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Mood Reactivity and Oral Contraceptive Use:

Do Oral Contraceptives Act as Mood Stabilizers?

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Abstract

Previous research has suggested that oral contraceptives (OCs) may provide a stabilizing effect on mood. The present study attempted to examine the differences between OC users, nonusers, and men on measures of mood and heart rate in response to mood primes, in order to determine whether exogenous and endogenous hormones affect mood and physiological reactivity to hormonally-relevant stimuli. A sample of 108 undergraduate students (41 OC users, 36 nonusers, and 31 men) completed a mood questionnaire before and after completing a randomized series of four mood-inducing tasks (to induce positive affect, jealousy, social ostracism, and parental feelings) while their heart rate was monitored. Partial support for the hypothesis that OC users would experience less mood reactivity than nonusers was found in that OC users experienced a blunted positive affect response to the tasks when compared with nonusers. The groups did not differ in terms of their negative affect, jealousy, parental feelings, feelings of ostracism, or HR reactivity in response to the four tasks. Possible mechanisms for an OC-induced positive affect stabilization effect are discussed.

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Mood Reactivity and Oral Contraceptive Use:
Do Oral Contraceptives Act as Mood Stabilizers?

Oral contraceptives (OCs) are a popular choice of birth control among women because they are highly effective, simple to use, easy to discontinue, and the effects are quick to reverse once they are discontinued (Dickey, 2000). According to the 1998 Canadian Contraceptive study, which surveyed 1599 women aged 15 to 44 across Canada, 28% of women were currently using OCs (Fisher, Boroditsky, & Bridges, 1999). Among sexually active women using contraception, the percentage increased to 43%. However, according to Fisher et al. (1999), 84% of women between the ages of 15 and 44 have taken OCs during their lifetime. Of the vast majority of OC users, 73% reported being very satisfied with their chosen method of contraception. However, some women discontinue the use of hormonal contraceptives after experiencing negative side effects. Rosenberg and Waugh (1998) found that 59% of women who discontinue OCs in favour of another contraceptive method do so because of side effects. The same authors found that 5% of OC discontinuations were due to mood changes. OC users may experience emotional changes affecting excitability, feelings of unrest, nervousness, and irritability (Dickey, 2000). Researchers have been particularly interested in OC-related mood change since OCs became available. However, in comparison, there are few studies examining mood variability, and fewer yet examining mood reactivity. As discussed below, research tends to suggest that OC users are experience less mood variability than nonusers (Oinonen & Mazmanian, 2002). Therefore, more research is needed to examine possible differences in mood reactivity. If OCs do cause mood changes, it is important for women to be informed of this possible side effect before they choose whether to use OCs or

another form of contraception, especially considering the widespread use of OCs. Hence, further research is needed to examine the potential benefits and adverse effects of OC use, particularly its effects on mood reactivity. Studies examining mood and physiological changes associated with OC use, jealousy induction, parental feelings, and social ostracism are reviewed below.

General Evidence of a Relationship between Hormones and Mood

Hormones appear to have an effect on mood in humans. Mood change during times of hormonal fluctuation in women is a well documented phenomenon. Although this is not an exhaustive review, this section will describe findings from recent studies examining the relationship between hormones and mood during pregnancy, the postpartum period, and perimenopause, prementrual syndrome/dysphoria, as well as the relationship between estrogen and mood disturbance in women.

In terms of evidence of a relationship between progesterone and mood, one study suggests that the formulation of progesterone in hormone replacement therapy in menopausal women may affect mood. Bjorn, Bixo, Njord, Nyberg, and Backstrom (2000) found that among those with no history of premenstrual syndrome (as observed using a measure of cyclic symptoms), women given medroxyprogesterone acetate experienced less negative and more positive mood symptoms than women given norethindrone. The same study found that women with a history of PMS responded to both progesterone treatments with lower reports of positive mood symptoms than women with no history of PMS. This suggests that pre-existing hormonal conditions may mediate the effects of progesterone on mood in women.

In a study of responses to an estrogen challenge test in women with or without premenstrual dysphoria (PMD), Eriksson, Backstrom, Stridsberg, Hammerlund-Udenaes, and Naessen (2006) used a sample of 13 women with PMD and 12 normal controls. The women were given an injection of estrogen after two baseline cycles. The results indicated that the PMD group experienced more feelings of irritability and depressed mood during the last 10 days of the menstrual cycle than the control women. This difference was not noted at the baseline. Women with PMD had higher luteinizing hormone (LH) levels at the nadir and more surge-like reactions of LH, as well as a stronger negative feedback response. Ratings of depressed mood were associated with baseline levels of follicle-stimulating hormone (FSH) in women with PMD, but not in the control group. These results suggest that levels of LH and FSH may be related to negative mood and other symptoms in women with PMD. This study suggests a possible relationship between LH, FSH, and mood. Given that OCs can affect levels of FSH and LH (see below), it is possible that this is a possible mechanism by which OCs affect mood.

A recent study by Schmidt et al. (2000) found that the majority of a sample of 34 women with perimenopausal-related depression who received estradiol treatment demonstrated a full or partial therapeutic response. Compared to women receiving placebo, women receiving estradiol treatment demonstrated significant mood and symptom improvement. This suggests that estradiol administration may be of use in treating symptoms of depression in perimenopausal women.

Buckwalter et al. (1999) conducted a study of 15 women and measured hormone and mood levels during the last two months of pregnancy and within two months of

delivery. Mood was measured using the Profile of Mood States (POMS), Symptoms Checklist 90, and Beck Depression Inventory. They found that higher levels of dehydroepiandrosterone (DHEA) were associated with better mood scores. Testosterone was associated with worse mood (e.g., depression, tension, anger) in the postpartum period. The change in estradiol levels from pregnancy to the postpartum period was correlated with negative mood change. As estradiol decreased, fatigue, confusion, and anxiety decreased, and vigour increased. Decreases in DHEA were associated with an increase in depression and interpersonal sensitivity. A decrease in progesterone was associated with lower ratings of phobic anxiety. Changes in cortisol levels were not associated with mood change. These results suggest that steroid hormone levels are related to mood and mood change during pregnancy and the postpartum period.

Hormones can also affect mood disturbance in mood or affective disorders. Hormones may play a role in depression and depressive symptoms in women. According to Payne (2003), evidence that may suggest a link between hormones and depression includes: (a) more women than men are diagnosed with depression; and (b) research has suggested that hormonal changes may be related to an increased risk of major depression and depressive episodes among women with bipolar disorder. Payne states that the research to date on estrogen treatment for post-partum depression suggests that it may be useful as a preventative measure, or an effective treatment. However, Payne's review also suggests that the findings regarding the use of estrogen as an antidepressant in major depression fail to find a robust effect.

In their review of the literature, Burt and Rasgon (2004) report that, in women, the course of bipolar disorder may be influenced by the menstrual cycle, menopause,

pregnancy, and the postpartum period. Thus the relationship between mood disorders, such as bipolar disorder and periods of hormonal change in women may have implications for treatment and should be investigated further.

In a recent review of the role of estrogen in mood disorders, Halbreich and Kahn (2001) concluded that there is a possibility that estrogen levels may affect the regulation of mood and may play a role in the pathobiology of mood disorders. The authors suggest that estrogen therapy for affective disorders may be efficacious for: (a) stabilizing estrogen levels during the postpartum, premenstrual, perimenopausal periods, or other periods when estrogen levels are disrupted; (b) use as an antidepressant for depressed women during the perimenopausal period; and (c) use as a psychomodulator when estrogen levels are low and there is a risk of dysphoric mood (e.g., postmenopause). The authors note that it is unknown if the use of estrogen in combination with SSRIs is an effective treatment for postmenopausal women.

There is ample evidence of a relationship between hormones and mood in women, especially during times of hormonal change, such as menopause and pregnancy. Not all women experience mood disturbance corresponding to hormone level fluctuations. Brace and McCauley (1997) conclude that based on a review of studies examining the relationship between hormonal change and mood disorders in women, a subgroup of women are at a greater risk of mood problems during times of hormonal change than other women. The ability to identify this group of women would have positive implications as hormonal treatment may be suitable for such a group of women with mood disorders.

Theories of How Hormones Affect Mood

Oinonen and Mazmanian (2002) reviewed the possible mechanisms through which estrogen and progesterone affect mood. Estrogen has been linked with changes in serotonin levels. Estrogen increases have been found to be associated with increases in 5-HT_{2A} receptor density, gene expressions of the 5-HT_{2A} receptor, and serotonin transporter mRNA (Fink & Sumner, 1996; Fink, Sumner, McQueen, Wilson, & Rosie, 1998). On the other hand, progesterone may mediate an increase in monoamine oxidase (MAO) activity, which results in lower serotonin levels (e.g., Sheehan & Sheehan, 1976; Sherwin, 1996). Both progesterone and estrogen may mediate the increase of inhibition induced by gamma-aminobutyric acid (GABA) and suppression of excitation through glutamate (e.g., Ghazal, Makar, & Daabees, 1976; Smith, Waterhouse, Chapin, & Woodward, 1987). Another mechanism whereby estrogen could increase negative affect is through an estrogen-induced pyridoxine deficiency which decreases levels of serotonin and GABA (e.g., McCarty, 2000; Patten & Love, 1993; Slap, 1981).

Rubinow, Schmidt, and Roca (1998) state that there is evidence supporting a connection between estradiol, serotonergic function and the mood disorders of perimenopausal depression and premenstrual syndrome. The research suggests that both estrogen and progesterone can alter serotonin levels through actions on the serotonergic system, or through other indirect actions. Thus, both the estrogen and progestin components of OCs have the potential to affect mood.

Studies Examining Oral Contraceptives and Mood

Although there have been many studies examining the possibility of OC-related mood changes as well as differences between OC users and nonusers, the results have been inconsistent. This may be due to the ever-changing OC formulation, different

research designs used, or the survivor effect (Oinonen & Mazmanian, 2002). The survivor effect (Kutner & Brown, 1972) occurs when women who experience problems or negative side effects while taking OCs discontinue their use, resulting in an unrepresentative study group of women who do not experience these effects.

Oinonen and Mazmanian (2002) outline a number of factors that research has suggested may predispose some women to negative mood or affect change during OC use. These factors include a history of depression, symptoms of psychological distress, a history of mood symptoms related to pregnancy, a family history of OC-related mood symptoms, age, being in the postpartum period, and dysmenorrhea and premenstrual mood complaints prior to using OCs. A study by Joffe, Cohen, and Harlow (2003) found that a previous diagnosis of depression was a significant predictor of OC-related premenstrual mood deterioration. OC-related mood improvement was predicted by both dysmenorrhea, and premenstrual mood disturbance with an early onset. Oinonen and Mazmanian note that there are a number of OC-related variables that seem to mediate mood changes in some individuals. These include the duration of OC use, the type of estrogen and progesterone in the pill, and the ratio of progesterone to estrogen in the pill. The findings of two studies (Deijen, Duyn, Jansen, & Klitsie, 1992; Parsey & Pong, 2000) suggest that the brand or formulation of OC may affect mood and mood variability. These predisposing factors deserve further study.

The review by Oinonen and Mazmanian (2002) states that studies examining the effects of OCs on depression and depressive symptoms have yielded mixed results. Some studies have found higher rates of depression among OC users (e.g., Cullberg, 1972; Herzberg, Johnson, & Brown, 1970; Nilsson & Almgren, 1968), whereas other studies

found lower rates (e.g., Herzberg, Draper, Johnson, & Nicol, 1971). Furthermore, some studies found no relationship between depression rates and OC use (e.g., Fleming & Seager, 1978; Vessey et al., 1985).

Oinonen and Mazmanian (2002) summarized the results of 13 studies that examined affect differences between OC users and nonusers using controlled, prospective daily ratings designs. Only one study, Marriott and Faragher (1986), found no group differences in mood between OC users and nonusers. The majority of the studies reviewed found no group differences in negative affect (NA) across the entire menstrual cycle (Almagor & Ben-Porath, 1991; Marriott & Faragher, 1986; Paige, 1971; Wilcoxon, Schrader, & Sherif, 1976), but did find group differences at specific cycle phases. Due to a paucity of studies on positive affect (PA) (viz, Almagor & Ben-Porath, 1991; Boyle & Grant, 1992; Silbergeld et al., 1971), no conclusions could be drawn about PA across the entire menstrual cycle.

Oinonen and Mazmanian (2002) also reviewed studies that examined affect at specific menstrual cycle phases. No consistent group differences in PA during any of the menstrual cycle phases were found among the four studies examined (Almagor & Ben-Porath, 1991; Boyle & Grant, 1992; McFarlane, Martin, & Williams, 1988; Walker & Bancroft, 1990). When group differences in NA at specific menstrual cycle phases were compared, the only consistent findings were for the menstrual phase. Three studies found no group differences in NA during the menstrual phase (Alexander et al., 1990; Almagor & Ben-Porath, 1991; Graham & Sherwin, 1993). One study found higher levels of NA for monophasic OC users but not for triphasic users (Walker & Bancroft, 1990), whereas four studies found that OC users experienced less NA than nonusers during the menstrual

phase (Boyle & Grant, 1992; Paige, 1971; Sutker et al., 1983; Wilcoxon, Schrader, & Sherif, 1976). Oinonen and Mazmanian suggest that since three of the above studies found less physical symptoms in OC users than nonusers during the menstrual phase, the decrease in NA during the menstrual phase could be due to an OC-related reduction in physical menstruation symptoms.

In summary, no firm conclusions regarding the effects of OCs on general levels of affect or depression can be made, as research suggests mixed results. However, as discussed above, there are factors seemingly related to mood symptoms and changes in women who use OCs. The majority of the controlled studies reviewed by Oinonen and Mazmanian (2002) found no differences between OC users and nonusers in NA across the entire menstrual cycle. However, nonusers do appear to have lower NA during menstruation. No consistent group differences in PA during any phase of the menstrual cycle were found. There are a number of problems associated with this particular type of research including: small sample sizes that may not be generalizable to all women; the fact that the results tend to be correlational and no firm cause and effect conclusions can be made; the fact that certain studies examine only negative affect and neglect positive affect; and the survivor effect (discussed previously), where samples of OC users tend to be made up of individuals not experiencing negative side effects.

Studies Examining OCs and Mood/Affect Variability

A number of methods have been used to examine whether OCs affect mood variability. Some studies have examined between-phase variability, where mood is assessed and compared between phases of the menstrual cycle (e.g., Wilcoxon et al. 1976). Day-to-day mood variability is assessed through daily mood measures and

calculating mood change between days, or calculating the variance in mood scores over a certain number of days (e.g., Oinonen & Mazmanian, 2001). Within-day mood variability is calculated by measuring mood at different points during the day and examining the variance over the day. Oinonen and Mazmanian (2002) note that there has been no examination of group differences between OC users and nonusers in within-day mood variability. Given that many women do report experiencing negative mood effects when taking OCs, and the fact that research has not discovered any strong general effect of OCs on mood or affect, it is possible that OCs affect mood variability as opposed to overall mood levels. Thus, it is important to study the variability of mood to gain a better understanding of whether OCs act on mood stability.

In their review of the literature, Oinonen and Mazmanian (2002) found some evidence that OCs may exert a stabilizing effect on mood. Oinonen and Mazmanian reviewed four studies (Graham & Sherwin, 1993; Paige, 1971; Sutker et al., 1983; Walker & Bancroft, 1990) that suggested that OC users demonstrated less day to day affect variability than nonusers. Only one study (i.e., McFarlane et al., 1988), found no significant differences between OC users and nonusers in affect variability. Thus, a day-to-day stabilizing effect of OCs deserves further investigation.

Five studies examined between phase differences between OC users and nonusers. Wilcoxon, Schader, and Sherif (1976) conducted a study to examine daily reports of mood, somatic changes, activities, and life events during the menstrual cycle. A sample comprised of 11 OC users, 11 nonusers, and 11 males filled out daily self-reports for 35 days. The change in mood between the menstrual cycle phases was greater for the OC

users than the nonusers and may suggest that OC users experience greater between-phase negative affect variability.

Marriott and Faragher (1986) conducted a study to examine changes in psychological state across the menstrual cycle. A sample of 65 women aged 16 to 45 completed the Moos Menstrual Distress Questionnaire (MDQ) daily for 32 days. The sample was comprised of 34 current OC users and 31 nonusers. Although there were changes throughout the menstrual cycle for both groups, there were no significant differences between the reports of the OC users and nonusers. The findings of this study suggest that OC users and nonusers experience similar variability in their mood across the menstrual cycle.

To examine the effect of OCs on the relationship between well-being and sexuality (although only differences in well-being will be discussed here), Warner and Bancroft (1988) used a sample of 4112 women. The women were divided into three groups: OC users (n = 860), previous users (n = 2574), and never users (n = 678). Participants reported the phases of the cycle that their feelings of well-being, energy, sexual interest and enjoyment were highest and lowest. The results indicated that OC users were less likely to report peaks of well-being across the cycle and less likely to report troughs of well-being in the week before menses, but more likely to report troughs during menses. Both of the latter two times are parts of the cycle when women are most likely taking the inert pill as opposed to the active pill. These retrospective results suggest that OC users and nonusers experience differences in cyclical mood changes. In particular, OC users may experience less mood variability during the days of the cycle when they are most likely to be taking the OC.

A study by Oinonen and Mazmanian (2001) examined the relationship between positive and negative affect and OC use. Ninety-six women between the ages of 18 and 27 completed daily questionnaires, including the Positive and Negative Affect Schedule (PANAS), for a period of 35 days. The sample consisted of 17 first-time OC users, 34 long-time users, and 45 never users. The results of the study showed no differences in positive or negative affect between groups or menstrual cycle phases. However, a significant result was found for day-to-day affect variability between the menstrual cycle phases. Both OC users and nonusers experienced less positive affect variability in the menstrual phase than the other phases. Furthermore, first-time monophasic users experienced higher positive affect variability during menstruation than either long-time monophasic, first-time triphasic, or long-time triphasic users. Given that the menstrual phase is the time when OC users are most likely taking the inert pills, the findings suggested a potential withdrawal effect of monophasic OCs on positive affect stability during early use of OCs.

A recent study by Rasgon, Bauer, Glenn, Elman, and Whybrow (2003) found that among a group of 17 women undergoing treatment for bipolar disorder, the majority of the participants (59%) reported having a long menstrual cycle (greater than 28 days). Comparisons of mean mood levels of the first and last seven days of the menstrual cycle revealed that there were significant differences, however no consistent pattern was found for the changes in mood. When the mood levels of the six OC users were examined, it was found that there were no significant differences between the first and last seven days of the cycle, whereas the 11 nonusers demonstrated significant mood change. Although there is no data as to whether the longer cycles were present prior to treatment, it may be

that abnormalities in estrogen levels are related to bipolar disorder. The evidence suggests that OCs may act as mood stabilizers for menstrual cycle-related mood changes in women with bipolar disorder.

Of the ten studies examined here, eight (Graham & Sherwin, 1993; Oinonen & Mazmanian, 2001; Paige, 1971; Rasgon et al., 2003; Sutker et al., 1983; Walker & Bancroft, 1990; Warner & Bancroft, 1988; Wilcoxon, Schader, & Sherif, 1976) suggest that OCs may affect mood variability. Two studies (Marriott & Faragher, 1986; McFarlane et al., 1988) suggested that OC users and nonusers do not differ in their mood variability across the menstrual cycle. Of the studies indicating affect variability differences between OC users and nonusers, three studies (Rasgon et al. 2003; Sutker et al., 1983; Warner & Bancroft, 1988) suggest that OC users experience less overall variability than nonusers. In addition, one study (i.e., Warner & Bancroft, 1988) found that OC users experience more NA variability during the pill-free period, whereas another (i.e., Oinonen & Mazmanian, 2001) found that monophasic OC users experience greater positive affect variability during this time. This provides additional evidence that OCs may stabilize affect and that the pill free week may be associated with greater mood variability for certain users.

Studies Examining Mood Reactivity

Mood reactivity, or mood responses to events, can be examined by measuring the difference in mood before and after exposure to an event. Differences between OC users and nonusers in mood reactivity has been a less popular topic of study, with only two studies examining how OCs affect mood reactivity to specific stimuli. However, only one

of these studies examined mood responses to stimuli that were designed to induce certain moods (i.e., a laboratory manipulation).

Rubino-Watkins, et al. (1999) conducted a study to examine the possibility that oral contraceptives may moderate the relationships between cognition, emotion, and daily stress. A sample of 29 OC users and 47 nonusers, ages 18 to 48, was recruited from a university population. The results indicated that when compared to nonusers, OC users were more likely to demonstrate greater anger and depressive attributes along with lesser levels of anger control in relation to increased daily stress *frequency*. However, when the *intensity* of daily stress increased, nonusers indicated an increased anger reaction, while OC users indicated a decrease in agitated depression. Finally, the authors found that greater levels of cognitive integration were associated with a higher experience of anger and decreased anger control among OC users. In terms of mood reactivity, the results suggest that in OC users, the *frequency* of the stressors is positively related to anger and depressive responses, but that the *intensity* of the stressors is negatively related to depressive responses.

A study by West, Stoney, Hughes, Matacin, and Emmons (2001) used a sample of 30 OC users and 30 nonusers to examine the effects of cigarette smoking, nicotine administration, and OC use on lipid and cardiovascular reactivity and mood. All of the participants were Caucasian and two-thirds were regular smokers. The sample was divided into three groups: non-smokers, deprived smokers, and smokers who were given nicotine gum. Blood pressure was monitored and electrocardiogram (ECG) readings were taken. Blood samples were taken to analyze lipids. The PANAS, along with several additional items, were used to assess group differences in affect prior to (baseline) and

following a stressful task. Non-smokers and deprived smokers were asked to sit quietly for 90 minutes while filling out questionnaires and reading magazines. The nicotine gum treatment group was given a piece of nicotine three times with 30 minute intervals between pieces. Participants were then asked to sit for 20 minutes while listening to music and having ECG and blood pressure (BP) readings taken. A fifteen minute baseline measure was taken and then participants were asked to prepare a speech about an embarrassing situation, and deliver it. A 15 minute recovery period followed the speech task. The findings involving mood are discussed here, while the other findings are discussed below. The results indicated that OC users reported feeling more frustrated, irritated, and challenged than nonusers following the stressful speech task, despite smoking status. There were no group differences in overall PA or NA at the baseline period or following the stressor. These findings suggest that OC users differed from nonusers in terms of certain negative emotions and may have an increased negative mood response to stress.

The two studies examined here suggest that OC users and nonusers may differ in their emotional responses to stress. One study (Rubino-Watkins et al., 1999) found that with an increased frequency of daily stress, OC users demonstrate more negative reactivity, but also that OC users responded with less agitated depression than nonusers when the intensity of the stress increased. The results by West et al. (2001) were more clear cut as they found that OC users had an increased negative affective response to a stressful task. These results are not consistent with the research reviewed above which suggests that OCs have a stabilizing effect on mood. It is worth noting that only one study

has used a laboratory manipulation of mood to examine OC effects and no studies have examined the effects of OCs with positive mood priming tasks.

Studies Examining Physiological Differences between OC users and Nonusers

There have been numerous studies examining physiological differences between OC users and nonusers. Only those related to the present study (e.g., those that measured cardiovascular differences) will be examined here. Systolic blood pressure (SBP) is a measure of pressure when the heart contracts in order to pump blood through the body, while diastolic blood pressure (DBP) is a measure of pressure when the heart is relaxed between contractions. Two studies have examined blood pressure differences between OC users and nonusers.

Arangino et al. (1998) conducted a study of OC use, BP, vascular reactivity, and catecholamine levels in OC users and nonusers. The study sample consisted of 22 OC users [n = 14, 30 μg ethinyl estradiol (EE); n = 8, 20 μg EE] and 22 nonusers controls matched for age and weight. The participants were asked to relax in a supine position for 30 minutes prior to the investigation. Heart rate, BP, and pulsatory index, which is believed to be a measure of downstream vasomotor state, were measured in the supine position and after 5 minutes of standing. Blood samples were collected to analyze catecholamine levels, specifically NE, epinephrine, and dopamine levels. The results indicated that the groups did not differ in terms of HR, SBP, or DBP. Axillary pulsatory index was higher among the higher dose EE OC users than in the lower dose users or nonusers. Levels of NE were higher in nonusers than in higher dose EE OC users at both measurements. Epinephrine levels did not differ between the groups. Dopamine levels were higher in nonusers than higher dose EE OC users in the supine position, and lower

dose EE OC users in the standing position. This study suggests that OCs may affect pulsatory index in the axillary artery.

