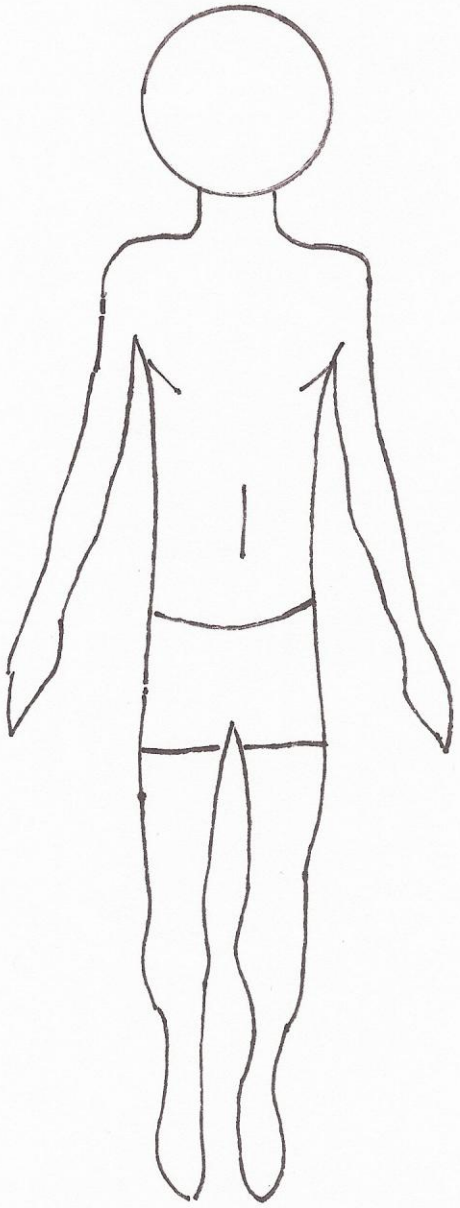
All stimuli revisions courtesy of Ronny Brown

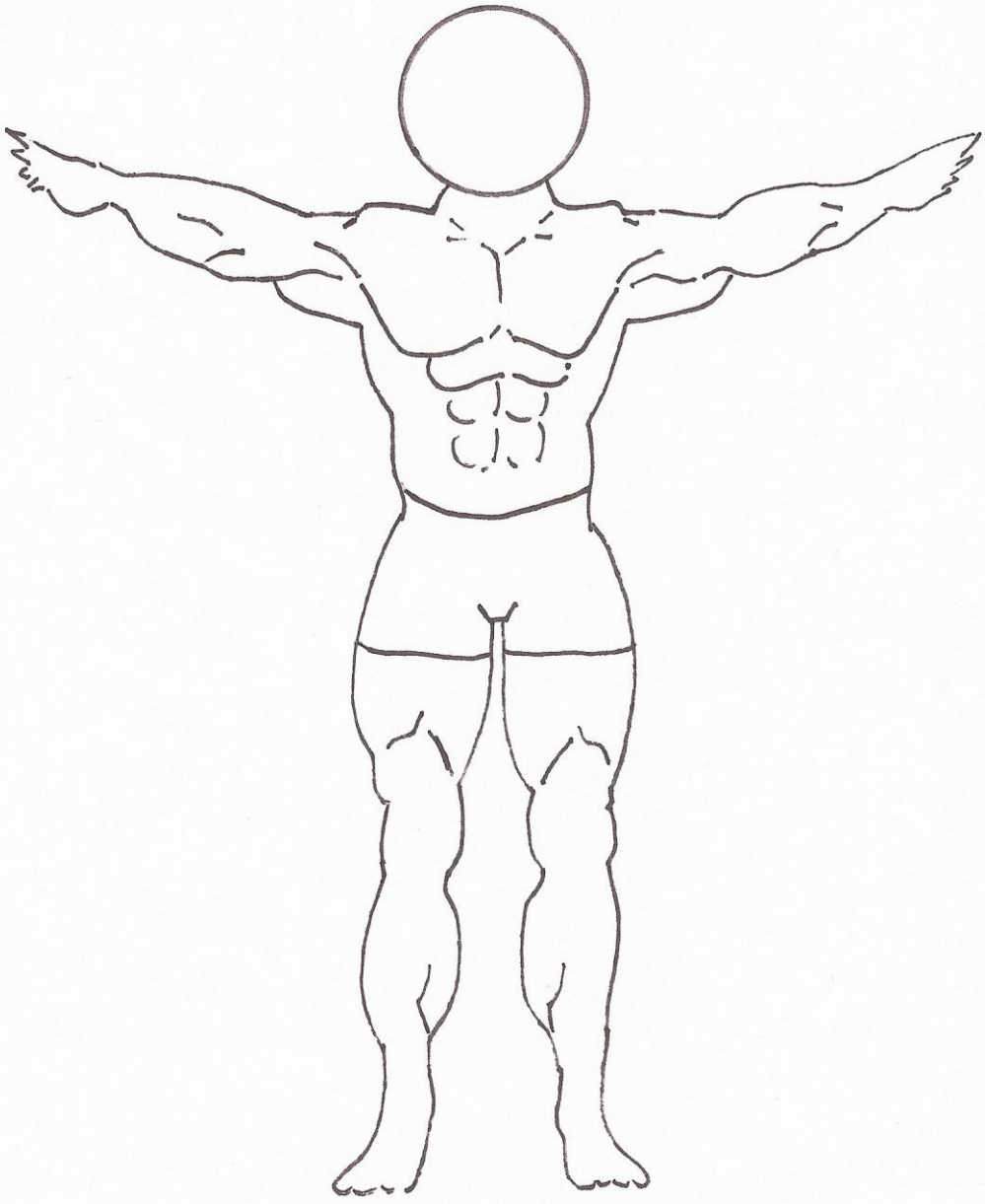


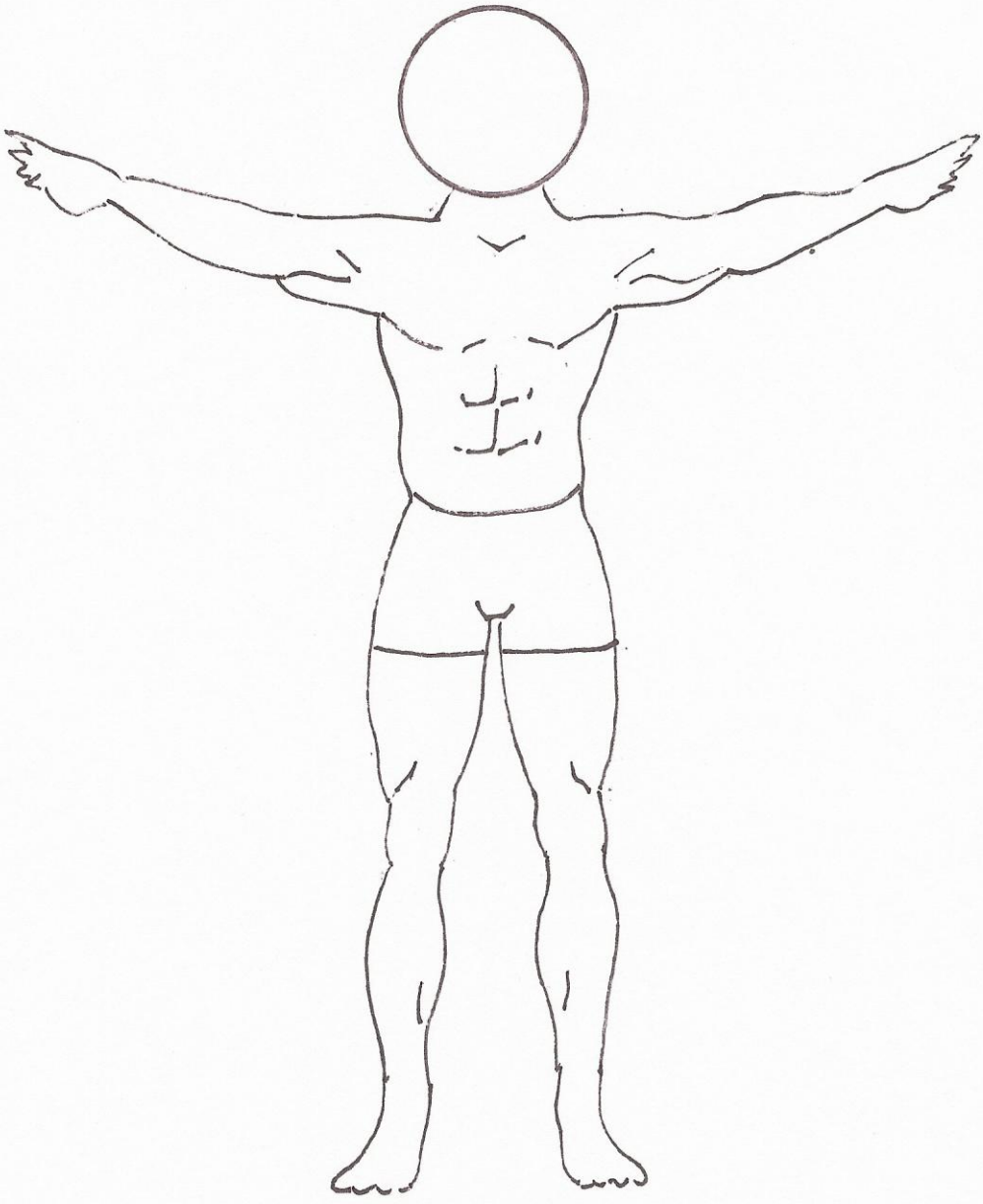


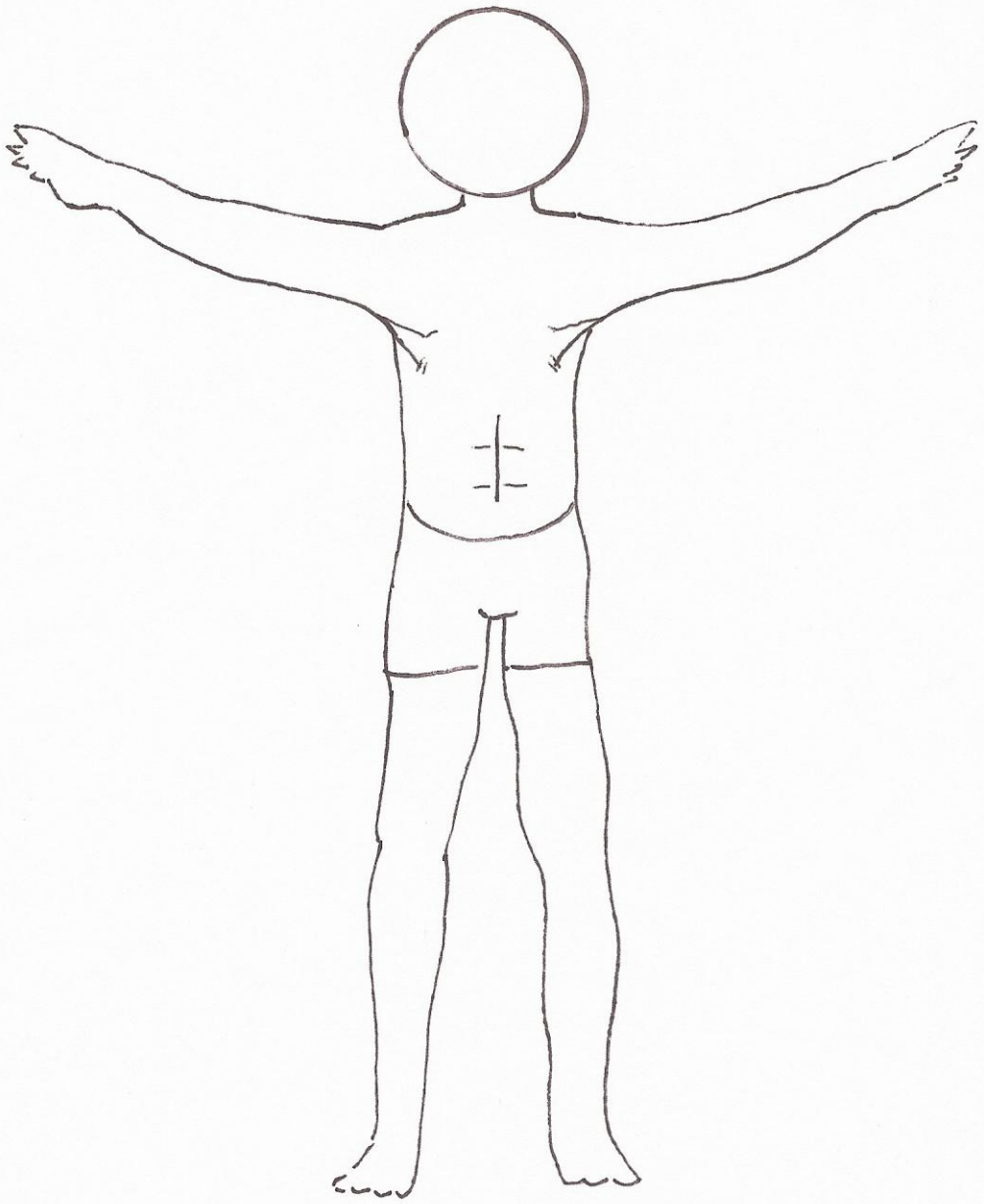


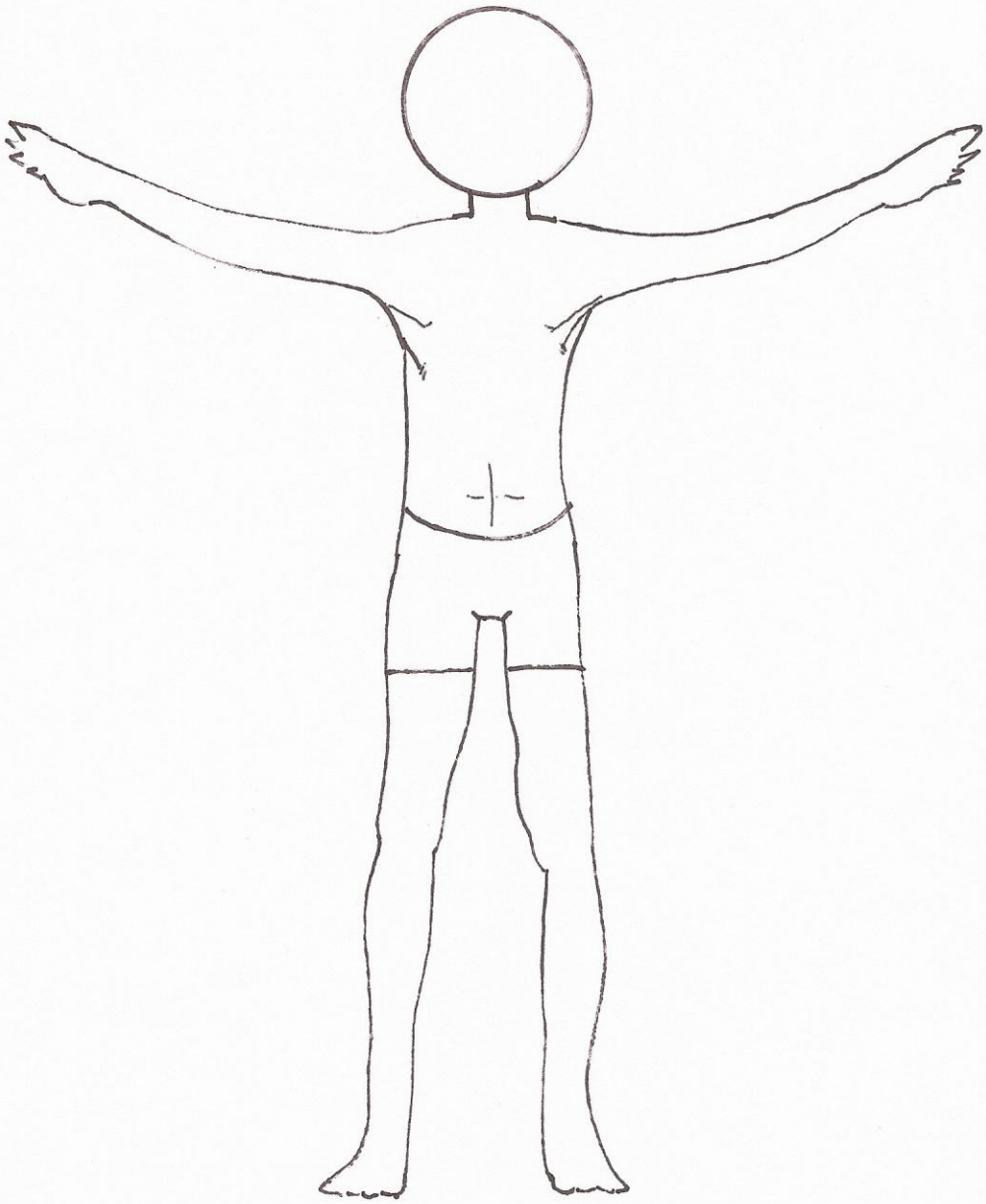


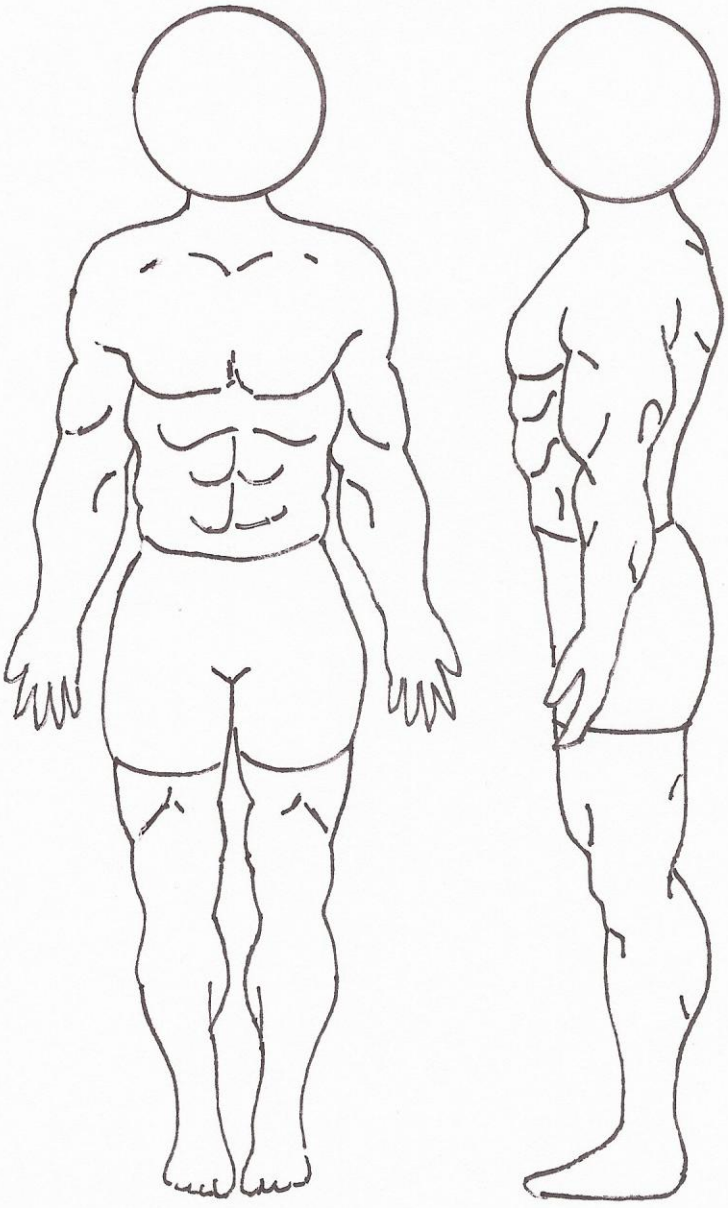


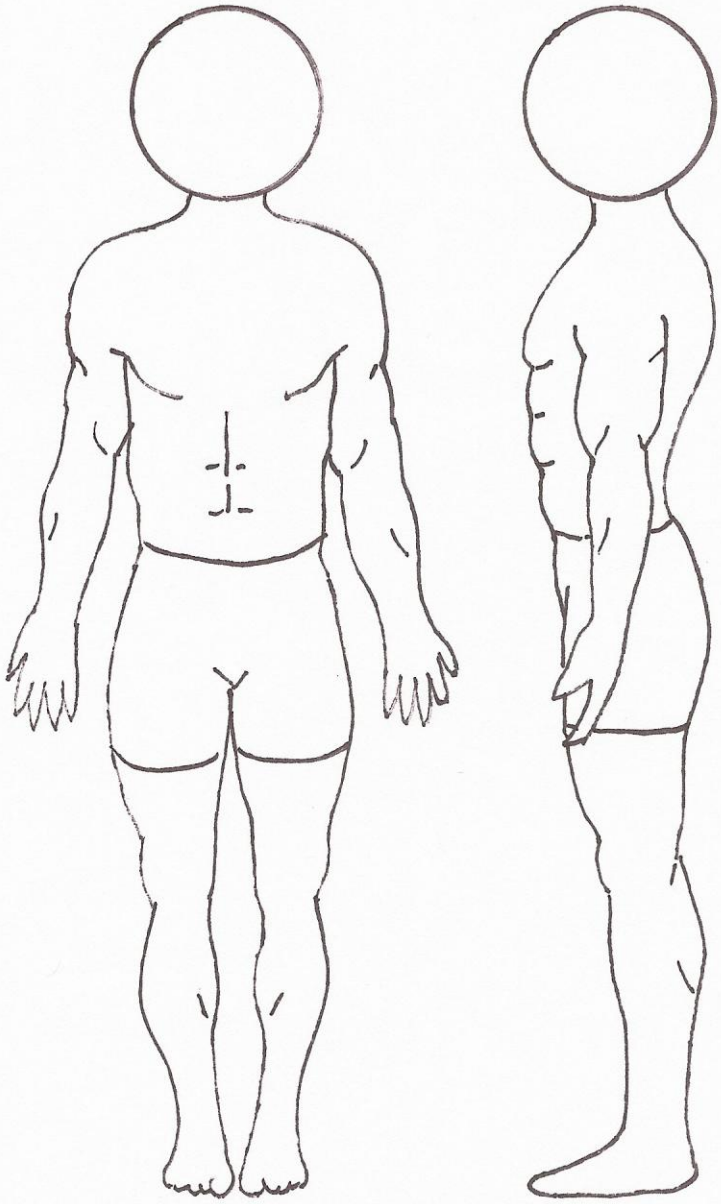


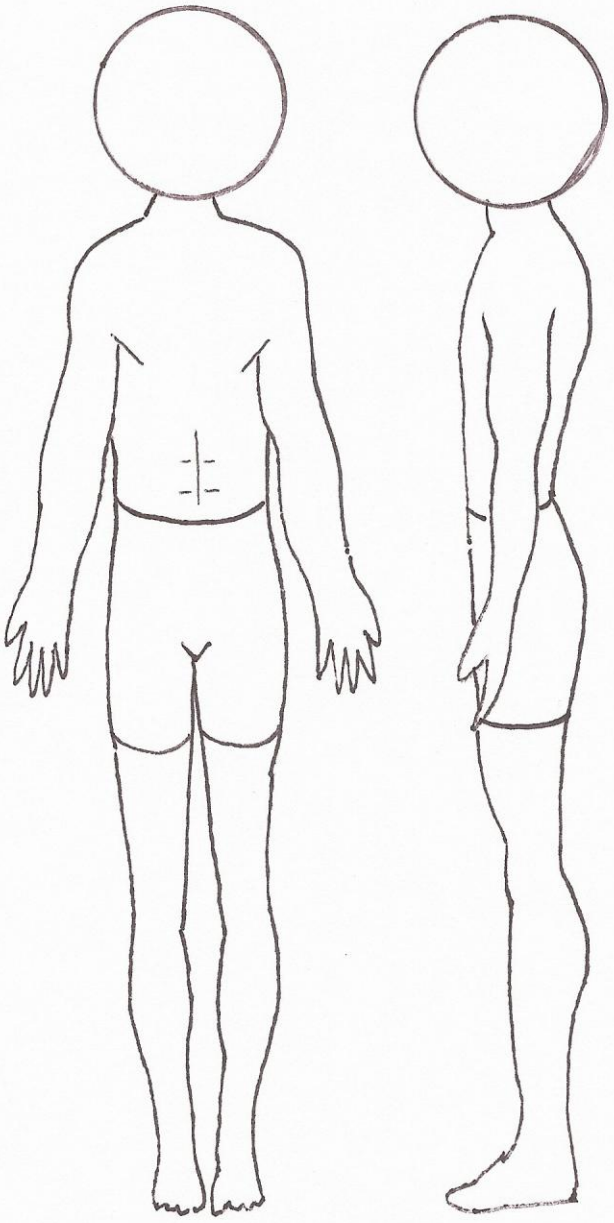


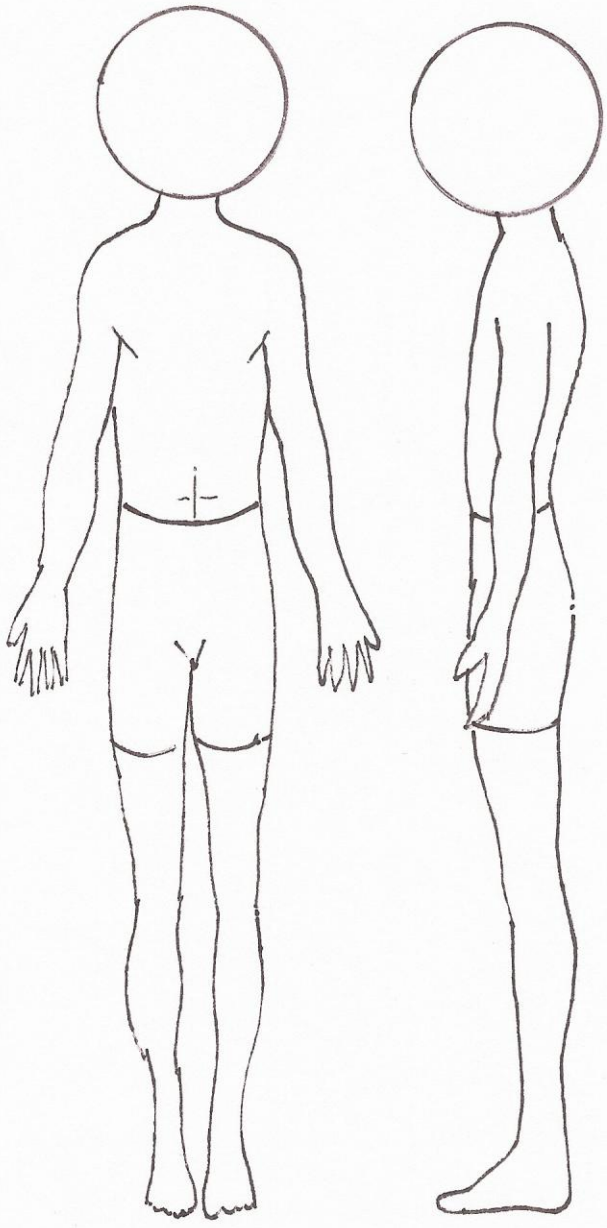


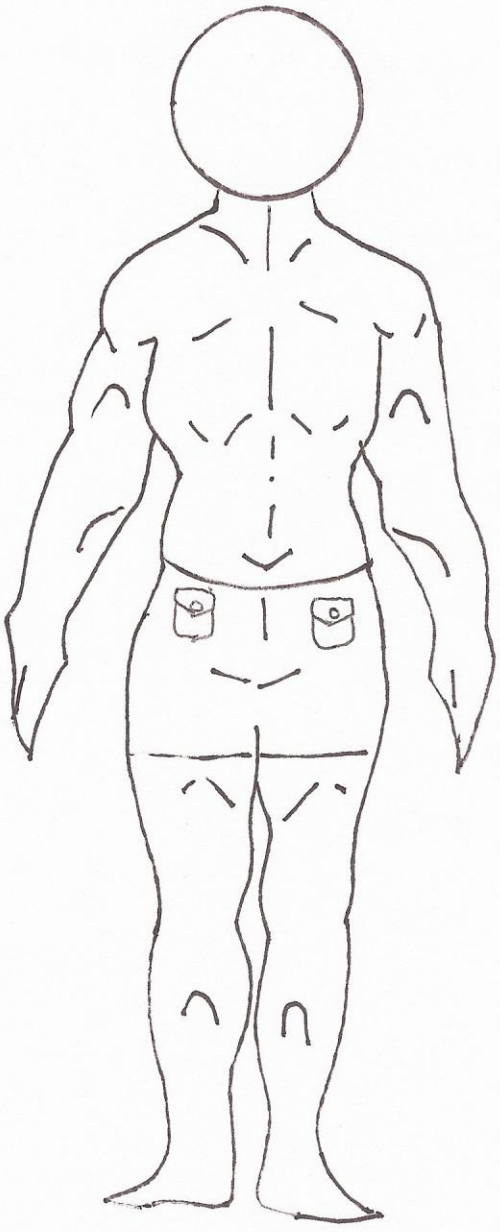