Cardoso, Polonia, Santos, Silva-Carvalho, and Ferreira-Almeida (1997) conducted a study examining the effects of OCs on 24-hour blood pressure. A sample of 15 women were given a low-dose OC, and a control group of 8 women used an intrauterine device (IUD). The women wore an ambulatory blood pressure monitor for 24 hours for a baseline period and 6 months, and 9 months after OC use. The results indicated that after 6-9 months of OC use, women experienced an increase in 24-hour ambulatory systolic and diastolic blood pressure. This result was significant during the daytime, and even more so during the night-time. In contrast, BP values did not change for women using an IUD. Furthermore, two of the OC-using participants experienced an increase in BP that was considered to be hypertensive. These findings suggest that OC use can affect BP in such a way as to cause significant increases, and in some women, hypertension.

Hume, Barbour, Lapane, Flint and Carleton (1996) conducted a study of two American communities and compared OC users and nonusers on cardiovascular and socio-demographic variables. Six biennial surveys were completed by a sample of 5239 women ages 18 to 45. The results showed that DBP was consistently lower in OC users compared to nonusers, while SBP was lower among OC users in the last two surveys only. There were no differences between groups in HDL cholesterol, while cholesterol concentration differed in the first survey only, with OC users having higher levels than nonusers. These findings suggest that OCs may lower the blood pressure of women who take them.

Reinberg et al. (1996) conducted a study to assess circadian changes in a variety of physiological variables in OC users and nonusers. The sample consisted of 9 women currently using OCs and 7 nonuser volunteers. The results indicated that OC users had significantly higher mean SBP, higher mean heart rate, higher mean skin blood flow, and greater levels of transepidermal water loss then nonusers. Oral contraceptive users were also found to have lower salivary cortisol levels, and lower skin amino acids. Oral contraceptive use was associated with a lack of a circadian rhythm of skin amino acids and salivary melatonin levels while such a rhythm was found in nonusers. No group differences were found for DBP. These findings suggest that there are differences in biological activity between OC users and nonusers. However, the methodology of this study does not allow one to conclude whether these differences are pre-existing conditions or an effect of OC usage.

The four studies that examined cardiovascular differences between OC users and nonusers had inconsistent findings, in regard to SBP and DBP. Only one of these studies (Cardoso et al. 1997) used a prospective design to measure within-subject BP changes with OC use.

Studies Examining Differences in Physiological Reactivity between OC Users and Nonusers

Differences in physiological reactivity (e.g., hormone secretion, heart rate, and blood pressure) to cognitive, social, and physical stress between OC users and nonusers have been examined in numerous studies. Cardiovascular variables have been examined frequently because of the research correlating OC use with an increased risk of

cardiovascular disease (CVD; Dickey, 2000). This relationship is strongest for women with risk factors such as hypertension, obesity, and smoking.

In a study of OC use, smoking, and cardiovascular reactivity to cognitive and physical stressors, Emmons and Weidner (1988) used four groups of women aged 17 to 31 years ($N = 69$). Twenty-four women were classified as non-smoking OC users, 12 were in the smoking nonuser group, 14 were in the smoking OC user group, and the final group consisted of 19 nonsmoking nonusers. Two stressors were used for this study, the cold pressor test, involving the participant immersing her right hand in ice water for 60 seconds, and the mental arithmetic task, involving the participant starting with the number 300 and summing consecutive digits for 90 seconds. SBP, DBP, and heart rate reactivity were measured. The results of this study indicated that the groups did not differ in reactivity to the cold pressor task. However, with respect to SBP, a non-significant trend was noted indicating that OC users responded with nonsignificantly higher increases than nonusers. Smoking OC users responded to the mental arithmetic task with greater increases in SBP than the smoking nonusers. The authors suggest that OC use among smokers may lead to greater increases in SBP in response to cognitive stress in comparison to smokers who are nonusers. However, the results do not suggest any overall differences between OC users and nonusers in terms of cardiovascular reactivity to stress, other than those mediated by smoking.

In a study of hormonal and physiological responses to mild and heavy exercise, Bonen, Haynes, and Graham (1991) used a sample comprised of 7 OC users and 8 nonusers, all aged 19 to 24 years old. OC users participated during days 6 to 11 of pill use and days 3 to 5 of the pill free period, while nonusers participated during the follicular

and luteal phases. Participants rested for 60 minutes, then walked on a slightly inclined treadmill for 30 minutes, followed by 30 minutes at a steeper incline. Blood samples were taken before the exercise, 15, 30, 45, and 60 minutes during the exercise, and 30 minutes following the exercise. Assays for FSH, LH, human growth hormone (hGH), free fatty acids (FFA), cortisol, insulin, estradiol, and progesterone were conducted as well as an analysis of glucose, lactate, and glycerol. Levels of FFA were higher in OC users during mild exercise compared to levels in nonusers. However no phase differences, or group differences were found during heavy exercise. Levels of hGH were higher in the OC use phase during mild exercise than nonusers in the luteal phase. Cortisol levels did not differ between groups or phases during mild exercise. However, cortisol increased significantly in the control group in both the follicular and luteal phases during heavy exercise. The OC users demonstrated no increase in cortisol during exercise. These findings suggest that there may be certain differences in physiological reactivity to physical stress between OC users and nonusers. In particular, nonusers demonstrate a significant increase in cortisol during heavy exercise while OC users do not.

In another examination of cortisol responses to stress, Kirschbaum, Pirke and Hellhammer (1995) compared OC users, nonusers and men in two studies. In Study 1 there were 6 OC user and 6 nonuser participants, and in Study 2 there were 22 OC user, 23 nonuser, and 19 male participants. The Trier Social Stress Test was the method of stress induction in these studies and it involves a stress anticipation period, a public speaking task, and a mental arithmetic task completed before an audience. In both studies the authors found that the cortisol increase in response to the stressful stimuli was greater among the nonusers than the OC users. While the male participants demonstrated a

higher increase in cortisol levels than the nonusers, they also had higher baseline levels, which according to the authors, may be due to a reaction to the anticipation of the stressful stimuli. Subjective ratings of the stressful stimuli (controllability and predictability) showed no differences between the OC users and nonusers. The findings of this study demonstrate that OCs may attenuate responses to stress in users.

In a study of cardiovascular and catecholamine responses to stress in menopausal women, Del Rio et al. (1998) found that women who received estradiol treatment had lower plasma epinephrine responses to a mental stressor than those receiving placebo treatment. Both women receiving estradiol and progesterone treatments demonstrated lower SBP, and plasma glycerol levels in response to the stressor compared to those receiving placebo. There were no significant group differences between DBP, heart rate, cortisol, or norepinephrine responses to the stressor. According to the authors, this study indicates that the administration of estradiol and progesterone can modify catecholamine and cardiovascular responses to stress in menopausal women. Given that OCs contain both estrogen and progesterone, this study suggests that OCs may also decrease the epinephrine, SBP, and plasma glycerol response to a mental stressor.

Masson and Gilbert (1999) conducted a study to examine the possibility that OCs moderate mood and cardiovascular responses to smoking and abstinence. The study sample consisted of 24 Caucasian smoking women aged 18 to 45 (12 OC users and 12 nonusers). Participants attended two sessions, one during the menses phase and the other during the luteal phase (day 22 +/- 1) of the menstrual cycle. Two baseline measures of heart rate, SBP, and DBP were taken. A quantified dose delivery system (QSDS) was used to administer cigarette smoke. Participants first sham-smoked using the QSDS

without a cigarette, after 30 minutes they smoked a cigarette with a moderate nicotine level, and after another 30 minutes smoked another cigarette. The cardiovascular measures were taken at 3, 5, 10, and 20 minutes following each of the QSDS administrations (i.e., sham-smoking, first cigarette and second cigarette). Mood was assessed 15 minutes after each administration. The results demonstrated that heart rate increased more for OC users than nonusers. There was a significant interaction between smoking, OC status, and time. OC users demonstrated a larger increase in heart rate following the smoking of each cigarette than nonusers. Only 20 minutes after smoking did the increase in heart rate for the OC users become non-significant. Changes in DBP also exhibited group differences. For nonusers, the lowest DBP was found at 10 minutes after smoking, compared to 20 minutes in OC users. OC users reported more physical withdrawal symptoms when abstaining from smoking. No group differences were found when the effects of smoking on negative affect scores were examined. Masson and Gilbert suggest that these findings may demonstrate that female sex hormones moderate cardiovascular responses to cigarette smoke. The findings suggest that smoking causes larger and longer heart rate increases in OC users than nonusers.

Low et al. (2001) conducted a study to examine OC use, hostility, and cardiovascular reactivity in women. A sample comprised of 19 OC users and 51 nonusers participated in an interview designed to induce a low level of stress, while their heart rate and blood pressure were monitored. Hostility, personal attributes, and social desirability were measured. The findings suggested that OC users and nonusers do not differ on any of the psychosocial measures used in the study. A stepwise multiple regression analysis revealed that an interaction between hostility and OC use predicted heart rate increases in

such a way that high hostile nonusers experiencing the greatest change. However, the model did not account for a significant amount of the variance. There was no significant interaction between OC use, hostility and social desirability on DBP reactivity. For SBP, however, OC use accounted for a significant proportion of the variance, and also interacted with social desirability, such that there was marginally greater reactivity in OC users while OC users high in social desirability had the greatest reactivity. In summary, OC users had higher SBP reactivity to the stressor, while OC users who were concerned with social representation experienced the greatest reactivity. The implications of these findings are that OC use may cause greater SBP reactivity to a social stressor, and that OCs may interact with other variables that increase stress (i.e., social desirability traits) to create an even more pronounced SBP response.

The findings of West, Stoney, Hughes, Matacin, and Emmons (2001; mentioned above) indicated that at the baseline measure, OC users had higher SBP than nonusers. For the baseline heart rate measure, OC users who were nicotine-treated smokers had a higher heart rate than OC using non-smokers. When OC users were analyzed, it was found that non-smokers had greater heart rate reactivity than both smoker groups, as well as greater DBP reactivity than the nicotine treated group. This pattern was similar for SBP reactivity, but was not significant. No significant differences were found for the nonusers regardless of whether they were smokers or non-smokers. Analysis of the PANAS scores found no smoking status differences. The results may suggest that OC use leads to greater cardiovascular reactivity in non-smokers than smokers.

In an unpublished Master's thesis, Hand (2001) sought to examine cardiovascular, endocrine, and mood responses to a psychosocial stressor. A sample of 79 (28 males, 29

OC users, and 22 nonusers) undergraduate students, aged 18 to 43, were asked to complete the Trier Social Stress Test (described above). Saliva samples were collected in order for cortisol levels to be analyzed. Blood pressure (BP) and heart rate (HR) readings were taken five times during the experiment: a baseline reading, before the speech reading task, after the mental arithmetic class, and at 10 and 20 minutes following the completion of the test. Overall, the participants experienced a drop in positive affect (PA) and an increase in negative affect (NA) following the stressor. Results of the cortisol analyses found a main effect for group, and a cortisol x group interaction. At Time 2, 10 minutes after exposure to the TSST, males had higher cortisol levels than OC users. However, no differences were found between OC users and nonusers. When cortisol levels between Time 1 (baseline) and Time 2 (10 minutes after TSST) were analyzed, the findings suggested that both OC users and males experienced a significant increase, but the increase in nonusers was not significant. The BP variables both showed effects of time and increased from the baseline measures to the measures before and after the stressor, suggesting that the stressor did cause BP increases. For heart rate, however, only Time 2, prior to the stressor, was found to have a significant increase from the baseline. Unfortunately, between-group analyses comparing OC users with nonusers were not conducted for affect, HR, or BP. This study suggests that OC users, but not nonusers, experience significant cortisol increases following a social stressor.

Rohleder, Wolf, Piel, and Kirschbaum (2003) conducted a study to examine HPA axis activation and glucocorticoid (GC) sensitivity of pro-inflammatory cytokine production after psychosocial stress. A sample of 14 OC users and 11 nonusers in the luteal phase (high progesterone) of the menstrual cycle, were given the Trier Social Stress

test. Blood and saliva samples were taken and assayed for cortisol, and GC sensitivity; and leucocytes, monocytes, lymphocytes, and granulocytes (all types of white blood cells involved in the immune system) were counted. The results indicated that OC users showed significantly lower cortisol responses to the stressor compared to the nonusers at 20 and 30 minutes after the test. Nonusers had significantly higher maximum increases as well. OC users had a significant increase in leucocytes following the stressor, but nonusers did not. Also, OC users were found to have significantly lower granulocytes throughout the experiment. Group differences in GC sensitivity were also found. OC users demonstrated a significant increase in GC sensitivity of pro-inflammatory cytokine production in response to the stressor, whereas the nonusers did not demonstrate this increase, and the baseline measures did not differ. Although the authors note that the mechanism through which OCs affect the variables examined in unknown, clearly there are physiological differences between OC users and nonusers. These findings indicate that the blunted cortisol response related to OC use can affect the response of GC sensitivity of pro-inflammatory cytokine production after stress. According to the authors the findings may have implications for the immune system, and may suggest that OC users develop a compensatory mechanism due to their attenuated cortisol responses that may protect them from some inflammatory or allergic diseases.

The above studies suggest that differences can occur in the way that OC users and nonusers react to certain stimuli. Two studies found that OC users had a higher SBP response to a stressor (Emmons & Weidner, 1988; Low et al., 2001), however, the results of the former study were mediated by the effects of smoking. One study (Masson & Gilbert, 1999) found no evidence of differences between OC users and nonusers in SBP.

Three studies (Bonen et al., 1991; Emmons & Weidner, 1988; Low et al., 2001) failed to find differences between OC users and nonusers in DBP. However one study (Masson & Gilbert, 1999) found that the increase in DBP after smoking was prolonged in OC users. Three studies found evidence that OC users experience attenuated cortisol responses (Bonen et al., 1991; Kirschbaum, Pirke, & Hellhammer, 1995; Rohleder, Wolf, Piel, & Kirschbaum, 2003), whereas one study (Hand, 2001) found no group differences. Thus, the most consistent finding in this area is that OCs may blunt cortisol responses to social stress and physical exercise.

Studies Examining Reactions to Primed Jealousy

According to Daly, Wilson, and Weghorst (1982) jealousy is a state that is activated when a threat to a relationship is perceived, and this state prompts behaviour to respond to the threat. Jealousy is defined as sexual if the relationship being threatened is sexual. Given that jealousy occurs in the context of romantic and sexual relationships and may have some evolutionary adaptiveness at low levels, it is surprising that only a few studies have examined the role of hormones in jealousy. This section will summarize four studies that examine reactivity in response to attempts to induce jealousy. Three of the studies summarized below compared men and women to explore sex differences in jealousy, and two examined menstrual cycle changes in jealous reactions in women. Of note is the fact that only one study (Geary, Desoto, Hoard, Sheldon, & Cooper, 2001) examined the differences in reactive jealousy to primed situations based on hormonal status (i.e., hormonal contraceptive users versus nonusers).

Buss, Larsen, Westen and Semmelroth (1992) conducted a series of studies to examine sex differences in jealousy. The first study examined whether men and women

differ in their reactions to sexual versus emotional jealousy. A sample of 202 participants were asked to imagine a committed relationship they are in, have been in sometime in the past, or would like to have, and were asked to imagine their partner becoming interested in another person. The participants were asked what would upset them more, emotional or sexual infidelity. The results of this forced choice task indicated that males were more distressed by sexual infidelity, whereas females were more distressed by emotional infidelity. Study two was similar to study one, but participants were asked to imagine the above situations for 30 seconds while their electromyographic activity (EMG) activity was monitored. EMG activity is a measure of muscle activity in the brow region. The results indicated that men showed greater increases in electrodermic activity (EDA) and pulse rate (PR) in response to the imagined sexual infidelity. A similar pattern was found for brow contraction, although the result was not significant. Women showed greater EDA to the imagined emotional infidelity, but, although they demonstrated PR increases to both imagined situations, there were no significant differences between the two. Again, a similar pattern was found for brow contraction, but it did not reach significance. Study three used a sample of 133 male and 176 female participants to examine the effects of relationship status on the activation of jealousy. The jealousy stimuli were the same as described above in study one. The findings suggested that women still indicated that they would experience more distress in response to a partner's emotional infidelity regardless of whether or not they had ever been in a committed sexual relationship. For the male participants, the majority of those who had been in a committed sexual relationship expressed that they would feel more distress in response to a partner's sexual infidelity. This number decreased to a minority among men who had not been in a committed sexual

relationship. This suggests that sexual jealousy in men increases with the experience of a sexual relationship. The results suggest that women report more distress and experience greater EDA activity in response to imagined emotional infidelity, whereas men report more distress and experience greater EDA and PR reactivity to sexual infidelity. Also, having experienced a committed sexual relationship seems to activate sexual jealousy in men. While sex differences in sexual and emotional jealousy suggest the possibility of a role of hormones in jealousy, a second study by Harris (2000) suggests that those results are confounded by the fact that men appear to have more reactivity to sexual stimuli in general.

Harris (2000) conducted a series of studies to measure psychophysiological responses to imagined infidelity on the part of a romantic partner. The first study used a sample of 43 women and 36 men to replicate the findings of Buss et al. (1992) (discussed above). The instructions for induced jealousy were the same as the above study. HR, DBP, and SBP were assessed for a baseline measurement and throughout the experiment. The results indicated that for the women, there was no difference in reactivity to the imagined emotional versus sexual infidelity. For the male participants, sexual infidelity elicited greater reactivity than emotional reactivity in HR, SBP, and DBP. The second study set out to explore whether the men's greater reactivity to sexual infidelity was specific to infidelity, or if men would show greater reactivity to sexual imagery than to nonsexual imagery. A sample of 82 male undergraduate students imagined two scenarios, one involving emotional activity, and the other involving sexual activity. One-half of the sample imagined themselves interacting with their partner, whereas the other half imagined their partner with another person. The results indicated that SBP, DBP, and HR

reactivity were greater for the sexual imagery than the emotional imagery. Infidelity did not produce a significantly different response than non-infidelity. This study suggests that men do not necessarily exhibit greater physiological reactivity to a partner's imagined sexual infidelity, but instead react more to sexual imagery. Nevertheless, even if reactivity to sexual stimuli accounts for the findings that males exhibit more reactivity to sexual versus emotional infidelity, it still does not negate the fact that a sex difference in reactivity to sexual jealousy exists and could involve a hormonal mechanism.

In an investigation of sensitivity to feelings of jealousy, social frustration, and changes in creativity during three phases of the menstrual cycle, Krug, Finn, Pietrowsky, Fehm, and Born (1996) used a sample of 16 women (ages 21 to 32 years) who were not using hormonal contraceptives (nonusers). The participants were tested at three points during the menstrual cycle (menstrual, preovulatory, and midluteal phases). Before each manipulation to induce jealousy, participants listened to taped instructions that induced mental and physical relaxation. Tape-recorded stories lasting one minute each were used to induce jealousy, and included the participant imagining her partner having sexual intercourse (sexual jealousy), or forming an emotional attachment to another person (nonsexual jealousy). After the tape, participants imagined the situation in detail for 40 seconds. The findings of this study suggest that for the induction of jealousy, the non-specific electrodermal response (NSR) frequency tended to be higher in the preovulatory phase during the relaxation time and in all stimulus conditions than when compared with the luteal and menses phases. The increase in NSRs during the preovulatory phase was pronounced for the story inducing nonsexual jealousy, but not sexual jealousy, and a similar pattern was found when the participants imagined the situations after listening to

the tape. When the ratings of jealousy were examined, it was found that ratings in response to nonsexual jealousy were significantly higher in the preovulatory phase than the luteal phase, and tended to be higher than in menses, but this latter finding was not significant. These results indicate that responses to nonsexual jealousy are more pronounced during the preovulatory phase, suggesting that high estrogen levels may facilitate the experience of nonsexual jealous feelings.

In two studies, Geary, Desoto, Hoard, Sheldon, and Cooper (2001) examined the relationships between sex hormones and responses to infidelity. A sample of 159 women and 133 men were asked to imagine their partners becoming interested in another person, and asked whether an emotional attachment or sexual infidelity would distress them more. The majority of the males indicated that sexual infidelity was more distressing, but the females reported the opposite. The female group was divided into two separate groups: 61 users of hormonal contraceptives (not necessarily OCs), and 77 nonusers. Though the finding did not reach statistical significance, more nonusers than users of hormonal contraceptives reported that emotional infidelity was more distressing than sexual infidelity. Hormonal contraceptive users reported significantly more hurt feelings, anger, and jealous feelings than nonusers in response to both emotional and sexual infidelity. When the frequency of sexual activity and nature of the last relationship were used as covariates, hormonal contraceptive users still reported significantly more intense hurt feelings in response to imagined emotional and sexual infidelity, but hormonal contraceptive users no longer had significantly more feelings of anger to both types of infidelity or more jealous feelings to emotional infidelity. Hormonal contraceptive users tended to report more intense feelings of jealousy, but the finding was not statistically

significant. Sex differences were analyzed by comparing males and nonusers. Significantly more males reported more distress for imagined sexual infidelity than emotional infidelity, whereas females reported the opposite pattern. In the second part of the study, 47 nonusers completed the same jealousy/infidelity task as above, and filled out a menstrual cycle questionnaire. Saliva samples were collected and assayed for estradiol. Throughout the four test weeks (not specific menstrual cycle phases), the majority of the participants indicated that emotional infidelity would be more distressing. A cyclical effect for anger intensity in response to sexual infidelity was found, but the pattern of response was inconsistent. When estradiol levels were analyzed, it was found that only week two of the experiment (when the majority of participants were in the luteal phase) demonstrated a significant effect, where higher estradiol levels during this week were associated with a greater tendency toward sexual rather than emotional jealousy. Also, higher estradiol levels in week two were related to more anger in response to emotional infidelity and more hurt in response to sexual infidelity. This study indicates that feelings of anger in reaction to sexual infidelity vary across the menstrual cycle, but there is no consistent pattern. However, hormonal contraceptive users may have more intense reactions to perceived infidelity than nonusers.

The two studies examining cyclical differences in reactions to primed jealousy differ in their findings, with one (Krug, Finn, Pietrowsky, Fehm, & Born, 1996) finding that cyclical effects do exist and the other (Geary, Desoto, Hoard, Sheldon, & Cooper, 2001) finding cyclical effects with no apparent pattern. The one study that examined differences between hormonal contraceptive users and nonusers found that hormonal contraceptive users reported more intense reactions to the infidelity (Geary et al., 2001).

The fact that sex differences have been documented by researchers (e.g., Buss, Larsen, Westen, & Semmelroth 1992; Geary et al., 2001) suggests the possibility that there may be a relationship between hormones and jealousy. While one study suggested that men react more strongly to imagined sexual infidelity simply because of the sexual imagery, this does not negate the fact that the sex difference exists. Furthermore, the enhanced responsivity due to the sexual content provides some support for the idea that hormones may play a role in sexual jealousy. However, DeSteno, Bartlett, Braverman, and Salovey (2002) suggest that the sex differences that have been found in jealousy research are due to the forced-choice format, and are not found using other formats. Contrary to this finding, Geary et al. (2001) found sex differences in levels of anger, jealousy, and hurt feelings in response to imagined infidelity. Clearly more research is needed to examine variability in jealousy across the menstrual cycle, and differences in jealous responses between OC users and nonusers, in order to allow for a better understanding of the role of hormones in jealousy.

Studies Examining Social Ostracism

According to Williams (2001), ostracism can be defined as the act of ignoring or excluding. The Cyberball game provides a way to produce feelings of ostracism in individuals. It involves a series of ball tosses between a number of animated players. The game is set up to make the participant believe that he or she is playing with other real participants, when in actuality there are no other live players. The game is designed to exclude the participant when the other "players" stop throwing the ball to him or her. In the first study to use the Cyberball game Williams, Cheung, and Choi (2000) found that it was successful in producing feelings of ostracism. Feelings of control and meaningful

existence were not affected by the game, however self-esteem was found to be positively correlated with the estimated number of throws received, but negatively correlated with aversive impact. This section will review literature that has involved the use of the Cyberball game to induce ostracism or social rejection, as well as the only study to examine cortisol responses to social rejection (i.e., Stroud, Salovey, & Epel, 2001).

In an examination of ostracism and factors related to it, Zadro, Williams, and Richardson (2004) conducted two studies. The first study used a sample of 20 male and 42 female undergraduate students (mean age = 19.9 years). Students played the Cyberball game (described above) and were told that their performance was not important. Participants were assigned to one of two conditions: inclusion, where the participant receives the ball for approximately one-third of the throws; or ostracism, where the participants received the ball for two throws at the start of the game, and then were excluded. One half of the participants were told that they were playing with other study participants at other universities, and the other half were told that they were playing with the computer. Manipulation checks found that participants correctly perceived ostracism or inclusion. Ostracized participants reported lower levels of belonging, control, self-esteem, and meaningful existence. No main effects or interactions for mood were found. Ostracized participants reported more feelings of anger than included participants, and those ostracized by a computer reported feeling angrier than those ostracized by people. In study two, the authors examined whether providing a reason for the ostracism decreased its negative impact on the participant. A sample of 71 undergraduate students (30 males and 41 females; mean age 19.6 years) played the Cyberball game. A similar procedure to that of the first study was used, except that along with the conditions of

ostracism versus inclusion, and computer versus human players, a condition of scripted versus unscripted choice manipulation was used. In the scripted condition, participants were told that the other players had to follow a script to play the game, but in the unscripted condition the participants were told that the players could throw to whichever player they chose. The results of this study suggest that when mood was analyzed, ostracized participants reported feeling more negatively than included participants. However, there were no other main effects or interactions. No significant main effects on the levels of needs were found for the source (computer vs. humans) or choice manipulation (free or forced choice). Marginally significant trends were found suggesting that participants who thought the game was unscripted, reported higher levels of "meaningful existence", and that the effects of inclusion status on meaningful existence produced more differences when players were thought to be human than when thought to be the computer. It was also found that ostracized participants reported more feelings of anger, and hurt, and they also enjoyed the game less than included participants. Ostracized participants reported feeling angrier when they were ostracized by a computer. When they were ostracized by human players that were unscripted, participants reported more hurt feelings than when scripted. However participants reported more hurt feelings after being ostracized by a computer, whether or not it was scripted. The results of this study suggest that reactions to ostracism can be strong even when participants believe that a computer is involved in the exclusion.

In a study designed to examine the neural correlates of social exclusion, Eisenberger, Lieberman, and Williams (2003) used functional magnetic resonance imaging (fMRI) to measure activity in the brain. Two types of social exclusion were used

in this study: explicit social exclusion (ESE), where participants were excluded using the Cyberball game; and implicit social exclusion (ISE), where participants were told that due to technical difficulties, they could only watch the Cyberball game being played. An inclusion condition was also included where participants played the Cyberball game, but were not ostracized by the other "players". The results indicated that participants reported feeling excluded and ignored during ESE. During ESE, the dorsal anterior cingulate cortex was more active than during inclusion, and this activity was positively correlated with self-reports of distress. The anterior insula was also active, but not correlated with distress. More activity in the right ventral prefrontal cortex was noted during ESE than during inclusion, and this activity was negatively correlated with self-reported stress. Right ventral prefrontal cortex activity was also negatively correlated to dorsal anterior cingulate cortex activity during ESE. Dorsal anterior cingulated cortex activity was found to mediate the path from the right ventral prefrontal cortex to distress. Activation of dorsal anterior cingulated cortex was also found for ISE participants, but right ventral prefrontal cortex activity was not present. The authors note that these patterns of activation are similar to those reported by individuals who experienced physical pain in response to social exclusion. This suggests that social and physical pain have a common neuroanatomical base. The authors suggest that the neurological function of social pain is similar to physical pain, and it alerts individuals to injuries of social connections to allow for behaviours to fix the problem.

Stroud, Salovey, and Epel (2001) examined sex differences in stress response to achievement stress and social rejection. A sample comprised of 24 men and 26 women not using OCs aged 17 to 23 completed a stressful mathematical task, and a social

rejection challenge. Social rejection was achieved by having two trained confederates gradually exclude and reject the participant. Salivary cortisol levels were measured. The findings suggested that women showed greater increases in cortisol levels in response to social rejection than males. The authors suggest that the findings indicate that women show more physiological reactivity to negative events of an interpersonal nature.

This series of studies suggests that ostracism can be induced through the use of the Cyberball game. Ostracism was associated with feelings of hurt, distress, and activation of the dorsal anterior cingulate cortex and the right ventral prefrontal cortex areas of the brain. No previous studies have examined HR reactivity to ostracism, or cortisol levels in response to ostracism by means of the Cyberball game. However, the results of Stroud, Salovey, and Epel (2001) suggest that, in women, cortisol levels can change in response to social rejection. The evidence suggesting changes in brain activity and cortisol levels during the Cyberball game suggests that this game may be a very useful tool for mood-priming research. Given that no studies appear to have examined a role for hormones in response to social ostracism, the Cyberball game also be useful in this regard.

Studies Examining Parental Feelings

A number of studies that measure correlations between hormone levels and variables such as feelings of attachment to an infant, responses to infant cries and odours, and recognition of infant odours have been conducted. These studies tend to exclude nonparents from their samples, studying only current parents and soon-to be parents. The current literature tends to ignore the responses of nonparents to infant-related stimuli, and the stimuli themselves tend to be of a more negative nature (i.e., hunger and pain cries).

Compared to the knowledge of the role of hormones in animal parental behaviours, little is known about that of human parental behaviours. This is partially due to the fact that certain methods used in animal research (such as hormone manipulation studies) are unavailable for use in human research. Human research is limited to correlational studies and, unlike animal research, tends to examine only the parental behaviours of actual parents. Thus, the parental behaviours of nonparents towards infants, which is relevant in the study of human behaviour, especially in the context of adoption, is neglected. This section will include a brief review of the literature on hormones and parental behaviour in animals, as well as a description of the limited studies that exist for humans.

Young and Insel (2002), in an examination of hormones involved in parental behaviours, concluded that gestational steroid hormones, especially estrogen and progesterone, act as a primer of parental behaviour in the brains of various vertebrate species, including primates. Young and Insel note that the emergence of maternal behaviour toward the end of pregnancy in the female rat is related to a decrease in progesterone and an increase in estrogen. Termination of pregnancy through hysterectomy combined with ovariectomy delays the onset of maternal behaviour in rats, but estradiol treatments reinstate the behaviours. Progesterone treatments, however, delay the onset of maternal behaviour (Bridges, Rosenblatt, & Feder, 1978). Young and Insel note that both an increase in estrogen and a decrease in progesterone appear to be the optimal condition for the initiation of maternal behaviour in rats. Results of the studies examining prolactin and oxytocin have had mixed findings depending on the species, with each being involved in the maternal behaviour in some species, but not in others.

The role of hormones in parental behaviour and affection is not as widely studied in humans as it is in animals. Keverne (1988) notes that caution is needed when applying the results of animal studies to humans because the origin of maternal behaviours differ. As discussed by Robinson and Stewart (1989), a human female's desire to have children and raise them is affected by cultural expectations. The psychosocial factors that humans are subjected to influence parental behaviours and set humans apart from animals in this respect. Clearly, hormones are a factor in parental behaviour, but the extent of their influence, as well as the mechanisms involved, are not completely understood.

An older study by Levy (1941) used a sample of 72 women to examine factors related to maternal behaviour. The participants were interviewed and classified into three groups: high maternal, medium maternal, and low maternal, and variables associated with maternal behaviour were examined. Maternal behaviour was rated using questions about behaviours such as playing with dolls as children, taking care of siblings, reactions to seeing pretty babies, and women's tendency to display 'mothering' behaviour towards men. One main finding of this study was that participants with a shorter duration of menstrual flow were more likely to be classified as low maternal, whereas women with a longer duration were more likely to be classified as high maternal. This study may suggest that hormones are related to maternal behaviour as hormonal differences likely play a role in menstrual cycle differences. However, the results should be interpreted with caution as it is an older study, and no evidence was provided for the reliability and validity of the measures of maternal behaviour.

Fleming, Steiner, and Anderson (1987) conducted a study to examine the relationship between hormones and a mother's responses to her infant during the

postpartum period. A sample of 25 pregnant women were interviewed and asked to fill out questionnaires three times: during the last two months of pregnancy; three or four days after delivery; and two to four months after delivery. Mother-infant interactions were observed during the two postpartum periods, and blood samples were taken twice during the first postpartum period. Both approach behaviours, which were behaviours that are affectionate, directed at the infant, but not fulfilling a caretaking purpose (e.g., kissing, talking, rocking); and instrumental behaviour, which are behaviours with a specific purpose (e.g., burping, adjusting position, etc.) were observed. Blood samples were taken prior to and after feeding and were assayed for prolactin, estradiol, progesterone, testosterone, thyroid-stimulating hormone, triiodothyronine, thyroxine, and cortisol. The results found that the demographic variables, desire for pregnancy, and the mood variables were not significantly related to the maternal behaviours. Feelings regarding caretaking activities during pregnancy were associated with approach behaviour, whereas feelings about other children during pregnancy were associated with instrumental behaviour. None of the variables relating to childbirth were associated with the maternal behaviours. Higher cortisol levels were found to be associated with more approach behaviours and a positive maternal attitude, but there was no relationship between hormones and instrumental behaviours. These results suggest that cortisol may be positively related to the expression of maternal behaviour in the postpartum period.

A study by Fleming, Steiner, and Corter (1997) found that among a sample of 63 new mothers, first-time mothers with higher cortisol levels were more attracted to their infants' body odour. Mothers with higher cortisol levels recognized their infants' odours with better accuracy than mothers with lower cortisol levels. However, levels of cortisol

were not related to ratings of maternal attitudes, and progesterone levels were not correlated with odour recognition or maternal attitudes. These findings suggest that cortisol levels may be related to certain maternal responses.

Stallings, Fleming, Corter, Worthman, and Stiener (2001) conducted a study to examine the correlates of maternal responses in new mothers. A sample of 86 early postpartum mothers and 60 non-postpartum women were exposed to either infant cries, odours, or a control tape. Affective, hormonal, and HR responses were measured. The results indicated that new mothers reported feeling more sympathetic, and more alert in response to the infant cries than the non-postpartum women, however there were no group differences in response to the odour or control stimuli. Mothers indicating feeling more sympathy in response to the infant cries had higher baseline cortisol levels, a higher heart rate, and experienced a greater decline in cortisol levels during the stimulus period compared with mothers reporting less sympathy. Stallings et al. suggest that these heightened responses may facilitate mothers' responses to infant cues.

A series of studies by Fleming, Ruble, Krieger and Wong (1997) found that pregnancy-related hormones were not associated with feelings of attachment to the infant during the pregnancy. However, the changes in the ratio of estradiol to progesterone throughout the pregnancy were related to the attachment feelings in the postpartum period such that women who demonstrated less of a decrease in the ratio indicated greater feelings of attachment. These results suggest that hormone level ratios during pregnancy may be related to a mother's postpartum feelings of attachment to the infant.

Storey, Walsh, Quinton, and Wynne-Edwards (2000) conducted a study of 31 men with partners who were pregnant or had newborn infants. The men were exposed to

olfactory, auditory and visual infant-related cues. Two blood samples were taken prior to and after stimulus presentation and assayed for prolactin, cortisol, and testosterone. The findings indicated that men with two or more pregnancy symptoms (e.g., weight gain, nausea) had higher prolactin levels than men with less symptoms. Both higher prolactin levels and a decrease in testosterone levels from the first and second samples were found in men who reported feeling concerned in response to hearing a baby's cry. Among men participating before their baby was born, those with two or more pregnancy symptoms demonstrated a greater decrease in testosterone levels in response to the stimuli. These results suggest that men may experience hormonal responses to infant-related stimuli.

Fleming, Corter, Stallings, and Steiner (2002) conducted a study using a sample of 43 fathers (first-time and experienced) and 24 nonfathers. Emotional and hormonal responses to either infant cries or odours were measured. The findings demonstrated that fathers indicated feeling more sympathetic and alert than nonfathers in response to hearing infant cries. Among nonfathers, higher sympathy to the crying stimulus was associated with lower testosterone and higher cortisol levels. Fathers with lower testosterone levels reported feeling more sympathetic and indicated a greater need to respond to the crying. Fathers with higher prolactin levels demonstrated significantly greater alertness and a trend toward more positive feelings than those with lower levels. Compared to fathers who did not hear cries, fathers who heard infant cries showed greater increases in testosterone levels from the baseline to one minute following the stimulus. Interestingly, fathers had lower testosterone levels in general, and reported higher levels of alertness and sympathy in response to infant cries. According to the authors, these results imply that fathers are more responsive to infant cues than nonfathers and that

these responses are associated with hormone levels, specifically prolactin and testosterone.

Hirschenhauser, Frigerio, Grammar, and Magnussen (2002) conducted a study to examine patterns of salivary testosterone levels and sexual behaviours in men. A sample of 27 male volunteers provided daily saliva samples for a period of 90 days. The findings indicated that among men in a relationship who expressed a desire to have children with their current partner, there was a 28 day cyclical pattern in testosterone levels. This pattern was not found in men who were also in a relationship but who did not wish to have children with their partner. These findings suggest that there may be a relationship between testosterone and parental feelings in men.

Animal research has found that there are hormonal factors involved in maternal behaviour. The five human studies examined here suggest that there is a relationship between hormones and maternal behaviour. It is interesting to note that the three studies to examine cortisol in women found a relationship between cortisol and maternal behaviour. While research examining hormonal influences on human maternal behaviour is limited, the research on paternal behaviour is scant compared to that of maternal behaviour. The three studies that examine a relationship between hormones and paternal behaviour summarized here suggest that testosterone, prolactin, and cortisol may affect paternal behaviour or attitudes. Most studies involving parental behaviour focus on new or expectant parents and fail to examine parental attitudes and behaviour in non-parents. Also, only one study (i.e., Storey, Walsh, Quinton, & Wynne-Edwards, 2000) has examined hormonal involvement in emotional reactions to infant-related visual stimuli using laboratory paradigms, however their stimuli differ from that used in the present

study because their stimuli not only involved infants, but parents interacting with their infants as well.

Studies Examining Population Differences between OC Users and Nonusers

A review of recent research on population differences between OC users and nonusers has revealed a number of ways the two groups consistently differ: (a) OC users are more likely to smoke (Hume, et al., 1996; Parazzini, Negri, Ricci, Franceschi, & La Vecchia, 1996; Wilkins et al., 2000); (b) OC users are more likely to have lower body mass indices (Hume, et al., 1996; Parazzini et al., 1996; Wilkins et al. 2000); and finally, and (c) OC users are more likely to be sexually active (Bancroft et al., 1991; McCoy & Matyas, 1996; Parazzini et al., 1996). While these and other studies have found other differences between OC users and nonusers as well, only the small number of findings that have been consistent across studies have been discussed here. These results suggest that OC users and nonusers differ in physiological and psychosocial ways. These differences are important to be aware of so that researchers can attempt to control for them, if they are potential confounds, in studies exploring the effects of OCs on behaviour and physiology.

The Present Study

The purpose of the present study was to examine any differences between OC users, nonusers, and men in terms of mood, mood reactivity, and heart rate in response to stimuli designed to induce positive affect, jealousy, social ostracism, and parental feelings. A sample of OC users, nonusers, and men had their mood measured before and after exposure to the above mentioned stimuli, and had their heart rate monitored throughout the exposure. Group differences in mood, mood variability, and HR were

examined. Many previous studies examining OC group differences in reactivity to stimuli failed to include a group of men to further examine the roles of sex differences (e.g., Low et al., 2001). Some of the studies examining sexual or relationship jealousy have included participants that have never been in a committed sexual relationship (Buss et al., 1992; Geary, DeSoto, Hoard, Sheldon, & Cooper, 1999). The present study will overcome these limitations by having a fairly large sample size ($N = 108$), a control group of men, and using participants who have, at some time in their life, been in a committed relationship lasting at least two months. Very few studies have examined parental behaviour in humans, and those that do, tend to examine maternal behaviour, as opposed to paternal or parental behaviour. This study will be the first to examine whether OCs affect mood and HR reactivity to stimuli that induce social ostracism, parental feelings stimuli, or relationship jealousy. Based on the previous literature, it was hypothesized that OC users will experience less overall mood reactivity to all of the stimuli.

Method

Participants

Screening Phase. Two-hundred eighty-one volunteers recruited from Introductory Psychology classes, upper year psychology classes, and other classes at Lakehead University, filled out a screening questionnaire for a study on factors affecting mood in men and women. Students received one bonus point towards their Introductory Psychology mark for their participation in the screening phase of the study. No exclusionary criteria were used at this phase of the study. However, only 260 participants who were not taking mood-altering or hormone-altering medications (other than OCs)

met criteria for the analyses (mean age = 19.59, *SD* = 2.94; 108 OC users, 89 nonusers, 53 men). Due to missing data, 215 participants were used for the analyses in this phase.

Experimental Phase. From the participants in the screening phase, 121 volunteers (mean age = 19.31, *SD* = 1.45) participated in the experimental phase of the study (54 OC users, 36 nonusers, and 31 men). However, 13 OC users were not in the periovulatory or luteal phases at the time of participation and were therefore not included in the analysis, leaving a sample of 41 OC users. The participants in the experimental phase met the following inclusion criteria: (a) age 18 to 25; (b) no history of mood-related disorders (e.g., depression, bipolar disorder); (c) no use of mood-altering medications (other than OCs) (e.g., antidepressants, lithium, benzodiazepines); (d) no current use of hormone-altering medications, with the exception of the OC user group; (e) have been in a committed relationship that lasted at least two months; and (f) heterosexual sexual orientation. In addition, the nonuser group must not have used OCs within the last three months, and women in the OC user group must have used OCs for at least the past three months (for frequencies of OC brand usage see Table 1). For their participation in the experimental phase of the study, those volunteers in first year Psychology received another bonus point toward their Introductory Psychology mark.

Measures and Tasks

Screening Questionnaire. The screening questionnaire (see Appendix A) includes sections on demographic information, health information, relationship information, reproductive and sexual history, beliefs/attitudes, and mood. The following measures were also included: the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988), the Positive and Negative Affect Schedule Expanded (Watson & Clark,

Table 1

Frequencies (Percentages) of OC Brand Usage for Current OC Users in the Screening and Laboratory Samples

OC Formulation	Screening Sample ($N = 91$)	Laboratory Sample ($N = 41$)
Alesse	27 (29.67)	12 (29.27)
Diane-35	7 (7.69)	2 (4.88)
Marvelon	17 (18.68)	7 (17.07)
MinEstrin	1 (1.09)	0 (0.00)
Min-Ovral	1 (1.09)	1 (2.44)
Ortho 1/35	0 (0.00)	0 (0.00)
Ortho 7/7/7	1 (1.09)	0 (0.00)
Ovral	1 (1.09)	1 (2.44)
Tri-cyclen	24 (26.37)	13 (31.71)
Tri-cyclen Lo	1 (1.09)	0 (0.00)
Triphasil	3 (3.30)	2 (4.88)
Triquilar	4 (4.40)	3 (7.32)
Yasmin	4 (4.40)	0 (0.00)

1994), the Sociosexual Orientation Inventory (Simpson & Gangestad, 1991), the Romantic Partner Attribute Index (Simpson & Gangestad, 1992), the Reactivity subscale of the Mood Survey (Underwood & Froming, 1980), the Dyadic Trust Scale (Larzelere & Huston, 1980) the Interpersonal Orientation Scale (IOS) (Hill, 1987), the Rejection Questionnaire (RSQ; Downey & Feldman, 1996), and the Relationship Jealousy Scale. Those measures of particular relevance to the present study are described below.

The Positive and Negative Affect Schedule (PANAS) (Watson, Clark, &Tellegen, 1988) (see question 15) consists of 20 adjectives that describe affective states (10 items for negative affect and 10 items for positive affect). The PANAS is included in the Screening Questionnaire with the instructions that the participants rate the degree to which they experienced each emotion "today" using a Likert scale ranging from 1 (*very slightly or not al all*) to 5 (*extremely*). Watson, Clark and Tellegen report that the positive affect (PA) subscale has a coefficient alpha of .89, and .87 for the negative affect (NA) subscale. In the screening sample of the present study, the alpha levels were found to be .85 for PA and .85 for NA.

In addition to the PANAS, a number of subscales from the expanded form of the measure, the Positive and Negative Affect Schedule Expanded (PANAS-X) (Watson & Clark, 1994) were used (see question 15). These subscales include the Sadness scale (five items), the Shyness Scale (four items), the Self-Assurance Scale (six items), the Serenity Scale (three items), the Guilt subscale (six items), and the Joviality subscale (eight items). These particular subscales were chosen as they may be the most relevant when it comes to predicting the amount of variability that participants end up experiencing in response to the stimuli used in this study. A number of studies assessing mood variability within

individuals suggested that the PANAS-X scales can validly assess short-term state affect (Watson & Clark, 1994). The PANAS-X was found to have adequate reliability and validity (Watson & Clark, 1994).

The Sociosexual Orientation Inventory (SOI), developed by Simpson and Gangestad (1991), is a valid and reliable (Cronbach's $\alpha = .73$) measure of sociosexual orientation (see question 17). Simpson and Gangestad define sociosexuality as differences among individuals in their willingness to engage in sexual activity without emotional bonding, commitment, or closeness. Individuals with an unrestricted sociosexual orientation tend to engage in sexual activity without these factors, whereas individuals with a restricted sociosexual orientation tend to display the opposite behaviours. The SOI includes items on the number of sexual partners in the past year and foreseen in the future, number of one-night stands, and other questions based on sexual attitudes and experiences. As suggested by Simpson and Gangestad (1991), the SOI score was calculated using a weighted formula as follows: SOI = 5(# of sexual partners in past year) + 1(# of partners foreseen in next 5 yrs) + 5(# of one-night stands) + 2(attitudes toward casual, uncommitted sex). The item assessing frequency of sexual fantasy about someone other than one's current partner infers the participant has a partner, and was therefore removed from the scale, as in Clark (2004). The internal reliability of the scale was found to be adequate in this sample at $\alpha = .74$. Given previous evidence that indicates OC users and nonusers differ in sociosexual orientation (e.g., Clark, 2004; Oinonen, & Jarva, 2006) this measure was included in this study.

In order to assess the trait of mood reactivity, the Reactivity subscale of the Mood Survey (Underwood & Froming, 1980) was included in the Screening Questionnaire

(question 24). The Reactivity subscale is comprised of eight items, six measured on a 6-point scale and two on a 99-point scale. Items include statements such as "I'm a very changeable person" and "my moods are quite consistent; they almost never vary". Test-retest reliability for the reactivity subscale has been found to be good for both three (.85) and seven (.83) week periods (Underwood & Froming, 1980). The Mood Survey has good concurrent validity and preliminary construct validity (Underwood & Froming, 1980). The scores on the Reactivity subscale may predict individual differences in mood responses to the stimuli used in this study.

The Dyadic Trust Scale (Larzelere & Huston, 1980) is an eight-item measure that was designed to be relevant for both dating and married couples (see question 28). Items are measured on a Likert-type scale adapted for the present study, ranging from 1 (*very untrue*) to 7 (*very true*). The scale includes statements such as "I feel that I can trust my partner completely". Dyadic trust is defined as an individual's judgement of a significant other's honesty and benevolence toward him/her (Larzelere & Huston, 1980). An examination of discriminant validity by Larzelere and Huston indicates that dyadic trust is more highly associated with love and self-disclosure than with social desirability or general trust. The scale was also found to have good face validity, reliability, and construct validity. This scale was included as dyadic trust may be related to the experience of jealousy.