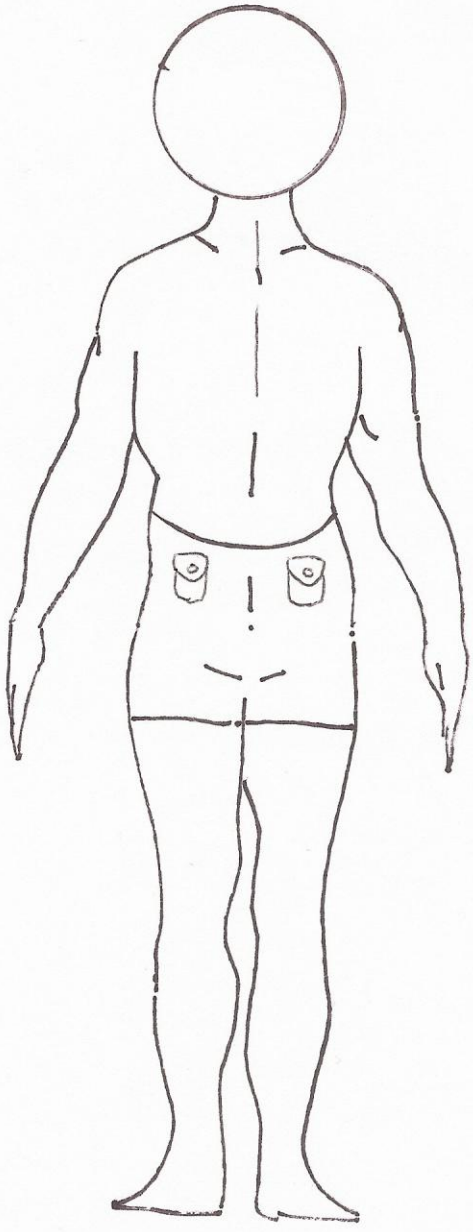


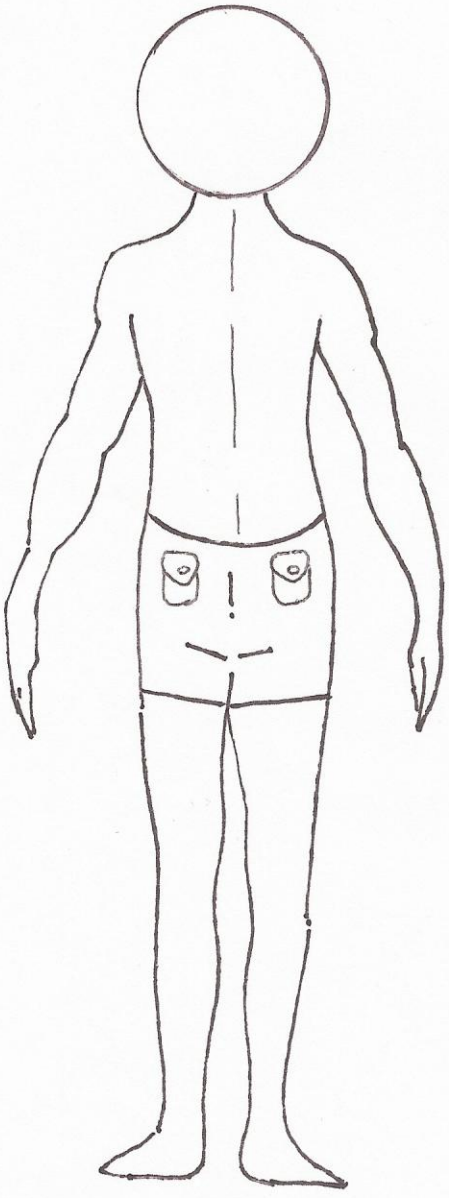


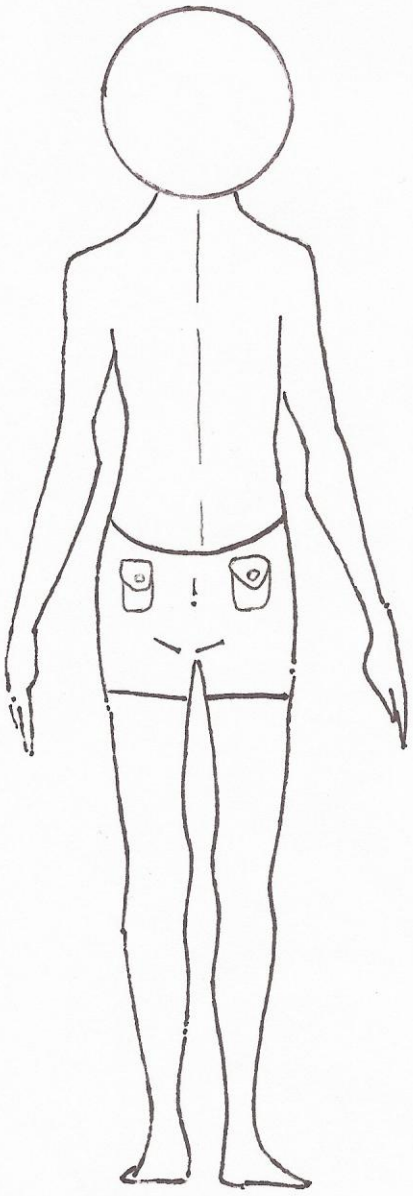












## Appendix D

## Birth Control Methods

Acceptable Birth Control
- Male Condom
- Female Condom
- Spermacides
- Diaphragm
- Cervical Cap
- Contraceptive Sponge

Unacceptable Birth Control
- Birth Control Pills
- Birth Control Injections (Depo-Provera, Lunelle)