Hill (1987) developed the Interpersonal Orientation Scale (IOS) to assess dimensions of affiliative motivation. Three of the four subscales of the IOS will be used in this study: the positive stimulation, emotional support, and social comparison scales (see question 44). The positive stimulation subscale reflects the extent to which an

individual receives positive stimulation from interpersonal closeness. The emotional support subscale reflects the extent to which emotional support or reduction in negative affect is gained through social contact. The social comparison scale reflects the degree to which an individual looks to others to gain information relevant to oneself. The emotional support and positive stimulations scales have alpha values ranging from .81 to .86 for women and men. The social comparison subscale has the lowest alpha coefficients of the three subscales at .71 for women and .76 for men. The test-retest reliabilities are .87, .81 and .66 for a one week period, and .70, .61 and .56 for a 6 to 15 week period, for the positive stimulation, emotional support, and social comparison scales, respectively. These scales may be related to mood or affective response to social ostracism or jealousy and are therefore included in the Screening Questionnaire.

The Relationship Jealousy Scale is a measure created for the purposes of this study. It originally consisted of 10 items describing different scenarios that may cause feelings of jealousy. Each item consists of a situation involving one's romantic partner (e.g., you see your partner smiling at an attractive member of the opposite sex), followed by a likert-type scale ranging from 1 (*not at all jealous*) to 7 (*extremely jealous*) which the participants use to rate how they would feel if they were in that situation. A reliability analysis ($n = 258$) of the ten item scale indicated that the reliability of the scale would improve with the deletion of one item (i.e., your partner has a child with a member of the opposite sex). Therefore, the final scale was comprised of nine items (Cronbach's $\alpha = .881$). A total score was calculated by summing the score of each item.

Pre- and Post-Stimuli Questionnaires. Before and after each mood induction task, participants were asked to fill out a questionnaire to assess their affective state (see

Appendices B to I for the questionnaires). The affect measure included the 20 items of the PANAS (Watson, Clark, & Tellegen, 1988) (see above for details), and three scales of 5 items each, that were chosen to best capture the type of mood change that occurs in response to specific stimuli that induce jealousy, parental feelings, and a sense of ostracism. The items of these three scales were chosen through a pilot study where 14 graduate students rated which emotions they would be most likely to experience in a number of situations similar to those used in the study. The highest scoring 15 items were included in the scales (5 items per scale). Internal reliability (coefficient alpha) for each of the three scales were calculated based on the post-task questionnaire for the corresponding task ($N = 108$). The jealousy scale includes the items angry, unloved, humiliated, jealous, and dejected. The jealousy scale was found to have good internal consistency ($\alpha = .91$). The parental scale included the items happy, delighted, affectionate, content, and motherly/fatherly. Reliability for the parental scale was found to be adequate, $\alpha = .80$. The social ostracism scale includes the items hurt, rejected, ignored, excluded, and sad. The social ostracism scale was found to have good reliability, $\alpha = .86$. The PANAS was included in the pre- and post-stimulus questionnaires with the instructions to rate the experience of the emotions "at this moment". As reported by Watson and Clark (1994), the "moment" instructions produce alpha coefficient values of .88 for the PA subscale and .85 for the NA subscale. In addition to these 35 items (i.e., 20 PANAS items and 15 additional items), the post-stimulus questionnaires for each task also included other questions that were only related to the specific mood-induction task. These items were used to evaluate the overall effectiveness of the mood induction procedure and are described below.

The jealousy task pre-stimulus questionnaire, labelled Script Questionnaire A (see Appendix B), contains the affect measure. The post-stimulus questionnaire for this task, labelled Script Questionnaire B (see Appendix C), contains the affect measure, Jealous Reactions Scales I and II (JRS-I and JRS-II) (Rich, 1991), and a number of questions regarding the degree and direction of any feelings of blame and anger. Rich (1991) developed the JRS-I and II to measure jealous responses to a jealousy-inducing situation. The first factor, the JRS-I reflects jealous behaviours aimed at protecting self-esteem through attacking one's partner. This factor contains items such as "plan ways to get back at my partner". The second factor, the JRS-II, reflects behaviours aimed at protecting against a threatened loss of the relationship through what the author refers to as partner enhancing behaviours. Items in this factor include "make myself more attractive to my partner". The JRS-I has alpha values of .82 for men and .84 for women, and the JRS-II has values of .90 for men and .84 for women. This scale was adapted for use in the present study, and is included in the post-stimulus questionnaire for the jealousy induction task. Participants were asked to fill out the questionnaire following the jealousy induction task. The JRS-I and II were used to assess reactions to the situation used in the present study.

The parental feelings pre-stimulus questionnaire, labelled Slideshow Questionnaire A (see Appendix D) contained the affect measure. The post-stimulus questionnaire, called Slideshow Questionnaire B (see Appendix E) contained both the affect measure and items about desire to have children, the number of children desired, and how soon participants would like to have children. These are items identical to those

found in the Screening Questionnaire and were used to assess the degree to which the task may have increased parental feelings.

The Cyberball Questionnaire A (see Appendix F) included the affect measure. The post-stimulus questionnaire, Cyberball Questionnaire B (see Appendix G), included both the affect measure, and a number of items adapted from previous studies using the Cyberball game (e.g., Zadro et al., 2004). These questions were used to further examine the extent to which the mood manipulation produced the intended effect.

The Video Questionnaire A (see Appendix H) and the Video Questionnaire B (see Appendix I) only included the affect measure. No additional measures were added as the positive affect scale on the PANAS was used to assess the expected increase in PA.

Baseline Task. In order to obtain a baseline measure of HR before each task, participants were required to sit with their eyes closed and visualize themselves walking to class on an ordinary day for a period of 30 seconds.

Social Rejection/Ostracism Task. A computer game called Cyberball was used to induce feelings of social rejection and ostracism. This ball-tossing game is available on the internet (http://www.psy.mq.edu.au/staff/kip/Announce/cyberball.htm), and has been found to adequately induce feelings of ostracism in a number of studies (Eisenberger, 2003; Williams, Cheung, & Choi, 1999; Zadro, Williams, & Richardson, 2004). The game involved four animated characters, one of which represented the participant, tossing and catching an animated ball. The characters were labelled with their sex and a subject identification number. The sex of the characters depended on the sex of the participant, and all participants played with one member of the same sex and two members of the opposite sex. Participants were told that the computer was connected online to computers

at other universities and that they were playing the game with other study participants. The game is designed to include the participant at the beginning of the game, but then the animated characters stop throwing the ball to the participant after a prescribed number of tosses. For the purposes of this study, the game lasted 75 throws, the ostracism started after the participant had two catches and throws, and the game was approximately 4 minutes in duration.

Parental Feelings Induction Task. A slide show consisting of 41 pictures of human babies was shown to the participants on a computer using Microsoft PowerPoint. Each photograph was shown for 4 seconds and the slideshow lasted 164 seconds (2 minutes 44 seconds). The pictures were positively toned, included babies from a mix of ethnicities, and none of the pictures included distressed or upset babies. The purpose of this task was to induce parental feelings.

Jealousy Induction Task. A written script (see Appendix J) depicting infidelity was read by the participants and they were asked to visualize and focus on their emotional response to the situation for 90 seconds. The script required participants to visualize their romantic partner being unfaithful to them and included aspects of both emotional and sexual infidelity. An identical script was used for the male and female participants except that the gender was changed in the description.

Positive Mood Induction Task. A comedy video segment lasting 118 seconds (1 minute 58 seconds) was shown at the end of the session in order to induce a positive mood. Unlike the other three tasks, this task was not presented in random order, as one purpose of placing this task last was to ensure that the participants did not leave the

session immediately following a negative mood inducement. However, affect was monitored both before and after this task as well.

Heart Rate Monitor. Heart rate (HR) was measured using a Polar S810i heart rate monitor. Participants wore the heart rate monitor strap around their chest under their clothes. Heart rate data was sent to the watch receiver and was recorded using Polar Precision Performance software. The HR data (beats per minute) was averaged over every 15 seconds. For each mood-priming task, two heart rate recording periods took place. The first reading was for a 30-second baseline period prior to completing the pre-stimulus questionnaire. The second recording was for the duration of the mood-priming task. There were often discrepancies in the number of readings for each task (between participants), most likely due to human reaction time error in pressing the start/stop button. Thus, only the middle portions of the HR readings were used in the analyses for all participants.

Procedure

Screening Phase. Recruitment for this study was targeted at Lakehead University's Introductory Psychology classes. A package containing Consent Form A (see Appendix K), the Screening Questionnaire (see Appendix A), and Debriefing Form A (see Appendix L) was given out to all student volunteers. Participants were told that the purpose of the study was to examine mood and cardiovascular response in undergraduate students. Introductory Psychology students received a bonus point towards their Introductory Psychology mark for participation in the screening phase. The participants were asked to drop off the completed consent form and questionnaire in a designated drop box. Participants were told that a researcher would contact them if they

were eligible to participate in the experimental phase of the study. Participants who met the inclusion criteria listed above were contacted by phone or email and asked if they would be willing to participate in the experimental phase of the study. They were told that they would be asked to perform a series of tasks, including playing a game, reading a short story, watching a slideshow, and filling out questionnaires, while their heart rate was monitored. Participants were also told that the session would last approximately 30 to 45 minutes, that they would be free to discontinue the study at any time without explanation or penalty, and that Introductory Psychology students would receive a second bonus point for completing the experimental phase.

Experimental Phase. For both nonusers and OC users, laboratory appointments were set up during either their periovulatory (days 10 to 15) or luteal (days 20 to 24) phases of their menstrual cycle based on the backward count method and information in their screening questionnaire. These days were chosen as they are likely to represent the menstrual cycle phases where OC users and nonusers differ most (e.g., nonusers experience LH, FSH, and estradiol peaks during the periovulatory phase, and progesterone peaks during the luteal phase, while OC users experience either continuous levels of hormones across the cycle or relatively continuous estrogen levels with weekly changes in progesterone). Upon arrival at the experimental session, participants were again given a description of the study, and were asked to read and sign Consent Form B (see Appendix M). They were fitted with the heart rate monitor and then asked to fill out the first Pre-Stimuli Questionnaire. Participants were asked to play the Cyberball game, read and visualize a script designed to induce jealousy, and view a slide show of pictures of human babies, all described above. These three mood-inducing tasks were presented in

a randomized order. The positive mood induction task (video) was shown at the end of the session so that participants did not leave the session while experiencing negative mood symptoms. Before and after the completion of each of the four mood-induction tasks, participants completed the relevant Pre- and Post- Stimuli Questionnaires. Before each pre-stimuli questionnaire was completed, a baseline HR was recorded for 30 seconds. Then the pre-stimulus questionnaire was completed and then the mood induction task was presented. A second HR monitoring period covered the duration of the mood-priming task. Thus, for each task there was a 30 second baseline HR, and a mean HR recorded throughout the entire mood induction task. Following the completion of all tasks, participants were fully debriefed, asked not to divulge the purpose of the study and the tasks involved to other potential participants, and were given the opportunity to ask any questions they may have about the study. Participants were given Debriefing Form B (see Appendix N) and reminded that they would receive a summary of the study results at the end of the study if they provided their email address on Consent Form B. For their participation in the experimental phase of the study, volunteers received an additional bonus point toward their Introductory Psychology mark. As part of Debriefing Form B, a list of mental health resources was provided to all participants in case anyone felt that they would like to receive additional information about how to cope with mood-related concerns (See Appendix N).

Data Reduction and Analyses

Screening Data. A multivariate analysis of variance (MANOVA) was planned to examine group differences (OC users, nonusers, men) in the following twelve variables: PANAS-X scores (positive affect, negative affect, joviality, sadness, guilt, shyness, self-

assurance, serenity), IOS scale scores (emotional support, positive stimulation, social comparison), and Mood Survey reactivity subscale scores. Two univariate ANOVAs were also planned to examine group differences in dyadic trust scores and SOI scores. The primary purpose of these analyses was to determine if any differences exist between OC users and nonusers.

Laboratory Session Data. The main planned analyses included four one-way between group multivariate analysis of variance (MANOVA). The first MANOVA examined group differences in overall mood reactivity in response to the four mood induction tasks. The three groups (OC users, nonusers, and men) were compared on five mood reactivity dependent variables: the sum of the absolute values of the mood change scores across the four tasks for PA, NA, the jealousy scale, the parental scale, the social ostracism scale. For each of the five affect variables (PA, NA, jealousy, ostracism, parental feelings) total mood reactivity scores were calculated in the following manner: total mood reactivity = | post-slideshow mood score – pre-slideshow mood score | + | post-script mood score – pre-script mood score | + | post-cyberball mood score – pre-cyberball mood score | + | post-video mood score – pre-video mood score |. Thus, each mood reactivity score represented the total amount of affect change across the four tasks for the specified affect dimension. For example, PA reactivity = | post-slideshow PA – pre-slideshow PA| + | post-script PA – pre-script PA | + | post-cyberball PA – pre-cyberball PA | + | post-video PA – pre-video PA |.

The second planned MANOVA used a repeated-measures design to examine group differences in mood reactivity that were specific to each of the four tasks. The repeated-measures variable was time (pre-task, post-task), and the same three groups

(independent variable) were compared on four dependent variables at both times: jealousy scale scores on the jealousy task, parental scale scores on the parental task, social ostracism scale scores on the social ostracism task, PA scale scores on the comedy video task.

The third planned MANOVA was of repeated-measures design and compared the groups in terms of heart rate change scores across the four tasks. The analysis examined change in heart rate from before each task (baseline pre-task HR) to the mean HR within each task (during-task HR).

The fourth planned MANOVA was conducted to examine group differences in terms of mean heart rate and heart rate variability across tasks. Mean heart rate was calculated for all pre-task and during-task time periods by taking the mean of all 15s HR readings during that time period. Change in HR variability due to the mood inductions was calculated as follows: HR reactivity = | HR slideshow variance –HR pre-slideshow variance | + | HR script variance – HR pre-script variance | + | HR cyberball variance – HR pre-cyberball variance | + | HR video task variance - HR pre-video variance |.

For all analyses, significant MANOVAs were followed up with univariate ANOVAs and pairwise comparisons were conducted on significant ANOVAs

Results

Data Screening

Prior to analyses, variables were inspected for data entry accuracy, outliers, normality, linearity, and homoscedasicity. All variables were screened separately for the three groups (OC users, nonusers, and men). Outliers were identified based on *z*-score values of >3.29 (Tabachnick & Fidell, 2001). Multivariate outliers were examined using Mahalanobis distance. Skewness and kurtosis values that differed significantly from zero

were considered non-normal (Tabachnick & Fidell, 2001). Variables that were heavily skewed and/or contained outliers were transformed to reduce the influence of these problems. In the case of one variable where a transformation was not effective, the value of the outlier was changed to one plus the next highest value, as per the advice of Tabachnick and Fidell.

Screening Questionnaire. The distributions of all fifteen variables from the Screening Questionnaire were examined separately for the three groups. The following eight scales were normally distributed and did not require adjustment: the PANAS-X subscales of PA, Serenity, Joviality, and Self-Assurance; the Emotional Support, Positive Stimulation, and Social Comparison scales of the IOS; and the Relationship Jealousy Scale. The following six variables were transformed for the analyses: NA (logarithmic), guilt (logarithmic), sadness (logarithmic), shyness (logarithmic), SOI (logarithmic), DTS (reflect and square root). See Appendix O for a description of normality problems and the transformations applied to the variables.

Laboratory Data. Five summed affect change scores across the tasks were examined in the first MANCOVA: PA, NA, parental feelings, jealousy, and ostracism (see Appendix P for normality issues and transformations). Each variable was transformed: PA (logarithmic), NA (square root), jealousy (square root), parental feelings (square root), ostracism (square root). The pre-test and post-test scores for the following variables were examined in the repeated-measures MANCOVA: parental feelings from the parental feelings mood induction; jealousy from the jealousy induction; ostracism from the social ostracism induction; and PA from the happy mood induction. Transformations were applied to the following variables: pre-test ostracism (logarithmic),

post-test ostracism (logarithmic), pre-test jealousy (logarithmic), and post-test jealousy (logarithmic). The third MANCOVA included two transformed variables: change scores for HR variance (square root), and change scores for HR means (square root) (see Appendix P for a description of the transformations).

Covariate Normality

The variables BMI, age, and alcohol use were all positively skewed and leptokurtic. Both BMI and age received a logarithmic transformation, and alcohol use received a square root transformation in order to reduce these normality problems (see below for rationale for using these covariates).

Statistical Considerations

Because of the number of analyses being conducted (six), a significance level of .01 was used to control for Type I errors. In the examination of group equivalency, a significance level of .05 was used. Pillai's criterion was used to evaluate multivariate significance. The Bonferroni adjustment was used for follow-up pairwise comparisons. All means reported are untransformed unadjusted means, unless otherwise indicated.

Examination of Group Equivalency

The three groups (OC users, nonusers, men) were examined for equivalency in the following variables: medication use, medical conditions, relationship status, body mass index (BMI), age, caffeine consumption, and total alcohol consumption (frequency of alcohol consumption x number of drinks) (see Table 2). Univariate ANOVAs were used to examine group equivalency in BMI, age, caffeine consumption, and total alcohol consumption. The three groups differed significantly in age, $F(2, 246) = 5.06$, $p < .01$, partial $\eta^2 = .040$; BMI, $F(2, 238) = 4.33$, $p = .014$, partial $\eta^2 = .035$; and total alcohol use,

$F(2, 246) = 7.926, p < .001$, partial $\eta^2 = .061$. The groups did not differ significantly in caffeine consumption, $F(2, 235) = 0.162, p > .05$, partial $\eta^2 = .001$, power = .075. As indicated in Table 2, post hoc tests found that: (a) OC users were significantly younger than males ($p = .019$); (b) OC users had lower BMIs than men ($p = .036$); and (c) both OC users and nonusers had lower total alcohol scores than men (both $p < .01$).

Examination of the categorical variables also revealed a group difference in relationship status, χ^2 (2, $N = 250$) = 7.93, $p = .019$, Cramer's V = .18. As expected, OC users were more likely to have a partner than nonusers χ^2 (1, $N = 202$) = 5.49, $p = .019$, Cramer's V = .17. Males were also more likely to have a partner than nonusers, χ^2 (1, $N = 145$) = 5.60, $p = .018$, Cramer's V = .20. The groups did not differ on medication use, χ^2 (2, $N = 249$) = 1.10, $p > .05$, Cramer's V = .072; or medical conditions, χ^2 (2, $N = 250$) = 1.22, $p > .05$, Cramer's V = .07 (see Table 2 for frequencies). Due to these group differences, age, BMI, alcohol use, and relationship status were used as covariates in all analyses of the screening questionnaire data. Thus, MANCOVAs and ANCOVAs were conducted instead of MANOVAs and ANOVAs.

Group equivalency for the participants in the laboratory session was also tested using the same dependent variables (age, BMI, total alcohol consumption, caffeine consumption, medication use, medical conditions, and relationship status)(see Table 3). Univariate ANOVAs were conducted on the first four variables listed above. The groups did not differ in the following dependent variables: BMI, $F(2, 100) = 2.77, p > .05$, partial $\eta^2 = .052$; age, $F(2, 104) = 2.79, p > .05$, partial $\eta^2 = .051$; and caffeine consumption, $F(2, 105) = 0.831, p > .05$, partial $\eta^2 = .016$. However, there was a significant group difference in total alcohol consumption, $F(2, 104) = 3.23, p = .044$, partial $\eta^2 = .058$. Follow-up tests

Table 2

Means (Standard Deviations) or Frequencies (Percentages) of Seven Variables Used to Examine Group Equivalency for the Screening Variables

Variable	OC users ($N = 93$)	Nonusers ($N = 77$)	Men ($N = 45$)
	Means (Standard Deviations)		
Age**	19.02 (1.26)$_b$	19.55 (2.85)	20.67 (4.79)$_b$
BMI*	22.96 (4.38)$_b$	23.94 (5.39)	25.46 (6.64)$_b$
Alcohol Use***	3.42 (1.37)$_b$	3.30 (2.12)$_c$	4.31 (2.70)$_{b, c}$
Caffeine Use	2.73 (1.24)	2.74 (1.03)	2.58 (1.08)
	Frequencies (Percentages)		
Relationship Status*			
Partner	50 (53.80)$_a$	29 (37.70)$_{a, c}$	25 (55.60)$_c$
No Partner	43 (46.20)	48 (62.30)	20 (44.40)
Medication Use			
Yes	8 (8.60)	8 (10.50)	3 (6.70)
No	85 (91.40)	68 (89.50)	42 (93.30)
Medical Conditions			
Yes	30 (32.30)	18 (23.40)	10 (22.20)
No	63 (67.70)	59 (76.50)	35 (77.80)

Note. Shared letter subscripts in a row indicate significant differences for the specified groups. $_a$ OC user and nonuser groups differ, $_b$ OC user and male groups differ, and $_c$ nonuser and male groups differ.
*** $p < .01$, ** $p \leq .01$, * $p < .05$

Table 3

Means (Standard Deviations) or Frequencies (Percentages) of Seven Variables Used to Examine Group Equivalency for the Laboratory Session Variables

Variable	OC users ($N = 41$)	Nonusers ($N = 36$)	Men ($N = 31$)
	Means (Standard Deviations)		
Age	19.39 (1.52)	19.03 (1.25)	19.87 (1.59)
BMI	22.36 (4.65)	22.61 (3.89)	24.21 (3.29)
Alcohol Use*	2.60 (1.39)	2.33 (1.91)$_c$	3.77 (2.99)$_c$
Caffeine Use	2.76 (1.18)	2.67 (1.12)	2.42 (1.02)
	Frequencies (Percentages)		
Relationship Status			
Partner	26 (63.40)	16 (44.40)	21 (67.70)
No Partner	15 (36.60)	20 (55.60)	10 (32.30)
Medication Use			
Yes	3 (7.30)	2 (5.60)	5 (16.10)
No	38 (92.70)	34 (94.40)	26 (83.90)
Medical Conditions			
Yes	10 (24.4)	5 (13.90)	8 (25.80)
No	31 (75.6)	31 (86.10)	23 (74.20)

Note. Shared letter subscripts in a row indicate significant differences for the indicated groups. $_c$ nonuser and male groups differ.
* $p < .05$

indicated that the nonuser group had lower alcohol use then the male group ($p = .020$).

Again, two-way contingency tables were used to assess group differences in the three categorical variables. The tests indicated that the groups did not differ significantly for: relationship status, χ^2 (2, $N = 108$) = 4.42, $p > .05$, Cramer's V = .20; medication use, χ^2 (2, $N = 108$) = 2.51, $p > .05$, Cramer's V = .15; or medical conditions, χ^2 (2, $N = 108$) = 1.79, $p > .05$, Cramer's V = .13. Because of the group differences in total alcohol consumption, this variable was used as a covariate in the analysis of the laboratory session data. Thus, MANCOVAs and ANCOVAs were conducted instead of MANOVAs and ANOVAs.

Main Analyses: Group Differences in Mood, Sociosexual Orientation, and Dyadic Trust

Mood. A MANCOVA was conducted to examine group differences on 13 mood variables: the PA, NA, sadness, shyness, self-assurance, guilt, serenity, and joviality subscales of the PANAS-X; the Relationship Jealousy Scale; the emotional support, positive stimulation, and social comparison subscales of the IOS; and the reactivity scale of the Mood Survey (see Table 4 for means and standard deviations). Four covariates were used: relationship status, alcohol consumption, BMI, and age. The overall MANCOVA indicated a significant difference between the three groups on the dependent variables, $F(26, 394) = 2.68$, $p < .001$, partial $\eta^2 = .150$, power = .999. Follow-up univariate ANCOVAs (see Table 5) indicated that the groups did not differ significantly in NA, sadness, guilt, joviality, IOS emotional support, IOS positive stimulation, and IOS social comparison. However, the groups did differ in PA, relationship jealousy scores, self-assurance, serenity, and shyness. A nonsignificant trend was found indicating group differences in mood reactivity scale scores.

Table 4

Untransformed Unadjusted Means and Standard Deviations for Screening Questionnaire Variables

Variable	OC users (n = 93)	Nonusers (n = 77)	Males (n = 45)
PA*	28.74 (7.95)$_{b}$	28.81 (6.26)$_{t}$	32.62 (6.48)$_{b, t}$
NA	17.89 (7.01)	18.08 (6.72)	16.53 (6.65)
Self-assurance**	13.68 (4.54)$_{b}$	14.38 (4.58)$_{c}$	17.58 (4.28)$_{b, c}$
Serenity**	8.76 (2.46)$_{a, b}$	9.82 (2.64)$_{a}$	10.62 (2.22)$_{b}$
Sadness	8.85 (4.08)	9.47 (4.53)	8.11 (4.32)
Shyness**	6.28 (2.21)$_{a}$	7.79 (3.10)$_{a}$	7.16 (3.00)
Guilt	9.20 (4.74)	9.62 (4.50)	8.16 (4.19)
Joviality	23.67 (7.00)	23.70 (6.75)	25.80 (5.03)
Relationship Jealousy*	47.33 (9.25)$_{b}$	44.19 (9.18)	41.00 (12.05)$_{b}$
Emotional Support	19.71 (4.28)	19.39 (5.46)	19.04 (4.47)
Positive Stimulation	28.14 (6.06)	28.88 (5.88)	29.09 (6.46)
Social Comparison	14.92 (3.25)	15.23 (3.89)	15.13 (3.53)
Reactivity^{t}	0.33 (5.38)$_{t}$	-0.22 (5.48)	-2.06 (5.53)$_{t}$

(*Table 4 continues*)

(*Table 4 continued*)

Variable	OC users	Nonusers	Males
	(n = 97)	(n = 80)	(n = 49)
SOI**	25.60 (22.93)$_a$	14.96 (13.43)$_{a,t}$	25.83 (19.48)$_t$
	(n = 55)	(n = 32)	(n = 29)
Dyadic Trust	48.00 (6.79)	49.63 (5.80)	44.76 (11.08)

Note. Shared letter subscripts in a row indicate significant differences for the indicated groups. $_a$ OC user and nonuser groups differ, $_b$ OC user and male groups differ, $_c$ nonuser and male groups differ. The t symbol denotes a trend ($p < .05$). SOI = Sociosexual Orientation Inventory.
$^t p < .05$, * $p < .01$, ** $p \leq .001$.

Table 5

Univariate ANCOVA Results from the Screening Questionnaire Data Examining Group Differences Between OC Users, Nonusers, and Men

Variable	*df*	MS	*F*	*p*	Partial η^2	Power
PANAS-X PA	2, 208	259.65	5.11*	.007	.047	.614
PANAS-X NA	2, 208	0.008	0.36	.699	.003	.030
PANAS-X Self-assurance	2, 208	210.29	10.33**	.000	.090	.945
PANAS-X Sadness	2, 208	0.03	0.95	.309	.009	.077
PANAS-X Guilt	2, 208	0.04	1.55	.215	.015	.141
PANAS-X Joviality	2, 208	89.96	2.10	.125	.020	.212
PANAS-X Shyness	2, 208	0.17	7.05**	.001	.064	.797
PANAS-X Serenity	2, 208	58.48	9.63**	.000	.085	.926

(*Table 5 continues*)

(*Table 5 continued*)

Variable	*df*	MS	*F*	*p*	Partial η^2	Power
Relationship Jealousy Scale	2, 208	499.98	5.07*	.007	.046	.610
IOS Emotional Support	2, 208	7.27	0.32	.726	.027	.027
IOS Positive Stimulation	2, 208	15.06	0.40	.668	.017	.033
IOS Social Comparison	2, 208	4.45	0.36	.701	.028	.030
Mood Survey Reactivity Scale	2, 208	107.20	3.60t	.029	.041	.420
SOI	2, 219	1.27	13.62**	.000	.111	.988
DTS	2, 110	2.83	1.95	.147	.034	.187

Note. PANAS-X = Positive and Negative Affect Schedule expanded, IOS = Interpersonal Orientation Scale, SOI = Sociosexual Orientation Inventory, DTS = Dyadic Trust Scale.
t $p < .05$, * $p < .01$, ** $p \leq .001$.

Pairwise comparisons indicated that OC users had lower serenity ($p < .01$) and shyness scores ($p = .001$) than nonusers. OC users differed from men in that the OC users had lower positive affect ($p < .01$), self-assurance ($p < .001$), serenity ($p < .001$) and higher relationship jealousy scores ($p < .01$). Nonusers differed from men in that they had lower self-assurance ($p < .01$), and a nonsignificant trend suggested that the nonusers had lower positive affect ($p = .016$). There was a trend for the reactivity subscale scores suggesting that OC users had higher scores than males ($p < .05$).

Sociosexuality. A univariate ANCOVA was used to examine group differences in SOI scores, with the same covariates listed above. The results indicated that the groups did differ ($p < .001$; see Table 4 for means and Table 5 for F values). Pairwise comparisons indicated that the OC user group had a significantly higher mean SOI score (indicating a more unrestricted orientation) than the nonuser group ($p < .01$). The OC user group did not differ from the male group, but there was a trend indicating that the men were more unrestricted than the nonusers ($p = .025$).

Dyadic Trust. A univariate ANCOVA was conducted on total DTS scores, with age, BMI, and total alcohol consumption as covariates. There were no group differences (see Table 5 for F values). This analysis was conducted separately as only those participants in a relationship were included.

Mood Induction Manipulation Check

In order to examine the effectiveness or validity of the mood induction tasks, a number of manipulation checks were conducted. Repeated-measures univariate ANCOVAs indicated that, across all groups, three of the four tasks produced significant increases in the affect dimension that was targeted (i.e., significant time effects) (see

Table 6 for pre-test and post-test means and see Table 7 for MANCOVA and ANCOVA results). The baby slideshow resulted in a significant increase on the parental scale ($p <$ .001). The jealousy script resulted in a significant increase on the jealousy scale ($p <$ .001). The cyberball game led to a significant increase in social ostracism scores ($p <$ .001). Despite a mean two-point increase in positive affect, the comedic video did not lead to a significant increase in positive affect for all participants ($p > .05$). However, this appears to be due to the adjustment in group means for the covariate, alcohol use. When the covariate is not included, the significant time effect indicates that the comedic video led to an increase in positive affect, $F(1, 105) = 26.86$, $p = .001$, partial $\eta^2 = 0.20$, power = .99. Thus, all four mood induction tasks appear to have validity as they resulted in the intended affect changes.

Additional validity checks provided further support for the mood induction effects of the baby slideshow and for the effectiveness of the infidelity script. Pre- and post-test questions indicated that the participants' 'desire to have children' increased after the baby slideshow, $F(1, 95) = 25.31$, $p < .001$, partial $\eta^2 = .210$, power = .991. Their ratings of enjoyment from being around babies also increased, $F(2, 95) = 3.22$, $p = .044$, partial $\eta^2 = .063$, power = .355. A manipulation check of the participants' ability to visualize the infidelity scenario found that, on a scale from 1(not at all) to 9 (extremely well), an overall mean score of 6.64 ($SD = 1.72$) indicated a good ability to visualize the situation.

Main Analyses: Group Differences in Mood Change Scores

A one-way MANCOVA was conducted to examine group differences in five variables: total mood reactivity across all four tasks for PA, NA, parental feelings, jealousy, and ostracism (see Table 8 for mean scores). Total alcohol consumption was

Table 6

Untransformed, Unadjusted Means and Standard Deviations for the Pre- and Post- Task Mood Scores that are most relevant to each Mood Induction Task

Variable	OC users (n = 40)		Nonusers (n = 36)		Males (n = 31)		All Participants (N = 107)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Parental Feelings (parental task)	11.60 (3.82)	14.43 (3.90)	12.19 (3.40)	14.67 (4.04)	12.77 (3.39)	15.77 (4.30)	12.41 (3.56)	14.90 (4.07)
Jealousy (jealousy task)	5.18 (0.55)	8.98 (5.19)	5.39 (1.02)	8.97 (5.36)	5.90 (1.66)	10.90 (5.17)	5.46 (1.15)	9.53 (4.98)
Ostracism (Cyberball task)	5.45 (0.96)	9.48 (3.71)	5.94 (2.27)	10.06 (4.14)	5.58 (1.12)	10.19 (4.17)	5.65 (1.56)	9.88 (3.97)
PA (video task)	22.25 (7.10)	23.68 (7.16)	23.50 (7.32)	26.39 (7.97)	25.68 (8.19)	27.39 (8.53)	23.66 (7.56)	25.66 (7.94)

Table 7

Repeated Measures Multivariate and Univariate Analyses of Covariance for Mood Change Scores Specific to the Four Tasks

		ANCOVA			
	MANCOVA	Parental Feelings Scores	Jealousy Scores	Ostracism Scores	PA Scores
Variable	$F(4, 100)$	$F(1, 103)$	$F(1, 103)$	$F(1, 103)$	$F(1, 103)$
Between					
Alcohol Use	1.34	4.16	1.10	0.94	1.69
Group	2.04^{t}	1.95	4.06	0.45	2.45
Within					
Time	6.97**	17.42**	12.26**	18.01**	0.45
Time x Alcohol	1.31	4.64	0.64	0.99	0.47
Time x Group	0.73	0.61	0.92	0.30	1.50

t $p < .05$, * $p < .01$, ** $p \leq .001$.

Table 8

Untransformed, Unadjusted Means and Standard Deviations for the Total Mood Reactivity Scores (across the Four Mood Induction Tasks) for the Three Groups

Variable	OC users ($n = 40$)	Nonusers ($n = 36$)	Males ($n = 29$)
PA[t]	12.20 (9.19)$_t$	17.00 (11.63)$_t$	15.21 (7.70)
NA	8.53 (8.04)	8.81 (7.66)	9.14 (6.00)
Jealousy	6.43 (7.66)	6.75 (6.38)	8.90 (7.24)
Parental Feelings	11.43 (6.89)	12.33 (8.07)	12.55 (7.44)
Ostracism	8.40 (8.80)	8.61 (6.95)	11.00 (8.26)

[t] trend, $p < .05$, * $p < .01$, ** $p \leq .001$.

used as a covariate. Multivariate tests indicated that the three groups did not differ significantly, $F(10, 194) = 1.55, p = .13$. However, a follow-up univariate ANCOVA was conducted on positive affect as this analysis was pre-planned. The analysis revealed a strong trend towards group differences in PA change scores, $F(2, 100) = 4.05, p = .020$. The post hoc tests indicated that OC users showed less of a change in PA across the four tasks than nonusers ($p = .034$) (see Figure 1).

To examine group differences in affect change for mood scales specific to the tasks, a one-way repeated-measures MANCOVA was conducted using the following dependent variables: pre- and post-task jealousy scores for the jealousy task; pre- and post- task parental feelings scores for the parental task; pre- and post-task ostracism scores for the Cyberball game; and pre- and post-task PA scores for the happy mood induction task (see Table 6 for means). Again, total alcohol consumption was used as a covariate (see Table 7 for F values). There were no time x group effects, indicating that OC users, nonusers, and men did not differ in their degree of mood change that was specific to the four tasks (e.g., no group differences in jealousy in response to the jealousy induction task).

Main Analyses: Group Differences in Heart Rate Change Scores

To examine group differences in heart rate change and heart rate change variability across the four tasks, a one-way MANCOVA was conducted (see Table 9 for means), again using alcohol use as a covariate. A multivariate test indicated the three groups did not differ on the dependent variables, $F(4, 142) = 0.76, p > .05$, partial $\eta^2 = 0.02$, power = .09.

To further explore group HR changes in response to the mood induction tasks, a

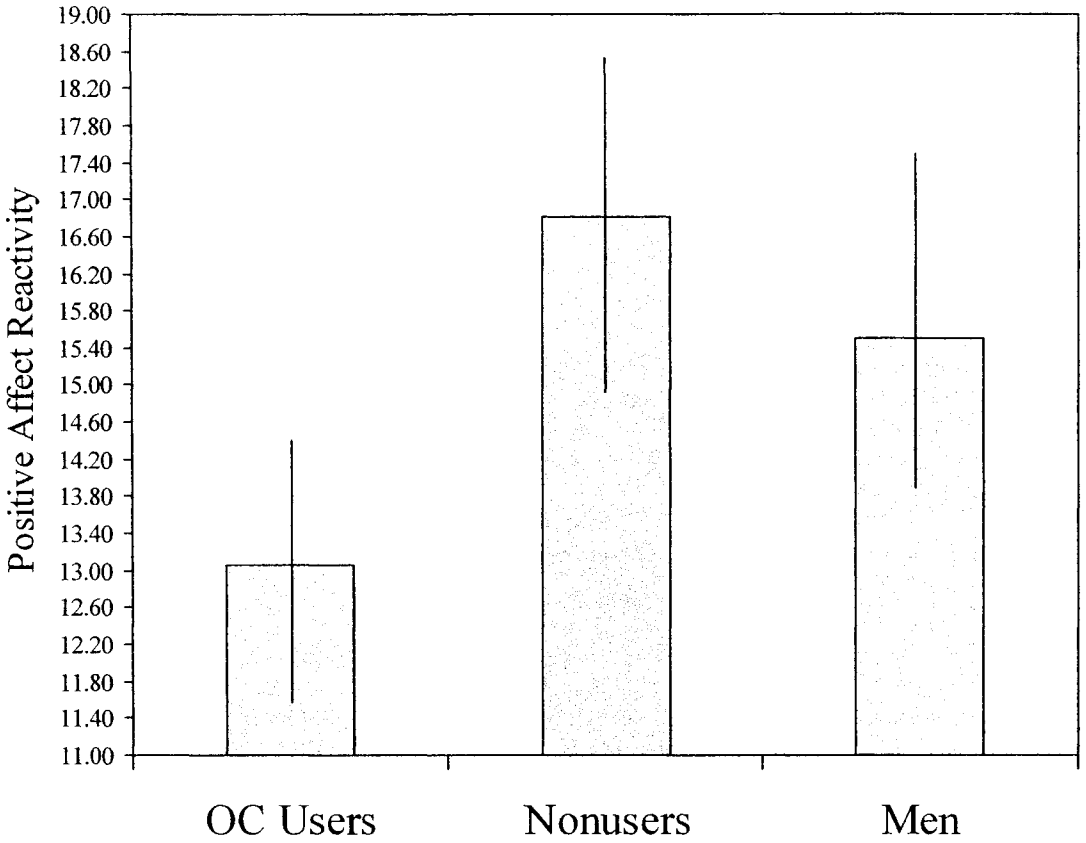

Figure 1. Total Adjusted Positive Affect Mood Reactivity scores (across all mood induction tasks) for the three groups (OC users, nonusers, males). The groups did differ ($p = .020$), with OC users experiencing less change in PA than nonusers in response to the four mood induction tasks ($p = .034$). Error bars represent ±1 SEM.

Table 9

Untransformed, Unadjusted Means and Standard Deviations for the Absolute Value of Pre-During Heart Rate Summed Change Scores across the Four Tasks

Variable	OC users (n = 31)	Nonusers (n = 28)	Males (n = 17)
Heart Rate Change	18.69 (11.03)	18.20 (7.41)	21.88 (9.01)
Heart Rate Change Variability	88.33 (83.74)	74.47 (63.16)	76.66 (55.06)

repeated-measures MANCOVA was conducted on the mean HR values before and during the tasks (see Table 10 for means), again using alcohol consumption as a covariate. The multivariate test indicated that there was a weak effect of time on the heart rates, $F(4, 68) = 2.23$, $p = .07$, partial $\eta^2 = .116$, power = .372. However, as indicated in Table 10, HR dropped during the tasks, suggesting that the tasks did not affect HR in the intended or expected manner. Furthermore, the multivariate test indicated that there were no group differences in the HR change in response to the mood induction tasks (group x time effect), $F(8, 138) = 0.65$, $p > .05$, partial $\eta^2 = .036$, power = .117. See Table 11 for the nonsignificant MANCOVA and ANCOVA results.

Discussion

Summary of the Results

Repeated measures of affect, before and after a number of mood-induction tasks, revealed one group difference between OC users and nonusers. A strong trend indicated that OC users experienced less overall PA change (i.e., less PA mood variability) across the mood induction tasks than did nonusers. There were no group differences in affect change scores for NA, jealousy, parental feelings, or ostracism across tasks. Furthermore, the groups did not differ in mood change that was specific to the tasks (i.e., jealousy in the jealousy induction). Neither overall mean HR nor HR variability across tasks differed between the groups. These findings provide partial support for the hypothesis that OC users experience more mood stability than nonusers, as OC users showed less positive affect reactivity than nonusers.

Comparisons of OC users, nonusers, and men on one-time assessments of particular types of affect indicated some group differences. OC users reported less

Table 10

Untransformed, Unadjusted Means and Standard Deviations for the Mean Pre-Task and During-Task Heart Rates for each Mood Induction Task

Variable	OC users (n = 31)		Nonusers (n = 28)		Males (n = 17)	
	Pre	During	Pre	During	Pre	During
Parental Feelings Task	78.15 (12.19)	76.72 (11.39)	82.63 (13.15)	80.73 (12.39)	71.53 (12.02)	66.94 (11.07)
Jealousy Task	79.94 (11.36)	78.08 (11.26)	83.00 (12.27)	81.45 (13.49)	71.97 (13.26)	69.79 (12.83)
Social Ostracism Task	80.71 (12.84)	78.35 (13.06)	83.00 (15.03)	79.97 (14.10)	71.82 (13.39)	67.71 (13.45)
Happy Mood Task	79.56 (10.22)	76.38 (12.32)	82.82 (11.89)	78.31 (12.70)	72.65 (10.60)	66.67 (11.33)

Table 11

Repeated Measures Multivariate and Univariate Analyses of Covariance Examining Group Differences in Heart Rate Change During Each Task

		ANCOVA			
	MANCOVA	Parental Task	Jealousy Task	Ostracism Task	PA Task
Variable	$F(4, 68)$	$F(1, 71)$	$F(1, 71)$	$F(1, 71)$	$F(1, 71)$
Between					
Alcohol Use	0.72	2.09	2.77	2.18	2.03
Group	1.63	4.42	3.10	2.87	3.49
Within					
Time	2.23	3.17	2.81	4.28[t]	2.59
Time x Alcohol	0.60	0.91	0.76	0.70	0.07
Time x Group	0.65	1.48	0.28	0.71	1.27

t < .05.

serenity and shyness than nonusers. OC users had less positive affect, self-assurance, serenity, and higher relationship jealousy than men. Nonusers were found to have lower self-assurance, and a trend indicated lower PA than males. A nonsignificant trend also indicated that OC users were more emotionally reactive than males. The groups did not differ in their NA, sadness, joviality, or IOS subscale scores. In terms of non-affect variables, OC users had higher SOI scores than nonusers, indicating a more unrestricted sociosexual orientation than nonusers. A trend indicated that males were also more unrestricted than nonusers. The three groups did not differ in Dyadic Trust scores. Thus, one-time assessments indicate that OC users experience less serenity and shyness, and are more sexually unrestricted than nonusers.

OC Users Experienced Less Positive Affect Change Following Mood Induction

The results of this study indicated that OC users experienced less overall PA change across the mood induction tasks than women not using oral contraceptives (p = .02). That is, exposure to the mood primes had less effect on OC users' PA than nonusers'. This suggests the possibility that oral contraceptives may dampen or reduce positive affectivity response to events. This is the first study to examine or to demonstrate that OC users experience less PA change than nonusers in response to a laboratory mood-induction paradigm.

The present finding is somewhat consistent with a recent unpublished study by Oinonen and Jarva (2006). Oinonen and Jarva found that nonusers' PA level showed more change than OC users' after answering personal questions about their sexual history. Nonusers' PA level decreased significantly while OC users' PA level did not change, suggesting that the sexual questions induced mood change for nonusers but not

OC users. The results remained when sociosexuality was controlled. These findings also suggested the possibility that OCs have the ability to stabilize positive affect.

Two other studies suggest that OCs may affect PA variability. A study by Ott, Sayegh, Shew, and Fortenberry (2005) found that adolescent women experienced a decrease in positive mood and positive mood variability during OC use. Another study by Oinonen and Mazmanian (2001) found that first-time monophasic OC users experienced higher PA variability during the menstrual phase than long-time monophasic, first-time triphasic, or long-time triphasic OC users. These results, along with those of the present study suggest that OCs may have the ability to stabilize mood, particularly positive mood, in women.

As reviewed by Oinonen and Mazmanian (2002), various studies have suggested that OC users experience less day-to-day mood variability than nonusers (e.g., Graham & Sherwin, 1993; Paige, 1971; Sutker et al., 1983; Walker & Bancroft, 1990). Another study (i.e., Warner & Bancroft, 1988), found that OC users experienced fewer peaks of well-being across the menstrual cycle and fewer troughs during menses than nonusers. The findings of these studies suggest that OCs may act as mood stabilizers, causing users to have less change in day-to-day mood.

Another study by Rasgon et al. (2003) found that bipolar women taking OCs reported similar mood levels in the first seven days and the last seven days of the menstrual cycle, whereas nonusers experienced significant mood change between those two time periods. Although this study did not look at specific menstrual cycle phases, it does suggest that among women with bipolar disorder, OC users experience less mood change across the menstrual cycle than nonusers.

The present finding of less PA variability in OC users than nonusers demonstrates partial support for the hypothesis that OC users experience less overall mood variability than nonusers. However, OC users did not experience less variability in any of the other mood dimensions analyzed (i.e., NA, jealousy, ostracism, and parental feelings). Thus, the affect stabilization effect of OCs may be specific to PA. An alternative explanation for the findings is that pre-existing differences in PA variability exist between OC users and nonusers. That is, women who subsequently take OCS may generally experience less PA reactivity to events prior to taking OCs. This seems plausible given that women with less PA reactivity may look for external sources of excitement to compensate for their blunted PA response. Such women may act in a more extroverted fashion (e.g., OC users are less shy in the current study) or engage in more unrestricted sociosexual behaviour (e.g., OC users are more unrestricted in the current study) in order to experience greater variability in PA. The problem with this hypothesis is that PA variability was not correlated with either SOI, $r(73) = -.01, p = .412$; or shyness, $r(76) = .17, p = .145$ in women in the current study. Thus, it is unlikely that the present finding of lower PA variability in OC users than nonusers can be explained by a pre-existing group difference prior to OC use.

Two studies suggest that there may be a relationship between hormones and PA. The first study by Whitley (2001) found that women reported experiencing less positive affect then men in response to cheating on an exam. This sex difference suggests that PA may be partially mediated by hormones. The second study, by Amin, Epperson, Constable, and Canli (2006) indicated that estradiol levels were positively correlated with activation of the dorsolateral prefrontal cortex while inhibiting responses to positively-

toned words in the luteal phase of the menstrual cycle. The authors state that these findings are consistent with the theory that estrogen modulates affective processing in the brain. A similar mechanism may be at work in the brains of OC users, as positive affect response appears to be inhibited.

Although, a decrease in positive mood variability may be considered a positive side effect by some people, such a decrease is more likely to have a negative effect on well-being. A blunting of positive affect by OCs could have profound implications for women. Not only would OC users fail to experience "normal" mood variability, they would also miss out on the exuberant "highs" of positive affect that nonusers could experience. This may result in the experience of a decrease in quality of life and may possibly affect health (see Cohen & Pressman, 2006; Pressman & Cohen, 2005 for reviews). The possibility exists that the PA stabilizing effect of OCs may also affect OC discontinuation rates. That is, women who stop taking OCs may do so because they make the connection between OC use and blunted PA. What is of potentially greater concern is that some women may experience an OC-induced PA stabilization and not connect this change to OC use. Such women may doubt their interest in their current jobs, studies, or relationships and may make life-altering decisions as a result (e.g., ending a relationship). Furthermore, a PA stabilization effect of OCs suggests the possibility that OC discontinuation may lead to a sudden increase in mood variability (i.e., a withdrawal effect, see Oinonen & Mazmanian, 2001), that may be unsettling to women. For such reasons, it is imperative that further research be conducted on the relationship between OCs and PA variability. It is important that women are made aware of all potential side

effects of OC use so that they can make an informed choice as to whether or not to use OCs, and so that they will properly interpret any side effects.