- Vaginal Rings (NuvaRing)
- Birth Control Patches
- Intrauterine Device (IUDs)
- Implants

## Appendix E

## Debriefing Statement

Thank you for participating. In this experiment we were studying the effects of ovulatory status on attraction to different levels of male muscle mass. During every experimental session, you were subjected to four different conditions. That is, you saw four different levels of muscle mass: a low muscle mass body, a medium muscle mass body, a high muscle mass body, and an extremely high muscle mass body. Also, during every experimental session, I asked about your menstrual cycle to determine if you were likely ovulating or not. It was necessary to withhold this information from you in order to get the most accurate attractiveness ratings from you. Had I told you everything about the experiment, there is a possibility that your attractiveness ratings could have been influenced by that information. Research indicates that women's perception of male attractiveness changes across their menstrual cycles, and I wanted to investigate whether attractiveness ratings of different levels of muscle mass changes across the menstrual cycle.

Feeling embarrassed or distressed about not being fully aware of the purpose of the study is a normal feeling. If you are still distressed, you may contact the UCO Student Counseling Center at (405) 974-2215 or http://www.uco.edu/student_counseling (Bruce Lochner, Ph. D., Director). If you would like to know more information about your participation in this experiment you may also contact the Institutional Review Board at (405) 974-5479.

If you have any questions concerning any portion of this study please refer these questions to the experimenter at this time. However, if you have no questions, please inform the experimenter that you have completed the experiment. Thank you again for your participation.