OC Users and Nonusers Do Not Differ in Negative Affect Reactivity

The literature on differences between OC users and nonusers in terms of mood reactivity to mood primes is sparse. However, there have been a number of studies examining day-to-day affect variability. These studies have had mixed results. As discussed previously, there is evidence that OCs have a stabilizing effect on mood (e.g. Graham & Sherwin, 1993), but there is also evidence that OC users and nonusers experience similar mood changes across the menstrual cycle (Marriott & Faragher, 1986; McFarlane et al. 1988). Only one study found significant differences between OC users and nonusers in NA variability (i.e., Warner & Bancroft, 1988), but the effect was only in the pill-free period. Given that the women in the present sample were examined during the periovulatory (days 10 to15) or luteal (days 20 to 24) phases, it is not a complete surprise that the present study found no differences between OC users and nonusers in NA variability. However, comparisons between the results of these studies and those of the present study must be done with caution because of the differences in the study design (i.e., day-to-day mood change versus mood change due to a mood prime).

The results of the present study also contrast with those of Ott, Sayegh, Shew, and Fortenberry (2005) who found that women experienced a week-to-week decrease in negative mood during OC use. This diary study suggested that as OC use continues, adolescent women experience a drop or blunting of negative affect. The present study did not find OC users to have lower mean NA or lower NA reactivity than nonusers.

Only two studies have examined differences in mood reactivity between OC users and nonusers, and only one of the two used a laboratory manipulation of mood. West et al. (2001) found that OC users experience an increased mood response to stressful tasks. Rubino-Watkins et al. (1999) found that OC users had greater negative affective response to the increased frequency of daily stress, but less agitated depression in response to increased stress intensity. These two studies examined different affect dimensions then those used in the present study as they focussed on reaction to stress. Only our jealousy and social ostracism mood inductions may be similar to a stressful task. However, we did not find that OC users experienced a greater NA response. Perhaps these results suggest that OC users' responses to emotion-inducing stimuli differ from nonusers only in certain situations. However, the inconsistency, combined with the limited number of studies, do suggest that this area of research deserves further investigation.

No Group Differences in Other Types of Affect Change Following Mood Induction

OC users, nonusers and men experienced similar changes in ostracism, jealousy, and parental feelings in response to the four mood-induction tasks. Furthermore, examination of mood change specific to the tasks (i.e., jealousy for the script task, parental feelings for the slideshow task, ostracism for the Cyberball game, and PA for the video task) also indicated that the groups did not differ. Given that all four tasks produced significant increases in the targeted affect dimension (e.g., parental feelings increased on the baby slideshow task), methodological problems cannot account for the lack of group differences. While we cannot rule out the possibility that *some* women experience OC-related affect stability related to emotions other than PA, our results do not provide

evidence that OCs have a general effect on variability in feelings of negative affect, ostracism, jealousy, or parental feelings in a group of current OC users.

This is the first study to examine if OC users, nonusers, and men show differences in their emotional responses to the Cyberball game. Previous research has found that being excluded from the game is highly effective in increasing negative feelings (Zadro, Williams, & Richardson, 2004). Given that social ostracism ratings did increase for all participants, we are confident that the mood priming task was successful. The results suggest that the women taking OCs do not differ from nonusers in their response to the perception of being socially ostracized.

This study found no differences between the three groups in their emotional responses to imagined infidelity. This is a somewhat surprising finding for the following reasons. First, previous research indicates that there is a relationship between OC use and jealousy. Geary et al. (2001) found that hormonal contraceptive users reported more feelings of hurt, anger, and jealousy in response to imagined emotional and sexual infidelity compared with nonusers. Second, multiple studies have found sex differences in reactions to emotional versus sexual infidelity, with women reporting more distress in response to emotional infidelity and men reporting more distress over sexual infidelity (e.g., Buss, Larsen, West, & Semmelroth, 1992; Geary et al., 2001). DeSteno, Bartlett, Braverman, and Salovey (2002) believe that these sex differences are due to the forced choice format of questions used to assess jealousy (i.e., asking men to indicate whether emotional or sexual infidelity is more distressing produces sex differences). This possibility and the fact that we incorporated both emotional and sexual infidelity into the script may explain why the present study found no sex differences in the reactions to

imagined infidelity. Further research to better understand the relationship between hormones, specifically OCs, and jealousy, is clearly needed.

There have been no previous studies examining differences between OC users, nonusers, and men in terms of parental feelings. As this study did show that pictures of babies produced an increase in mean parental feelings in the participants, methodological factors cannot be blamed for any lack of group differences. Although the present study did not find group differences, the impact of hormones on parental feelings is an area that should be examined further. Given the association between OCs and mood, and the fact that OCs alter the production of natural pregnancy-related hormones, the possibility exists that OCs may affect affective response to babies or other reproductive stimuli.

Possible Links between OC Use and both Serenity and Shyness

Women using OCs differed from nonusers in that OC users had lower serenity and shyness scores, as measured on a one-time assessment in the screening phase of the study. Although it is possible that OC use affects levels of serenity and shyness, a number of other reasons could account for this finding. First, it is possible that OC users are less shy prior to taking OCs (i.e., a premorbid individual difference). Given that OC users are more likely to be sexually active than nonusers (e.g., McCoy & Matyas, 1996) and are more unrestricted in their sexual behaviour (present study), it seems to follow that less shy unrestricted women tend to start using OCs. In fact, in this study, PANAS-X shyness scores were inversely correlated with SOI scores, $r(243) = -.183$, $p = .004$. Furthermore, one study (Eysenck, 1972), found that sexual behaviour was positively correlated with extraversion. Thus the hypothesis that those who are less shy and more unrestricted are more likely to take OCs is plausible. It is not clear how similar reasoning would suggest

that women who feel less serene are more likely to start using OCs. Furthermore, serenity scores (a total score from the items *calm, relaxed,* and *at ease*) were not correlated with SOI scores, $r(243) = .039$, $p = .544$. There have been no previous studies examining differences between OC users and nonusers in terms of PANAS-X serenity. Thus, further research should examine the possibility that OCs may alter a woman's feelings of serenity.

Sex Differences in Self-Assurance and Positive Affect

Both OC users and nonusers reported lower self-assurance than did men. Thus, there appears to be a sex difference in self-assurance scores, which is consistent with the results of Watson and Clark (1994), who found consistent sex differences in self-assurance across all samples studied, with male participants scoring higher than females. While it is possible that the sex difference in self-assurance is due to hormones, other possibilities are more likely. It may be that the self-assurance dimension of mood is strongly affected by socialization and that men are socialized to appear and respond with self-assurance. It may also be that socialization factors tend to reduce women's self-assurance by constantly reminding them of the ideals of what a woman should be (e.g., thin, beautiful), and that this causes lower feelings of self-assurance, and possibly lower PA. Another possible explanation for this finding relates to the fact that there were positive correlations between self-assurance and SOI scores in the current study, $r(243) = .174$ $p = .007$, indicating that unrestricted individuals are more self-assured. It is possible that having a more unrestricted sociosexual orientation leads to increases in self-assurance. Since men have both the highest SOI scores and self-assurance scores in the

sample, these two constructs may be related in a causal fashion, or may be determined by a third variable.

Both OC users and nonusers reported lower PA than men, although the latter group difference was a trend ($p < .025$). Watson and Clark (1994) found inconsistent sex differences in 2 of their 10 study samples. Male participants scored higher in one sample, and female participants scored higher in the other. A study by Azim et al. (2005) found that female and male participants differed in the activation of brain structures in response to humorous cartoons. Females were found to have activation in the left prefrontal cortex, which the authors suggest indicates a greater degree of executive processing and language-based decoding. Activation in the female participants' mesolimbic regions, was also observed, which the authors believe is indicative of a greater reward network response, and perhaps lower reward expectation. These findings suggest that future research on sex differences in mood and affect should continue to include PA as a variable as men and women may differ in their level of this affect dimension. Furthermore, men and women may differ in which brain regions are activated during the processing of positive stimuli.

OC users Tend to Have Higher Ratings of Mood Reactivity than Men

This study was the first to examine differences between OC users, nonusers and men in terms of scores on the reactivity subscale of the Mood Survey. OC users did not differ from nonusers, nor did nonusers differ from men on this measure. However, there was a trend ($p < .025$) indicating that OC users had higher rates of mood reactivity than men. A previous study (Williams, 1993) found no sex differences in terms of mood reactivity using the Mood Survey, but did find that mood reactivity was positively

correlated with neuroticism. Interestingly, this correlation was higher in male participants than it was for female participants, suggesting that neuroticism affects mood reactivity in men more than in women. The trend towards higher mood reactivity in OC users than men may represent a Type I error, given that previous research did not include sex differences. However, since previous studies have not examined women on the basis of OC status, this finding may be worth following up on.

No Group Differences in Negative Affect, Joviality, Guilt, Sadness, or IOS Scores

Analysis of the screening questionnaire data indicated that OC users, nonusers and men reported similar levels of NA, guilt, sadness, and joviality. The lack of a sex difference in NA levels is consistent with the findings of Watson and Clark (1994). As discussed previously, studies examining level of NA across the entire menstrual cycle rarely find differences between OC users and nonusers (e.g., Almagor & Ben-Porath, 1991). Given that some women do report depression or negative affect while taking OCs (e.g., Cullberg, 1972), the "survivor effect" (Kutner & Brown, 1972) may account for our lack of group differences in negative affect. That is, women who experience NA increases while taking OCs would likely discontinue use, leaving a group of OC users with normal NA levels. Thus, it is not surprising that the present study found no group differences in overall NA.

To date, this is the first study to examine differences between OC users and nonusers in affect using the PANAS-X scales. However, Watson and Clark (1994) found sex differences on the guilt subscale in four out of ten study samples, indicating that men may experience more guilt than women. The same authors found that women had higher joviality scores than men in four samples; and in one sample, women indicated higher

sadness scores than men. Consistent with the majority of Watson and Clark's samples, the current study found no sex differences in guilt, sadness, or joviality.

This study found no group differences in the three IOS subscale scores (social comparison, emotional support, or positive stimulation). This is the first study to examine group differences between OC users, nonusers and men using this measure. No sex differences in this scale were found in the present study, whereas Hill (1987) found that women exhibited a significantly higher preference for emotional support and positive stimulation than men. The same author found no sex differences in the social comparison scale.

OC users Indicate Higher Relationship Jealousy than Men

OC users reported significantly greater relationship jealousy than men. There were no such differences between OC users and nonusers, or nonusers and men. Only one previous study appears to have examined such group differences in jealousy. Geary et al. (2001) found that hormonal contraceptive users (not all were OC users) reported more hurt feelings, anger, and jealousy in response to both imagined emotional and sexual infidelity. Given that Geary et al. found differences between hormonal contraceptive users and nonusers, and the present study found differences between OC users and men, taken together the results do suggest a possible relationship between hormones and jealousy. However, given that the mood priming results of the present study did not suggest any group differences in jealous responses to imagined infidelity, it is difficult to interpret the difference in jealousy between OC users and men.

It is not clear why OC users might experience higher jealousy then men. However, here are some possibilities: (a) women who are more jealous are more likely to

take OCs (possibly because they believe that OC use will enhance their sexual relationship and decrease infidelity); or (b) OCs may affect jealousy. Correlational analysis suggests that sociosexual orientation is unrelated to relationship jealousy, $r(246) = -.114, p = .074$. Thus it appears that the unrestricted sociosexual orientation of OC users cannot account for their increased jealousy. This jealousy finding is clearly not a sex difference as nonusers do not differ from men in relationship jealousy scores. If OCs affect jealousy, one potential mechanism could involve the hormones in OCs affecting mate-guarding behaviour, causing users to be more jealous. However, this is speculation at this point. More research should be conducted to examine the possible connection between OC use and jealousy, as this could potentially have consequences for the romantic relationships of OC users.

OC Users Report a More Unrestricted Sociosexual Orientation

OC users had higher SOI scores than nonusers, indicating a more unrestricted sociosexual orientation. Thus, OC users require less commitment and closeness before engaging in sexual activity with a partner. Although this group difference is likely pre-existing prior to OC use, previous research supports a relationship between OC use and alterations in sexuality (see below). The finding that OC users have more unrestricted sociosexual orientations than nonusers is consistent with previous findings (Clark, 2004; Oinonen & Jarva, 2006). Thus, the SOI group difference appears to be a reliable finding in female undergraduate students.

A number of other studies examining types of sexual behaviour other than sociosexual orientation have also found differences between OC users and nonusers. Multiple studies have found that OC users have had more sexual partners in the past year

than nonusers (e.g., Bancroft et al., 1991; McCoy & Matyas, 1996, Parazzini et al., 1996; Wilkins et al., 2000), a finding that is not surprising due to the fact that the primary purpose of OCs is to prevent pregnancy. McCoy and Matyas (1996) found that OC users were less likely to be virgins, more likely to be sexually active, and had sexual intercourse more frequently than sexually active nonusers. OC users also became sexually active at an earlier age, and reported more sexual thoughts and fantasies than nonusers. Bancroft et al. (1991) found that OC users were more likely to have a sexual partner, less likely to be virgins, reported a less restrictive sexual morality, and were more interested in erotic images. A recent study by Caruso et al. (2005) found that women using OCs reported increased sexual enjoyment, orgasm frequency and satisfaction with sexual activity at the 3rd, 6th and 9th cycles of OC use compared to the baseline cycle. Levels of arousal and frequency of sexual activity also increased at the 6th and 9th cycles of pill use. Thus, the link between OCs and sexual behaviour may be due to a pre-existing socialized difference, a pre-existing genetic or hormonal difference (e.g., Bailey et al., 2000), a secondary effect of OCs (i.e., a physical or emotional change that makes sexual intercourse more enjoyable or desirable), a direct effect of OCs on sociosexuality, or a fifth unrecognized variable. Further research on hormonal and genetic factors involved in sociosexuality may provide insight into this group difference.

Given that age of first sexual intercourse, a possible indicator of SOI, has a genetic component (Dunne et al., 1997), sociosexuality may be at least partially determined by genetics. Previous research indicates that sexual behaviour is positively correlated with extraversion (Eysenck, 1972). This fits with our finding as OC users were both less shy and more unrestricted than the nonusers. Thus, the present findings suggest

that OC users may be more unrestricted than nonusers due to a pre-existing genetic difference related to their extroversion. However, it remains possible that OCs may also alter sociosexuality.

No Group Differences in Heart Rate Responses to the Mood-induction Tasks

OC users, nonusers, and males did not differ in terms of their mean heart rate change or their heart rate variability in response to the four mood-induction tasks. A weak trend indicated that HR values decreased over time. This suggests the possibility that the mood-priming tasks did not activate heart rate. Very little research appears to have examined whether hormones affect heart rate response to mood primes. However, a study by Del Rio et al. (1998) found that menopausal women receiving estradiol treatment did not differ from those receiving placebo in terms of HR responses to a stressor. This finding is consistent with our findings and suggests that hormones may not alter heart rate response to events that affect mood. However, given that none of the groups in the present study experienced heart rate change in response to the mood primes, further research is needed.

How Do OCs Affect Mood?

It is not completely understood how oral contraceptives affect mood, however a number of theories have been presented (see Oinonen & Mazmanian, 2001; Kurshan & Epperson, 2006, for reviews).

Firstly, a number of studies have suggested a relationship between estrogen, progesterone, and serotonin levels. As mentioned previously, a review by Oinonen and Mazmanian (2002) states that estrogen has been linked with serotonin levels in that increases in estrogen are related to: increases in certain serotonin receptors, gene

expressions in serotonin receptors (5-HT_{2A}), and serotonin transporter mRNA (Fink & Sumner, 1996; Fink, Sumner, McQueen, Wilson, & Rosie, 1998). Biegon and McEwen (1982) found that estradiol injections decreased the concentration of serotonin receptors in ovariectomized rats 1 to 2 hours after administration. However, 72 hours after the 1st injection of estradiol, there was an increase in serotonin receptors levels in the amygdala, mediobasal hypothalamus, and preoptic area. Another study suggests a relationship between serotonin and positive affect. Flory, Manuck, Matthews, and Muldoon (2004) found that lower average positive mood was related to a blunted prolactin response to fenfluramine, a serotonin-releasing substance. Prolactin response is reflective of CNS serotonin responsivity. These results contrast with those of Zald and Depue (2001) who found that in male participants, serotonin functioning is negatively correlated with PA and NA, suggesting a possible affect blunting effect of serotonin. This finding was found in a sample consisting of only male participants, which may account for the differences between these findings and the above findings, as sex differences in PA have been noted in other studies (e.g., the present study; Whitley, 2001). Given the connection between serotonin and mood, OCs may affect mood by altering estrogen levels, leading to altered serotonergic activity.

Secondly, there is evidence that estrogen and progesterone alter monoamine oxidase levels. Estrogen may inhibit the MAO pathway resulting in higher serotonin levels (Chakravorty & Halbreich, 1997). Both estrogen and progesterone treatments decreased monoamine oxidase A and B (MAO-A and MAO-B) in the hypothalamic nuclei, and decreased MAO-A in the dorsal raphe nucleus of the rhesus monkey (Gundlah, Lu, & Bethea, 2002). The authors suggest that estrogen and progesterone may

indirectly cause an increase in serotonin levels (due to effects on MAO), and therefore cause mood or affective change.

Thirdly, GABA, an inhibitory neurotransmitter, has been implicated in mood disorders (see Shiah & Yatham, 1998, for a review). Research has shown that estrogen and progesterone may affect GABA levels. Follessa et al. (2001) found that exposure to OCs were related to a decrease in the progesterone metabolite allopreganolone, which altered $GABA_A$ receptor structure and function. This suggests a possible mechanism by which OCs affect mood in women.

The combined effect of the hormones present in OCs is likely an increase in serotonin. The present findings suggest that this may result in a stabilization or loss of variability in PA for OC users. It seems that there are a number of possible mechanisms by which OCs might exert an influence on mood. However, more research is needed to determine exactly how OCs affect mood in women.

How Would OCs Affect Mood Variability?

Oral contraceptives may affect PA variability by altering pulsatile hormone release leading to a more constant level of estrogen and progesterone, which in turn may affect other systems in the body. For example, Felthous and Robinson (1981) suggest that stabilization of central neurotransmtters may occur through the stabilization of cyclical changes in estrogen and progesterone levels with monophasic OC use. Thus, OC use may decrease mood variability by decreasing variability in hormone levels.

There is evidence that OC use may modify patterns of release for other hormones as well. Hemrika, Slaats, Kennedy, de Vries, Robles-Korsen, and Schoemaker (1993) concluded that while pulsatile release of LH continues with OC use, the number of pulses

is fewer than in nonusers. Their results also indicated that FSH levels are suppressed during OC use. Wiegratz et al. (2003) found that with four different formulations of OCs, testosterone and DHEAS decreased across the treatment cycles. However, prolactin levels rose significantly in the 6th cycle of only one group. Serum levels of sex-hormone binding globulin and corticosteroid-binding globulin rose during the treatments, with the former rising progressively throughout the study, and the latter rising within the 1st cycle and remaining at that level for the following cycles. Rapkin, Morgan, Sogliano, Biggio, and Concas (2006) found that natural increases in ALLO, THDOC, P, pregnenolone, between day 7 and day 21 of the menstrual cycle were no longer present after 3 months of OC use. There were no natural changes in DHEA levels between days 7 and 21 prior to OC use, and levels were not altered by OC use. Thus, there is evidence that OC use may alter testosterone, DHEAS, prolactin, ALLO, THDOC, pregnenolone, LH, and FSH. Decreased variability in hormones affected by OC use may be associated with decreased positive affect variability.

While there is evidence that ovarian follicles do develop during OC use, there appear to be individual differences and OC formulation differences that determine whether ovulation occurs during OC use. Some studies have found that ovulation does not occur in the pill-free period of OC use (e.g., Baerwald, Olatunbosun, & Peirson, 2004), whereas other studies have found that ovulation does occur during OC use (e.g., Grimes et al., 1994; Schlaff et al., 2004). Further evidence suggests that altering or eliminating the pill-free period may partially suppress follicular development (e.g., Birtch et al., 2004; Schlaff et al. 2004). One study suggests that follicular development may be influenced by the day of the menstrual cycle on which OC use is started (Killick, Eyong,

& Elstein, 1987). Thus, different OC formulations and individual differences may exert individual effects or interact to alter natural menstrual cycle activity, affecting pulsatile hormone release, follicular development, and ovulation. Furthermore, deviating from normal patterns of OC use may further alter these natural patterns. The hypothesis that PA stability in OC users is caused by stability in hormone levels, predicts that women who do not ovulate while taking OCs should show more PA stabilization than OC users who do ovulate. Testing this prediction may shed light on the mechanisms underlying a possible PA stabilization effect in OC users.

Why Do OCs Stabilize Positive Affect But Not Other Types of Affect?

It is not yet clear exactly how OCs affect PA stability, or why OCs do not also affect stability in NA and other types of affect. However, there are two possible, speculative, explanations. Firstly, research indicates that both higher trait and state PA are associated with lower levels of the stress hormone cortisol (e.g., Polk et al., 2005; Pressman & Cohen, 2005). Thus, positive affect and cortisol appear to be inversely related. A recent study by Kuhlmann and Wolf (2005) found that the administration of cortisol impairs memory in free-cycling women (i.e., nonusers), but not in OC users. These results suggest that the brains of OC users may be less sensitive to any effects of alterations in cortisol. Furthermore, as discussed previously, OC use has been shown to be associated with a blunted cortisol response to social stressors (e.g., Kirschbaum, Pirke, & Hellhammer, 1995; Rohleder et al., 2003) as well as physical stress (Bonen, Haynes, & Graham, 1991). The hypothesized OC-induced reduction in cortisol sensitivity could explain our findings of greater positive affect stability in OC users compared to nonusers. Given that the mood-induction tasks utilized in the current study would have affected

women by increasing or decreasing cortisol levels (e.g., Buchanan, al'Absi, & Lovallo, 1999; Smyth et al., 1998), a blunted cortisol response or decreased receptor sensitivity to cortisol changes in OC users could have resulted in fewer fluctuations in positive affect.

Secondly, another possible explanation for the OC-induced positive affect stabilization effect relates to the findings regarding within-day variability of PA. The findings of Murray, Allen, and Trindler (2002) suggest that there is a circadian component of PA. The authors found that PA followed a 24-hour rhythm, whereas NA displayed no such pattern. Similarly, Clark, Watson, and Leeka (1989) found that PA varied diurnally, while NA did not. It is possible that that OCs have the ability to alter the circadian variability as well as reactivity of PA through the same mechanism by which they alter pulsatile hormone release. These two explanations seem plausible mechanisms for our finding of stabilization of PA in OC users.

Strengths of the Present Study

This study has a number of strengths. First, the present study employed a large sample. The sample size in the screening phase consisted of 215 participants. The experimental phase utilized a sample of 108 participants (41 OC users, 36 nonusers, and 31 men). This sample is larger than many studies examining differences between OC users and nonusers in terms of mood, mood variability, or mood reactivity (e.g., Wilcoxon, Schader, & Sherif, 1976).

Secondly, this study used a group of male participants as a comparison group. Many studies comparing OC users and nonusers only use groups of women, and do not include male participants (e.g., Oinonen & Mazmanian, 2001; Rubino-Watkins et al., 1999). Sex differences can be hormone-related as well, and, where possible, men should

be included in studies examining hormones. Furthermore, a male control group allows a determination of whether the OC users are more or less similar to men than nonusers.

Thirdly, menstrual cycle phase was controlled, in that female participants attended the laboratory session during the periovulatory phase (days 10 to15) or the luteal phase (days 20 to 24). This method was used to ensure that any differences between OC users and nonusers could not be attributable to menstrual cycle phase differences. Furthermore, these two phases were chosen as they were the times in the cycle when OC users' and nonusers' hormone levels should differ the most.

Fourthly, this study used strict inclusion criteria for participation in the laboratory phase. For example, participants must have had at least one relationship lasting at least two months, be heterosexual, and could not be taking any hormone or mood altering medications (see method for all criteria). Also, an attempt was made to ensure that one-half of all participants were currently in a relationship, and one-half were not, in order to control for any effects of having a romantic partner on reactions to the jealousy and parental feelings induction tasks.

Finally, the current study examined the effect of OCs on mood reactivity by examining five different affect dimensions and using four mood-priming tasks. Very few studies have examined OC effects on mood reactivity, and this is the first study to include such a wide range of affect primes.

Limitations of the Present Study

The main limitation of this study is that the mood induction tasks did not cause HR increases. Instead, HR decreases were found. This may be due to the fact that the participants were sitting at a desk during the session, and were at rest. It may be that the

participants were nervous upon coming to the laboratory for the experiment, and became more and more calm as the session progressed. One way to overcome this effect is to have participants sit quietly before the experimental procedure begins, or to have a control group perform a series of neutral tasks to compare HR decreases between groups. Another potential explanation for the lack of findings is that the HR monitor used in this study was created for monitoring HR in people engaged in physical activity, and was not sensitive enough to detect changes in individuals at rest. In any case, the tasks used in the present study did not appear to produce enough of a physiological change to cause HR increases. Thus, group differences could not be adequately examined.

There are four additional limitations of the present study that should be discussed. First, the present study did not have enough power to find a difference between OC users and nonusers in positive affect reactivity at the .01 alpha level, although an effect was found at the .05 alpha level. Thus, a larger sample size would have increased power. Second, the findings of the present study may only be generalizable to relatively intelligent university-aged women. It is not clear what would be found in other samples (e.g., non-student women outside the 18-25 year age range). However, it is possible that less educated women may be less likely to inhibit an emotional response that they might experience. Thus, larger differences might be found in non-student populations. Third, the findings of this study may be influenced by the survivor effect (Kutner & Brown, 1972), in that women who experience negative OC effects would likely have already discontinued their use, and would therefore not be included in the sample of OC users, leaving an unrepresentative sample of women. If women were to discontinue OC use due to a "blunting" of their positive affect, then the power of this study would have been

diminished due to the survivor effect. Fourth, only a limited number of affect types were examined in the current study (e.g., PA, NA, jealousy, parental feelings, and social ostracism). While the inclusion of four mood induction procedures is a strength of the study, there are many other types of affect that could be examined for OC effects (e.g., fear, disgust, anger, sadness, excitement). Given that OC users and nonusers showed a strong trend toward group differences in positive affect, the use of mood induction paradigms that would lead to maximal changes in positive affect might be useful (e.g., a relaxation mood induction, a lottery winning script, use of fast-tempo music). These limitations could enhance a future study on this topic.

Summary and Conclusions

There is a long established link between hormones and mood as demonstrated in studies examining mood and the following hormone-related conditions: pregnancy and the post-partum period (e.g., Buckwalter et al., 1999; Ahokas, Kaukoranta, Wahlbeck, & Aito, 2001); premenstrual syndrome or premenstrual dysphoric disorder (Eriksson et al., 2006; Schmidt et al., 1998) perimenopausal-related depression (e.g., Schmidt et al., 2000; Soares, Almeida, Joffe, & Cohen, 2001); and OC use (see reviews by Oinonen & Mazmainan, 2002; Kurshan & Epperson, 2006). OCs, as well as other hormonal contraceptives, are widely used among women. Thus, it is important to examine the effects these medications have on mood and mood responses. The purpose of this study was to examine mood, mood reactivity, and cardiovascular reactivity in OC users, nonusers, and men. The results indicate that OC users experience less change in positive affect than nonusers when exposed to mood-inducing tasks. Thus, oral contraceptives may reduce the overall variability in positive affect that is experienced in response to

events. No group differences in other dimensions of mood response or heart rate response were found. However, oral contraceptive users did show lower levels of serenity and shyness, and a more unrestricted sociosexuality than nonusers. Given the possibility that the present findings may be pharmacological effects of OCs, further research is necessary.

If OC use influences mood levels, mood variability, or mood reactivity, it is important that mood research control for this variable. Mood research using only nonusers may not be generalizable to women taking hormonal contraceptives (and vice versa). Mood research using samples from university populations must also be aware of the high prevalence of OC use among female students. In the present study, 52% of the women who participated in the screening phase of the study were taking OCs. Given the possibility that OCs may influence PA variability or PA reactivity and serenity, both OC users and nonusers should be included in mood studies.

It is important that future research examine mood change associated with all hormonal contraceptives, as women need to be informed of any potential side-effect they may experience while taking these drugs. Future studies on the possible PA stabilization effect of OCs should focus on two tasks. The first important task would be to replicate the current finding of a reduced PA response to mood primes in OC users. The second task would be to attempt to determine the cause of the mood stabilization. One way to examine causal factors would be to compare the effects of monophasic and multiphasic preparations on PA reactivity, or to examine whether different formulations have different effects on PA reactivity. A second way to examine causal factors would involve

examining whether polymorphisms on specific hormonal genes (e.g., estrogen or progesterone genes) are associated with individual differences in OC-related PA stability.

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Appendix A

Participant #: _____

Screening Questionnaire

1) Age: _____

2) Sex (Circle your answer): male female

3) Height: _____ (feet & inches) or _____ (cm)

4) Weight: _____ (pounds) or _____ (kg)

5) Today's date: _____ _____ _____
Day of week (e.g., Monday) | Day of Month (e.g., 5th) | Month: (e.g., May)

6) a) Are you currently taking any medications? (Circle your answer) YES NO

b) If YES, what medications are you taking? (Please list):

_____
_____
_____
_____

7) Please list any medical or psychological conditions which you have been diagnosed with (e.g., hypothyroidism, depression, asthma, cancer, diabetes, etc.).-

_____
_____
_____
_____

8) Are you currently diagnosed with or being treated for depression or bipolar disorder (manic depression)? (Circle your answer)
YES NO MAYBE

9) If you were to see a psychologist, psychiatrist, or physician, do you believe that you would be diagnosed with depression or bipolar disorder (manic depression)? (Circle your answer)

YES NO MAYBE

10) Do you think that any of your parents, siblings, or children have had any psychiatric problems (e.g., depression, anxiety, mood problems, schizophrenia, eating disorder, alcoholism, panic attacks)? (Circle your answer)

YES NO MAYBE

11) Have any of your family members been diagnosed with or treated for any of the following disorders? Check all that apply and indicate the person's relationship to you (i.e., brother, mother, etc.).

[ ] depression _____ [ ] bipolar disorder _____

[ ] anxiety _____ [ ] schizophrenia _____

12) Check the box that best describes your current romantic situation:

[ ] married or living with partner [ ] one steady partner but living apart

[ ] no steady partner [ ] more than one steady partner

[ ] other:_____

13) If you are currently in a steady relationship, how long have you and your partner been together (in years and months)? _____years and _____ months

14) If you have ever been in a relationship, what is the longest relationship that you have ever been in? _____years and _____ months

a) If you are not currently in a steady relationship, have you ever been in a steady relationship?

YES NO

b) If yes, how long has it been since your last relationship ended? _____years and _____ months

c) If yes, how long did your last steady relationship last? _____years and _____ months

15) This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way today. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ cheerful	____ calm	____ joyful	____ enthusiastic
____ attentive	____ afraid	____ nervous	____ downhearted
____ bashful	____ happy	____ lonely	____ sheepish
____daring	____ timid	____ excited	____ distressed
____ strong	____ alone	____ hostile	____ blameworthy
____relaxed	____ alert	____ proud	____ determined
____ irritable	____ upset	____ jittery	____ interested
____ delighted	____ bold	____ lively	____ confident
____ inspired	____ blue	____ ashamed	____ energetic
____ fearless	____ shy	____ at ease	____ dissatisfied with self
____ disgusted with self	____ active	____ scared	
____ sad	____ guilty	____ angry at self	

16) Rate the importance of the following characteristics in your selection of a potential romantic partner. (Circle the number that best describes the importance of these traits in a romantic partner):

	Not at all Important								Extremely Important
kindness and understanding	1	2	3	4	5	6	7	8	9
sex appeal	1	2	3	4	5	6	7	8	9
faithfulness and loyalty	1	2	3	4	5	6	7	8	9
physical attractiveness	1	2	3	4	5	6	7	8	9
stable personality	1	2	3	4	5	6	7	8	9
social status	1	2	3	4	5	6	7	8	9
responsibility	1	2	3	4	5	6	7	8	9
financial resources	1	2	3	4	5	6	7	8	9
sense of humour	1	2	3	4	5	6	7	8	9
fun and exciting personality	1	2	3	4	5	6	7	8	9
similar values and beliefs	1	2	3	4	5	6	7	8	9
desire for children	1	2	3	4	5	6	7	8	9
qualities of a good parent	1	2	3	4	5	6	7	8	9
quality of health	1	2	3	4	5	6	7	8	9
intelligence	1	2	3	4	5	6	7	8	9

17) Please answer all of the following questions honestly. For the questions dealing with behaviour, write your answers in the blank spaces provided. For the questions dealing with thoughts and attitudes, circle the appropriate number on the scales provided.

a) How old were you when you first had consensual sexual intercourse?

_____

b) With how many different partners have you had sex (sexual intercourse) within the past year? _____

c) How many different partners do you foresee yourself having sex with during the next five years? (Please give a specific, realistic estimate)

_____

d) With how many different partners have you had sex on one and only one occasion? _____

e) How often do (did) you fantasize about having sex with someone other than your current (most recent) dating partner? (Circle one; If you have not been in a dating relationship then leave this question blank)

1. Never
2. Once every two or three months
3. One a month
4. Once every two weeks
5. Once a week
6. A few times each week
7. Nearly every day
8. At least once a day

f) Sex without love is OK.

I Strongly disagree								I Strongly agree
1	2	3	4	5	6	7	8	9

g) I can imagine myself being comfortable and enjoying casual sex with different partners.

I Strongly disagree								I Strongly agree
1	2	3	4	5	6	7	8	9

h) I would have to be closely attached to someone (both emotionally and psychologically) before I could feel comfortable and fully enjoy having sex with him/her

I Strongly disagree	I Strongly agree

1 2 3 4 5 6 7 8 9

i) With how many partners have you had sex within the past year? _____

j) How frequently do you think about sex?

Virtually never								Almost all of the time
1	2	3	4	5	6	7	8	9

k) During the past year, with how many different partners have you had only one occasion of sexual contact (e.g., hands to genitals, hands to breasts, oral-genital) that did not include sexual intercourse? _____ partners.

l) How would you rate your level of satisfaction with the quality of your current sex life?

Not at all satisfied								Very satisfied
1	2	3	4	5	6	7	8	9

m) How would you rate your level of satisfaction in the amount of sex you are currently having?

Not at all satisfied								Very satisfied
1	2	3	4	5	6	7	8	9

18) Check the box that best describes your sexual orientation.

[ ] heterosexual [ ] bisexual [ ] homosexual

19) a) Do you smoke cigarettes? (Circle response) YES NO

b) If you are a smoker, how many cigarettes on average do you smoke per day?_____

20) a) How often do you normally consume alcohol? Circle one number from 0 to 4.

Never	once or twice a month	once or twice a week	three to four times a week	almost every day
0	1	2	3	4

21) What is the average number of drinks you have when/if you drink? Circle one number.

None	one to three	four to seven	eight to twelve	more than 12
0	1	2	3	4

22) How often do you use recreational/illegal drugs such as marijuana, ecstasy, hash, cocaine, LSD, etc.?

Never	once or twice a month	once or twice a week	three to four times a week	almost every day
0	1	2	3	4

23) How often do you consume caffeine (e.g., coffee, tea, colas, chocolate)?

Never	once or twice a month	once or twice a week	three to four times a week	every day
0	1	2	3	4

24) Below are a number of statements about your experience of moods. We would like you to consider your usual behaviour when you respond. Using the scale, indicate the appropriate number below each question and try to be as honest as you can.

a) I may change from happy to sad and back again several times in a single week.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6

b) Compared to my friends, I'm less up and down in my mood states.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6

c) Sometimes my mood swings back and forth very rapidly.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6

d) My moods are quite consistent; they almost never vary.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6

e) I'm a very changeable person.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6

f) I'm not as "moody" as most people I know.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6

g) If 1 = hardly ever and 99 = extremely frequently, how frequently do your moods change? ____

h) If 1 = not at all and 99 = extremely intensely, how intensely do you react to mood experiences? ___

25) The following questions refer to situations where someone has "cheated" or been unfaithful in a relationship. When answering these questions please use your own definition of what you think it means to "cheat" or "be unfaithful".

a) Have you ever cheated on a romantic partner? YES NO

b) To your knowledge, has a romantic partner ever cheated on you?

YES NO MAYBE

c) To the best of your knowledge, have either of your parents cheated on a romantic partner?

YES NO UNSURE

d) Have either of your parents ever cheated on your other parent?

YES NO UNSURE

e) How often do you worry about your romantic partner cheating on you? (leave blank if you have never had a romantic partner)

Never						Extremely Frequently
1	2	3	4	5	6	7

f) How often do you engage in behaviours to check up on your partner to make sure that he/she is not cheating on you? (leave blank if you have never had a romantic partner)

Never						Extremely Frequently
1	2	3	4	5	6	7

g) For each of the behaviours listed below use the following scale to indicate the frequency with which you engage in the behaviour due to concerns that your partner might be unfaithful.

1 = Never
2 = Occasionally or at least once
3 = Fairly often
4 = Often
5 = Very Frequently

Checking your partner's pockets ____
Monitoring telephone conversations _____
Checking partner's caller ID ____
Checking partner's phone bills _____
Checking partner's other bills____
Check partner's daily schedule____
Checking your partner's email accounts ____
Driving past your partner's home or place of work ____
Question partner's friends to confirm partner's whereabouts____

Smelling partner's clothes____
Reading partner's mail____
Checking partner's wallet____
Following your partner____
Unexpectedly visit partner____

h) Have you ever found any evidence that your partner was being unfaithful?
YES NO UNSURE

i) Have you ever had an argument with a partner over your suspicions that he/she was unfaithful? YES NO

j) Have you ever had an argument with a partner over your partner's suspicions you were unfaithful? YES NO

k) Have you ever done something (e.g., flirting with other people, discussing a former partner) in order to make a partner jealous?
YES NO

l) Have you ever flirted or cheated to get back at an unfaithful partner?
YES NO

26) The following questions contain a number of situations which may cause you to feel jealous. Rate the situations on the given scale for how jealous (if at all) you would feel if you were in that situation.

a. You see your partner talking to an attractive member of the opposite sex.

Not at all Jealous						Extremely Jealous
1	2	3	4	5	6	7

b. You see your partner smiling at an attractive member of the opposite sex.

Not at all Jealous						Extremely Jealous
1	2	3	4	5	6	7

c. You see your partner admiring or "checking out" an attractive member of the opposite sex.

Not at all Jealous						Extremely Jealous
1	2	3	4	5	6	7

d. Your partner spends time with a friend of the opposite sex.

Not at all Jealous						Extremely Jealous
1	2	3	4	5	6	7

e. Your partner spends time with a friend of the opposite sex whom you dislike.

Not at all Jealous						Extremely Jealous
1	2	3	4	5	6	7

f. Your partner admits to being attracted to a member of the opposite sex.

Not at all Jealous						Extremely Jealous
1	2	3	4	5	6	7

g. Your partner admits to kissing a member of the opposite sex.

Not at all Jealous						Extremely Jealous
1	2	3	4	5	6	7

h. Your partner admits to having sexual intercourse with a member of the opposite sex.

Not at all Jealous					Extremely Jealous	
1	2	3	4	5	6	7

i. Your partner admits to falling in love with a member of the opposite sex.

Not at all Jealous					Extremely Jealous	
1	2	3	4	5	6	7

j. Your partner has a child with a member of the opposite sex.

Not at all Jealous					Extremely Jealous	
1	2	3	4	5	6	7

27) Rate you happiness with the current romantic situation you are in, regardless of whether you have no partner, a number of different partners, or one steady partner.

Extremely happy/ satisfied				Extremely unhappy/ unsatisfied
0	1	2	3	4

28) If you are currently in a romantic relationship, please fill out the following questions (a to h) based on your relationship with your current partner. If you are not currently in a relationship, please fill out the questions based on your last romantic relationship. Please leave these questions blank if you have never been in a romantic relationship.

a) My partner is primarily interested in his/her own welfare.

Very untrue						Very true
1	2	3	4	5	6	7

b) There are times when my partner cannot be trusted.

Very untrue						Very true
1	2	3	4	5	6	7

c) My partner is perfectly honest and truthful with me.

Very untrue						Very true
1	2	3	4	5	6	7

d) I feel that I can trust my partner completely.

Very untrue						Very true
1	2	3	4	5	6	7

e) My partner is truly sincere in his/her promises.

Very untrue						Very true
1	2	3	4	5	6	7

f) I feel that my partner does not show me enough consideration.

Very untrue						Very true
1	2	3	4	5	6	7

g) My partner treats me fair and justly.

Very untrue						Very true
1	2	3	4	5	6	7

h) I feel that my partner can be counted on to help me.

Very untrue						Very true
1	2	3	4	5	6	7

29) a) Are you a parent? YES NO

b) If yes, how many children do you have? _____ How many biological children do you have? _____

30) Do you want to have children during your lifetime? YES NO MAYBE

31) How important is it that you have at least one child in your lifetime?

Not at all important						Extremely important
1	2	3	4	5	6	7

32) Ideally, how many children would you like to have in total? _____

33) Rate your level of desire to have children or more children.

Do not at all desire								Extremely desire
1	2	3	4	5	6	7	8	9

34) How soon would you like to have children?

[ ] immediately
[ ] next 2 years
[ ] next 4 years
[ ] next 6 years
[ ] next 8 years
[ ] next 10 years
[ ] next 12 years
[ ] next 14 years
[ ] 16 or more years
[ ] never

35) How important is it that you do NOT have children right now?

Not at all Important						Very Important
1	2	3	4	5	6	7

36) How much do you care for your current romantic partner if you have one? (leave blank if you do not currently have a romantic partner)

Not at all						Very
1	2	3	4	5	6	7

37) When you see a baby, what do you normally do? Check all that apply.

[ ] smile at the baby
[ ] talk or coo at the baby
[ ] play with the baby
[ ] watch the baby
[ ] talk to the parent about the baby
[ ] remember all of the reasons you don't have children
[ ] pick up the baby
[ ] ignore the baby
[ ] make funny faces at the baby
[ ] mention the baby to your companions
[ ] adjust the babies clothing
[ ] walk away

38) On the following scale, rate your general comfort level around babies.

Very uncomfortable						Very comfortable
1	2	3	4	5	6	7

39) Do you like taking care of children or babies?

Not at all						Very Much
1	2	3	4	5	6	7

40) Do you enjoy being around babies?

Not at all						Very Much
1	2	3	4	5	6	7

41) Do you enjoy being around older children?

Not at all						Very Much
1	2	3	4	5	6	7

42) Do you feel that you would be a good parent?

Not at all						Definitely
1	2	3	4	5	6	7

43) Each of the items below describes things college students sometimes ask of other people. Please imagine that you are in this situation. You will be asked to answer the following questions:

1) How concerned or anxious would you be about how the other person would respond?
2) How do you think the other person would be likely to respond?

a) You ask someone in class if you can borrow his/her notes.

How concerned or anxious would you be over whether or not the person would want to lend you his/her notes.

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that the person would willingly give me his/her notes.

Very unlikely					Very likely
1	2	3	4	5	6

b) You ask your boyfriend/girlfriend to move in with you.

How concerned or anxious would you be over whether or not the person would want to move in with you?

Very Unconcerned					Very Concerned
1	2	3	4	5	6

I would expect that he/she would want to move in with me.

Very Unlikely					Very Likely
1	2	3	4	5	6

c) You ask your parents for help in deciding what programs to apply to.

How concerned or anxious would you be over whether or not your parents would want to help you?

Very Unconcerned					Very Concerned
1	2	3	4	5	6

I would expect that they would want to help me.

Very Unlikely					Very Likely
1	2	3	4	5	6

d) You ask someone you don't know well out on a date.

How concerned or anxious would you be over whether or not the person would want to go out with you?

Very Unconcerned					Very Concerned
1	2	3	4	5	6

I would expect the person would want to go out with me.

Very Unlikely					Very Likely
1	2	3	4	5	6

e) Your boyfriend/girlfriend has plans to go out with friends tonight, but you really want to spend the evening with him/her, and you tell him/her so.

How concerned or anxious would you be over whether or not you botfriend/girlfriend would decide to stay in?

Very Unconcerned					Very Concerned
1	2	3	4	5	6

I would expect that the person would willingly choose to stay in.

Very Unlikely					Very Likely
1	2	3	4	5	6

f) You ask your parents for extra money to cover living expenses.

How concerned or anxious would you be over whether or not your parents would help you out?

Very Unconcerned					Very Concerned
1	2	3	4	5	6

I would expect that my parents would not mind helping me out.

Very Unlikely					Very Likely

1 2 3 4 5 6

g) After class, you tell your professor that you have been having some trouble with a section of the course and ask if he/she can give you some extra help.

How concerned or anxious would you be over whether or not your professor would want to help you out?

Very unconcerned 1 2 3 4 5 Very concerned 6

I would expect that my professor would want to help me out.

Very unlikely 1 2 3 4 5 Very likely 6

h) You approach a close friend to talk after doing or saying something that seriously upset him/her.

How concerned or anxious would you be over whether or not your friend would want to talk with you?

Very unconcerned 1 2 3 4 5 Very concerned 6

I would expect that he/she would want to talk with me to try to work things out.

Very unlikely 1 2 3 4 5 Very likely 6

i) You ask someone in one of your classes to coffee.

How concerned or anxious would you be over whether or not the person would want to go?

Very unconcerned 1 2 3 4 5 Very concerned 6

I would expect that the person would want to go with me.

Very unlikely					Very likely
1	2	3	4	5	6

j) After graduation, you can't find a job and ask your parents if you can live at home for a while.

How concerned or anxious would you be over whether or not you parents would want you to come home?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect I would be welcome at home.

Very unlikely					Very likely
1	2	3	4	5	6

k) You ask your friend to go on a vacation with you over Spring Break.

How concerned or anxious would you be over whether or not your friend would want to go with you?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that he/she would want to go with me.

Very unlikely					Very likely
1	2	3	4	5	6

l) You call your boyfriend/girlfriend after a bitter argument and tell him/her you want to see him/her.

How concerned or anxious would you be over whether or not your boyfriend/girlfriend would want to see you?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that he/she would want to see me.

Very unlikely					Very likely
1	2	3	4	5	6

m) You ask a friend if you can borrow something of his/hers.

How concerned or anxious would you be over whether or not your friend would want to loan it to you?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that he/she would willingly loan me it.

Very unlikely					Very likely
1	2	3	4	5	6

n) You ask your parents to come to an occasion important to you.

How concerned or anxious would you be over whether or not your parent would want to come?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that my parents would want to come.

Very unlikely					Very likely
1	2	3	4	5	6

o) You ask a friend to do you a big favour.

How concerned or anxious would you be over whether or not you friend would do you this favour?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that he/she would willingly do this favour for me.

Very unlikely					Very likely
1	2	3	4	5	6

p) You ask your boyfriend/girlfriend if he/she really loves you.

How concerned or anxious would you be over whether or not your boyfriend/girlfriend would say yes?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that he/she would say yes sincerely.

Very unlikely					Very likely
1	2	3	4	5	6

q) You go to a party and notice someone on the other side of the room and then you ask them to dance.

How concerned or anxious would you be over whether or not the person would want to dance with you?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that he/she would want to dance with me.

Very unlikely					Very likely
1	2	3	4	5	6

r) You ask your boyfriend/girlfriend to come home to meet your parents.

How concerned or anxious would you be over whether or not your boyfriend/girlfriend would want to meet your parents?

Very unconcerned					Very concerned
1	2	3	4	5	6

I would expect that he/she would want to meet my parents.

Very unlikely					Very likely
1	2	3	4	5	6

44) The following questions are to be answered on the following scale:

1 = not at all true
2 = slightly true
3 = somewhat true
4 = mostly true
5 = completely true

a) One of my greatest sources of comfort when things get rough is being with other people. ____
b) The main thing I like about being around other people is the warm glow I get from contact with them. ____
c) It seems like whenever something bad or disturbing happens to me I often just want to be with a close, reliable friend. ____
d) I think I get satisfaction out of contact with others more than most people realize. ____
e) When I have not done very well on something that is very important to me, I can get to feeling better simply by being around other people. ____
f) Just being around others and finding out about them is one of the most interesting things I can think of doing. ____
g) I seem to get satisfaction from being with others more than a lot of other people do. ____
h) I feel like I have really accomplished something valuable when I am able to get close to someone. ____
i) During times when I have to go through something painful, I usually find that having someone with me makes it less painful. ____
j) If I feel unhappy or kind of depressed, I usually try to be around other people to make me feel better. ____
k) I think it would be satisfying if I could have very close friendships with quite a few people. ____
l) I usually have the greatest need to have other people around me when I feel upset about something. ____
m) I think being close to others, listening to them, and relating to them on a one-to-one level is one of my favourite and most satisfying pastimes. ____
n) I would find it very satisfying to be able to form new friendships with whomever I liked. ____
o) One of the most enjoyable things I can think of that I like to do is just watching people and see what they are like. ____

p) I prefer to participate in activities alongside other people rather than myself because I like to see how I am doing on the activity. ____

q) When I am not certain about how well I am doing at something, I usually like to be around others so I can compare myself to them. ____

r) If I am uncertain about what is expected of me, such as on a task or in a social situation, I usually like to be able to look to certain others for cues. ____

s) I find that I often have the desire to be around other people who are experiencing the same thing I am when I am unsure of what is going on. ____

t) I find that I often look to certain other people to see how I compare to others.____

THE FOLLOWING QUESTIONS ARE FOR FEMALES ONLY:

1) Are you currently pregnant? (Circle your answer) YES NO MAYBE

2) Are you currently taking oral contraceptives? (Circle your answer) YES NO

3) If you are currently taking oral contraceptives, please put an **X** beside the type of oral contraceptive you are currently taking.

Alesse	____	Ortho-Cept	____
Brevicon 0.5/35	____	Ortho 7/7/7	____
Brevicon 1/35	____	Ortho 10/11	____
Cyclen	____	Synphasic	____
Demulen 30	____	Tri-Cyclen	____
Loestrin	____	Triphasil	____
Marvelon	____	Triquilar	____
MinEstrin	____	Demulen 50	____
Min-Ovral	____	Norlestin 1/50	____
Norinyl	____	Ovral	____
Ortho 1/35	____	Ortho-Novum 1/50	____
Ortho 0.5/35	____	Other _____ Name:	_____

4) Check the box that best describes why you are taking oral contraceptives.

[ ] birth control [ ] other reasons [ ] birth control and other reasons

5) How long have you been taking oral contraceptives? _____ years _____ months

6) How long have you been taking your current brand of oral contraceptive? _____ years and _____ months

7) Since you began using oral contraceptives, have you discontinued using them for longer than one week? YES NO

8) Do you have any intentions of discontinuing the use of oral contraceptives within the next few weeks? YES NO MAYBE

9) If you are not currently taking oral contraceptives, have you ever taken oral contraceptives before? (Circle your answer) YES NO

10) If you have previously taken oral contraceptives but are not taking them right now, how many years and months has it been since you last took oral contraceptives?
_____ years and _____ months

11) If you are currently taking oral contraceptives, how many pills from your current package have you taken so far? ____

12) If you are not currently taking oral contraceptives, would you say that you are currently practicing some form of contraception (i.e., are you using some physical or chemical method to prevent pregnancy)? YES NO

13) a) Are you currently using a type of hormonal contraceptive other than an oral contraceptive (e.g., Depo Provera, the patch)?

YES NO Please specify:_____

b) How long have you used this method of contraception? _____ years _____ months

14) What is the average length of your menstrual cycle (i.e., how many days are there from the first day of one period to the first day of your next period)? _____

15) What is your average length of menstruation (i.e., how many days does your period last)? _____

16) Which statement best describes your menstrual cycle? (Put an X beside your response)

____ I have not had my period in the past three months.
____Some months I get my period and some months I don't.
____I usually get my period every month, but it is irregular and I cannot predict when it will start.
____I usually get my period within two to three days of when I expect it.
____My period is like clockwork and the same number of days elapse between periods each month.

17) How old were you when you first started menstruating? _____ years old

18) Using the calendars below, please **circle** the **first** day of your **last** menstrual period. If you are not completely sure, please estimate the day that you believe you started menstruating on. Also, please put an **X** over the day that you believe your **next** period will start.

February

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

March

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

April

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

May

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

19) How confident are you that the above circled day was the first day of your last period? (Circle the best response)

0%		25%		50%		75%		100%
0	1	2	3	4	5	6	7	8

20) How confident are you that the above day with an X is the day that you will next get your period? (Circle the best response)

0%		25%		50%		75%		100%
0	1	2	3	4	5	6	7	8

21) How important is it to you that you do **NOT** become pregnant right now?

Not at all Important						Extremely important
1	2	3	4	5	6	7

Appendix B

Participant # ____
Order # ____

Script Questionnaire A

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item carefully and mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way at this moment. Please place an answer for all of the descriptive words. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ interested	____ ashamed	____ delighted
____ distressed	____ inspired	____ excluded
____ excited	____ nervous	____ affectionate
____ upset	____ determined	____ rejected
____ strong	____ attentive	____ jealous
____ guilty	____ jittery	____ content
____ scared	____ active	____ ignored
____ hostile	____ afraid	____ dejected
____ enthusiastic	____ angry	____ motherly/fatherly
____ proud	____ happy	____ humiliated
____ irritable	____ hurt	____ sad
____ alert	____ unloved	

Appendix C

Participant # ____
Order # ____

Script Questionnaire B

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item carefully and mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way at this moment. Please place an answer for all of the descriptive words. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ interested	____ ashamed	____ delighted
____ distressed	____ inspired	____ excluded
____ excited	____ nervous	____ affectionate
____ upset	____ determined	____ rejected
____ strong	____ attentive	____ jealous
____ guilty	____ jittery	____ content
____ scared	____ active	____ ignored
____ hostile	____ afraid	____ dejected
____ enthusiastic	____ angry	____ motherly/fatherly
____ proud	____ happy	____ humiliated
____ irritable	____ hurt	____ sad
____ alert	____ unloved	

1) To answer the following questions, please give your best assessment of how you would feel should the situation you just imagined had actually happened.

a) To what extent would you feel angry at your partner?

Not angry						Extremely angry
1	2	3	4	5	6	7

b) To what extent would you feel angry at your rival?

Not angry						Extremely angry
1	2	3	4	5	6	7

c) To what extent would you feel angry at yourself?

Not angry						Extremely angry
1	2	3	4	5	6	7

d) To what extent would you blame your partner?

Not at all						Completely
1	2	3	4	5	6	7

e) To what extent would you blame your rival?

Not at all						Completely
1	2	3	4	5	6	7

f) To what extent would you blame your self?

Not at all						Completely
1	2	3	4	5	6	7

m) If your partner was emotionally unfaithful (i.e., fell in love with another person) how distressed would you feel?

Not at all						Extremely
1	2	3	4	5	6	7

n) If your partner was sexually unfaithful how distressed would you feel?

Not at all						Extremely
1	2	3	4	5	6	7

o) How likely would you be to immediately end your relationship with an unfaithful partner?

Not likely						Extremely likely
1	2	3	4	5	6	7

2. Based on what you would do or how you would feel if the situation you imagined actually happened to you, rate the following possible reactions on the scale given.

a) Tell my partner how much I need him/her.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

b) Feel like getting even.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

c) Buy more cards or gifts for my partner.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

d) Make myself more attractive to my partner.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

e) Give my partner the "cold shoulder".

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

f) Be more willing to do things that my partner asked me to do.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

g) Do something to hurt my partner emotionally.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

h) Try to say positive things about my partner when speaking to other people.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

i) Begin to value my partner more highly.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

j) Spend less time with my partner.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

k) Threaten to break up if my partner continues to act that way.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

l) Do things to be more interesting to my partner.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

m) Plan ways to get back at my partner.

Not at all descriptive								Extremely good description

of me								of me
1	2	3	4	5	6	7	8	9

n) Complain to other people about my partner.

Not at all descriptive of me								Extremely good description of me
1	2	3	4	5	6	7	8	9

3) How well were you able to imagine or visualize the infidelity scenario?

Not at all								Extremely Well
1	2	3	4	5	6	7	8	9

Appendix D

Participant # ____
Order # ____

Slideshow Questionnaire A

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item carefully and mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way at this moment. Please place an answer for all of the descriptive words. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ interested	____ ashamed	____ delighted
____ distressed	____ inspired	____ excluded
____ excited	____ nervous	____ affectionate
____ upset	____ determined	____ rejected
____ strong	____ attentive	____ jealous
____ guilty	____ jittery	____ content
____ scared	____ active	____ ignored
____ hostile	____ afraid	____ dejected
____ enthusiastic	____ angry	____ motherly/fatherly
____ proud	____ happy	____ humiliated
____ irritable	____ hurt	____ sad
____ alert	____ unloved	

Appendix E

Participant # ____
Order # ____

Slideshow Questionnaire B

---

1) This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item carefully and mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way at this moment. Please place an answer for all of the descriptive words. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ interested	____ ashamed	____ delighted
____ distressed	____ inspired	____ excluded
____ excited	____ nervous	____ affectionate
____ upset	____ determined	____ rejected
____ strong	____ attentive	____ jealous
____ guilty	____ jittery	____ content
____ scared	____ active	____ ignored
____ hostile	____ afraid	____ dejected
____ enthusiastic	____ angry	____ motherly/fatherly
____ proud	____ happy	____ humiliated
____ irritable	____ hurt	____ sad
____ alert	____ unloved	

2) Do you want to have children during your lifetime? YES NO MAYBE

3) How important is it that you have at least one child in your lifetime?

Not at all important						Extremely important
1	2	3	4	5	6	7

4) Ideally, how many children would you like to have in total? _____

5) Rate your level of desire to have children or more children.

Do not at all Desire								Extremely Desire
1	2	3	4	5	6	7	8	9

6) To what extent did the slideshow increase your desire to be a parent at some point in your life?

Not at all						Extremely
1	2	3	4	5	6	7

2) How many children (or more children) would you like to have?_____

3) How soon would you like to have children?

[ ] immediately
[ ] next 2 years
[ ] next 4 years
[ ] next 6 years
[ ] next 8 years
[ ] next 10 years
[ ] next 12 years
[ ] next 14 years
[ ] 16 or more years
[ ] never

4) How important is it that you do NOT have children right now?

Not at all Important						Very Important
1	2	3	4	5	6	7

5) On the following scale, rate your general comfort level around babies.

Very uncomfortable						Very comfortable
1	2	3	4	5	6	7

6) Do you like taking care of children or babies?

Not at all						Very Much
1	2	3	4	5	6	7

7) Do you enjoy being around babies?

Not at all						Very Much
1	2	3	4	5	6	7

8) How much do you care for your current romantic partner if you have one? (leave blank if you do not currently have a romantic partner)

Not at all						Very
1	2	3	4	5	6	7

Appendix F

Participant # ____
Order #____

Cyberball Questionnaire A

1) This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item carefully and mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way at this moment. Please place an answer for all of the descriptive words. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ interested	____ ashamed	____ delighted
____ distressed	____ inspired	____ excluded
____ excited	____ nervous	____ affectionate
____ upset	____determined	____rejected
____ strong	____attentive	____ jealous
____ guilty	____ jittery	____ content
____ scared	____ active	____ ignored
____ hostile	____ afraid	____ dejected
____ enthusiastic	____ angry	____ motherly/fatherly
____ proud	____ happy	____ humiliated
____ irritable	____ hurt	____ sad
____ alert	____ unloved	

Appendix G

Participant # ____
Order #____

Cyberball Questionnaire B

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item carefully and mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way at this moment. Please place an answer for all of the descriptive words. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ interested	____ ashamed	____ delighted
____ distressed	____ inspired	____ excluded
____ excited	____ nervous	____ affectionate
____ upset	____ determined	____ rejected
____ strong	____ attentive	____ jealous
____ guilty	____ jittery	____ content
____ scared	____ active	____ ignored
____ hostile	____ afraid	____ dejected
____ enthusiastic	____ angry	____ motherly/fatherly
____ proud	____ happy	____ humiliated
____ irritable	____ hurt	____ sad
____ alert	____ unloved	

Please answer the following questions based on your experience of playing the Cyberball game.

1. I felt poorly accepted by the other players

Not At All							Very Much So	
1	2	3	4	5	6	7	8	9

2. I felt as though I bonded with the other players during the game.

Not At All							Very Much So	
1	2	3	4	5	6	7	8	9

3. I felt like an outsider during the game

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

4. I felt that I was able to throw the ball as often as I wanted during the game.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

5. I felt somewhat frustrated during the game.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

6. I felt in control during the game.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

7. I felt good about myself during the game.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

8. I felt that the other players failed to perceive me as a worthy and likeable person.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

9. I felt somewhat inadequate during the game.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

10. I felt as though my existence was meaningless during the game.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

11. I felt that my performance had some effect on the direction of the game.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

12. I enjoyed playing the game.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

13. I feel as though I could be friends with the others players if I met them.

Not At All								Very Much So
1	2	3	4	5	6	7	8	9

Appendix H

Participant # ____
Order # ____

Video Questionnaire A

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item carefully and mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way at this moment. Please place an answer for all of the descriptive words. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ interested	____ ashamed	____ delighted
____ distressed	____ inspired	____ excluded
____ excited	____ nervous	____ affectionate
____ upset	____ determined	____ rejected
____ strong	____ attentive	____ jealous
____ guilty	____ jittery	____ content
____ scared	____ active	____ ignored
____ hostile	____ afraid	____ dejected
____ enthusiastic	____ angry	____ motherly/fatherly
____ proud	____ happy	____ humiliated
____ irritable	____ hurt	____ sad
____ alert	____ unloved	

Appendix I

Participant # ____
Order # ____

Video Questionnaire B

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item carefully and mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way at this moment. Please place an answer for all of the descriptive words. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____ interested	____ ashamed	____ delighted
____ distressed	____ inspired	____ excluded
____ excited	____ nervous	____ affectionate
____ upset	____ determined	____ rejected
____ strong	____ attentive	____ jealous
____ guilty	____ jittery	____ content
____ scared	____ active	____ ignored
____ hostile	____ afraid	____ dejected
____ enthusiastic	____ angry	____ motherly/fatherly
____ proud	____ happy	____ humiliated
____ irritable	____ hurt	____ sad
____ alert	____ unloved	

Appendix J

Jealousy Script for Women

Please read the following paragraph and, while reading, make your best effort to imagine yourself in the situation described.

You have just found out that your partner has been cheating on you with an attractive woman. He admits to secretly meeting her often to have sex. An acquaintance of yours, who also just found out about the relationship, knows the woman and says that she was told that your partner and the woman have been having passionate and adventurous sex. They also share common interests, and your partner states that he has developed strong feelings for her. At the current time, you don't know if your partner will continue this relationship or how serious it is.

Please raise your hand to indicate to the experimenter that you have finished reading the script. Then, sit quietly for the next 90 seconds and imagine the situation above, how you would feel, how you would react, and what you would do if it happened to you. The experimenter will tell you when to stop.

Jealousy Script for Men

Please read the following paragraph and, while reading, make your best effort to imagine yourself in the situation described.

You have just found out that your partner has been cheating on you with an attractive man. She admits to secretly meeting him often to have sex. An acquaintance of yours, who also just found out about the relationship, knows the man and says that he was told that your partner and the man have been having passionate and adventurous sex. They also share common interests, and your partner states that she has developed strong feelings for him. At the current time, you don't know if your partner will continue this relationship or how serious it is.

Please raise your hand to indicate to the experimenter that you have finished reading the script. Then, sit quietly for the next 90 seconds and imagine the situation above, how you would feel and how you would react if it happened to you. The experimenter will tell you when to stop.

Appendix K

Consent Form A

This study is being conducted by Janelle Jarva under the supervision of Dr. K. Oinonen of the Department of Psychology at Lakehead University. Portions of this study will be used for Ms. Jarva's Master's thesis. The purpose of the study is to examine factors affecting mood in men and women. The attached screening questionnaire will be used to select participants for the next phase of the study. Participation in this screening phase of the study involves completing this questionnaire, and individuals enrolled in Psychology 1100 will receive one bonus point toward their final mark for participation. Please complete the attached bonus point form to ensure that you receive a bonus point.

This questionnaire, which will take approximately 30 minutes to complete, includes personal questions on topics such as demographic information, health information, relationship information, reproductive history, sexual history, beliefs and attitudes, and mood.

Individuals who meet the criteria for the next phase of the study will be contacted by telephone or e-mail. Therefore we have asked for your name and phone number on this form. Once it is determined who will be asked to participate in the next phase of the study, this form will be removed from the questionnaire, and your responses will remain confidential and anonymous. Your name will not be connected to your responses. Data will be stored by Dr. Oinonen for seven years as per university regulations. There are no known psychological or physical risks associated with participating in this study. You are free to withdraw from the study at any time without explanation and/or penalty.

I have read the consent form, understand it, and agree to participate in this study under these conditions.

Name (Please Print): _____

Phone Number:_____

E-mail Address (print clearly):_____

Signature:_____

Date:_____

If you have any questions or concerns regarding this study please contact Dr. Oinonen at 343-8096.

Appendix L

Debriefing Form A

Thank you for participating in the screening phase of this study on factors affecting mood in men and women. Portions of this research constitute a Master's thesis by Janelle Jarva. This research project is being supervised by Dr. Kirsten Oinonen of the Department of Psychology. If you are selected to participate in the next phase of the study you will be contacted by telephone by the researcher, Janelle Jarva, within the next few weeks. Participants in the second phase of the study will receive one bonus point towards their final mark if they are enrolled in Psychology 1100.

Be assured that once participants have been selected for the study, the consent forms will be removed from the screening questionnaires and there will be no way to identify that your name is associated with your responses. All responses will be coded to conceal your identity on the questionnaires and all data will remain anonymous. Thank you again for your participation.

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Appendix M

Consent Form B

This study is being conducted by Janelle Jarva under the supervision of Dr. K. Oinonen of the Department of Psychology at Lakehead University. The purpose of the study is to examine variables affecting mood in men and women.

This session will last approximately 30 minutes. During this session you will be asked to complete a number of short questionnaires, provide two saliva samples, have your heart rate monitored, and complete four tasks which include playing a game and viewing some pictures. Participants in Psychology 1100 will receive an additional bonus point towards their final mark, for a total of two bonus points for the study.

Participation in this study is voluntary and you may withdraw at any time without explanation and without penalty. All records of participation will be kept in strict confidence and reports of the study will not identify you as a participant. All data will be stored by Dr. K. Oinonen at Lakehead University for seven years and remain confidential and anonymous. There are no known serious physical or psychological risks associated with participating in this study.

I have read and understood the consent form, and I agree to participate in this study under these conditions. If you would like to receive a summary of the results of the study, please print your email address in the space provided below.

Name (Please Print): _____ Student Number:_____

Signature:_____

Date:_____ Email:_____
(to receive a summary of study results)

If you have any questions or concerns regarding this study please contact Dr. K. Oinonen at 343-8096.

Appendix N

Debriefing Form B

Thank you for participating in this study. Portions of this research will be used for a Master's thesis being conducted by Janelle Jarva under the supervision of Dr. K. Oinonen. The data you have contributed will be used to examine hormonal effects on mood (for example, sex differences). We are also investigating how mood is affected by material designed to induce parental feelings, jealousy, and positive affect. The heart rate readings and saliva samples will be used to examine heart rate and hormonal responses, respectively.

At the beginning of this study, you were informed that you were playing the Cyberball game with participants at another university. However, in actuality, there were no other human players. You were playing the game with the computer and the computer program was designed to exclude you. We apologize for not being completely forthright, but we wished to examine the effects of social exclusion, or ostracism, on mood. In order for us to obtain accurate results from all participants, we have to ask you to please keep this study confidential until the end of the study. If you have any concerns about the study, please feel free to express them to the experimenter right now.

Please be assured that all of your responses are coded to conceal your identity and all data will remain anonymous. Below are some references which may be of use to you if you would like to learn more about ostracism using the Cyberball game, or hormonal effects on mood.

Attached to this form is a list of mental health resources. If you are concerned about your mood or have any mental health concerns, please to not hesitate to contact one of these resources to receive help.

If you have provided your email address to receive a summary of the study, one will be sent to you following the completion of the study.

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References:

Oinonen, K.A. & Mazmanian, D. (2002). To what extent do oral contraceptives influence mood and affect? *Journal of Affective Disorders, 70*, 229-240.

Zadro, L., Williams, K.D., & Richardson, R. (2004). How low can you go? Ostracism by a computer is sufficient to lower self-reported levels of belonging, control, self-esteem, and meaningful existence. *Journal of Experimental Social Psychology,* 40, 560-567.

Mental Health Resources

If you are concerned about your feelings, have questions about your mental health, or would like to talk to a mental health professional, please do not hesitate to contact the resources listed below.

- Lakehead University Health and Counselling Centre: 343-8361
- Thunder Bay Crisis Response (available 24 hours): 346-8383
- Catholic Family Development Centre: 345-7323
- Family Services Thunder Bay: 626-1880
- Emergency services are available at the Thunder Bay Health Sciences Centre

Appendix O

Transformations of Non-normal Variables from the Screening Questionnaire

Variable	Outliers	Normality	Transformation and Effect
MANCOVA #1			
PANAS-X NA	OC users (59), nonusers (128), males (89)	all positively skewed and leptokurtic	logarithmic, male group still positively skewed
PANAS-X Guilt	OC users (506), nonusers (128, 29), males (89)	all positively skewed and leptokurtic	logarithmic, normalized
PANAS-X Sadness	OC users (415, 547), males (89)	all positively skewed, OC users and males were leptokurtic	logarithmic, male group still positively skewed
PANAS-X Shyness	OC users (1), nonusers (70),	all positively skewed	logarithmic, normalized
Reactivity Scale	males (146)	male group positively skewed	none, value of outlier changed, normalized

(*Appendix O continues*)

(*Appendix O continued*)

Variable	Outliers	Normality	Transformation and Effect
ANCOVA #1			
Dyadic Trust Scores	OC users (521), males (98)	all negatively skewed, male group was leptokurtic	reflect and square root, normalized
ANCOVA #2			
SOI	OC users (189, 519), nonusers (393), males (534)	all positively skewed and leptokurtic	logarithmic, normalized

Note. The numbers in parentheses refer to the participant numbers with outlying data points.

Appendix P

Transformations of Non-normal Variables from the Laboratory Session

Variable	Outliers	Normality	Transformation and Effect
MANCOVA #2			
Affect Change Scores Across All Tasks			
PA change scores	OC users (61), nonusers (81),	OC user and nonuser groups were positively skewed and leptokurtic	logarithmic, normalized
NA change scores	none	OC user group was positively skewed	square root, normalized
Jealousy change scores	none	OC user group was positively skewed	square root, normalized
Parental Feelings change scores	nonusers (81)	OC user and nonuser groups were positively skewed, nonuser group was leptokurtic	square root, normalized
Ostracism change scores	OC users (62)	OC user group was positively skewed	square root, normalized

(*Appendix P continues*)

(*Appendix P continued*)

Variable	Outliers	Normality	Transformation and Effect
Repeated-Measures MANCOVA #1			
Pre-test and Post-test Affect Scores for Specific Tasks			
Pre-test Ostracism scores (from Cyberball task)	OC users (74, 123), nonusers (450)	all positively skewed, OC user and nonuser groups were leptokurtic	logarithmic, one outlier was removed, others reduced
Post-test Ostracism scores (from Cyberball task)*	none	no problems with normality	logarithmic
Pre-test Jealousy scores (from jealousy task)	OC users (158), nonusers (450)	all positively skewed, OC users and nonusers were leptokurtic	logarithmic, outliers reduced
Post-test Jealousy scores (from jealousy task)*	none	no problems with normality	logarithmic

(*Appendix P continues*)

(*Appendix P continued*)

Variable	Outliers	Normality	Transformation and Effect
MANCOVA #3: Heart Rate Variance and Means			
HR variance change score	OC users (420)	all positively skewed, and leptkurtic	square root, normalized
HR Means (change score)	OC users (428)	OC group was positively skewed and leptokurtic	square root, normalized

Note: variables marked with an * were part of a repeated-measures MANCOVA that required them to be transformed despite a lack of problems with normality or outliers. The numbers in parentheses refer to the participant numbers with outlying data points.