

Premenstrual Syndrome and Misattribution: A Self-Perception, Individual Differences Perspective

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Self-perception theory suggests that premenstrual syndrome (PMS) may arise from the misattribution of hormone-induced bodily changes. If so, individual differences in the role of bodily responses in emotional feelings, measured in a separate expression-manipulation procedure, should be related to susceptibility to PMS. In Study 1, women responsive to cues from their bodies showed significant mood changes, both negative and positive, with their cycle, over a 60 day span; whereas women relatively unresponsive to personal, bodily cues showed no consistent cycle effects. PMS was also predicted by a measure of emotional complexity. In Study 2 women whose moods were based on bodily cues also rated their moods as less positive if they were in their premenstrual week, and women unresponsive to their bodies were unaffected by their cycle. A reminder of their cycle-stage prevented PMS in the body cue group, which is a kind of discounting effect. Women who were unresponsive to their bodies also did not show PMS, and were unaffected by the reminder.

During their premenstrual week, many women experience negative mood changes: They report suffering from affective lability, persistent anger or irritability, anxiety, tension, a lack of energy, and so on. This phenomenon is generally referred to as Premenstrual Syndrome (PMS).¹ Although PMS seems to have a biological basis, its causes remain obscure (Gitlin & Pasnau, 1989; Mortola, 1998) and cultural and individual expectations also play a role (e.g., Olasov & Jackson, 1987; Ruble, 1977; Walker, 1995). Self-perception theory provides an account of how these two kinds of factors may be integrated, as its basic premise is that emotional feelings arise from interpretations of bodily states, interpretations that can vary across individuals, and probably cultures. This article describes two studies that tested predictions from a self-perception explanation of PMS.

PREMENSTRUAL SYNDROME

According to Simon (1978), Hippocrates and Galen postulated an association between the menstrual cycle and affective and behavioral disturbances millennia ago. However, Frank (1931) seems to have been the first researcher to systematically describe the negative mood changes that occur 7 to 10 days before the onset of menstruation (Logue & Moos, 1986). Since then, considerable research effort has explored mood variations over the menstrual cycle, but investigators still have not agreed on an explanation for PMS, and some people express doubt that PMS even exists (McFarlane & Williams, 1990).

One problem with the diagnosis and treatment of PMS is confusion about what constitutes PMS. More than 150 different symptoms have been reported to be correlated with the menstrual cycle (Hamilton, Parry, Alagna, Blumenthal, & Herz, 1984). These symptoms include both emotional and other feeling states and various physical symptoms, such as lack of energy, headaches, breast tenderness or swelling, and a sensation of bloating. Adding to the confusion, the impact of menstrual cycle seems to vary widely among women.

In this article we focus on the emotional changes that may be associated with the menstrual cycle. These usually are thought to include some or all of anxiety, irritability, depression, or tension. Logue and Moos (1986) found that in retrospective reports, about 40% of women describe mild

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¹The name *Premenstrual Syndrome* implies a more severe problem than most women encounter, and the term *premenstrual tension* would seem more appropriate, if a bit too narrow, because tension is only one symptom. However, common usage is to refer to cycle-related emotional changes as *PMS* and we will follow that custom.

to moderate such symptoms, and 2% to 10% describe severe symptoms. Other estimates range around these numbers, suggesting that PMS is common but by no means universal. We are primarily concerned with the moderate range of symptoms that do not reach the level of potential psychological disorder. We will refer to these moderate effects of menstrual cycle on mood variables as PMS, but do not intend to imply by that label that these effects are in any sense abnormal, nor that they require treatment.

Traditionally, PMS effects have been presumed to occur approximately 7 days prior to the onset of menstruation (Rubinow, Roy-Byrne, Hoban, Gold, & Post, 1984). Numerous biological etiologies of PMS have been proposed, most of which focus on hormonal variations. McFarlane and Williams (1990) list no less than 19 examples of proposed medical etiologies. The two hormones most often implicated in PMS are progesterone and estrogen, both of which ordinarily are relatively high at the beginning of the premenstrual week, and drop rapidly through the week. However, their role in PMS, if any, is certainly unclear (Mortola, 1998). For example, some studies have found that women who suffer from PMS have chronically lower levels of progesterone (e.g., Trunell, Turner, & Keye, 1988), an observation that is consistent with the rapid fall in levels during the premenstrual week. However, suppressing normal ovarian function and hence reducing progesterone and estradiol levels led to improvement of symptoms in one study (Schmidt, Nieman, Danaceau, Adams, & Rubinow, 1998), and when progesterone or estradiol levels were restored experimentally, PMS symptoms reoccurred. Women who were not prone to PMS and who received the same hormonal treatment did not experience any alterations in mood and physical symptoms. Schmidt et al. (1998) concluded that “normal plasma concentrations of gonadal steroids can trigger an abnormal response—deterioration in mood state—in susceptible women” (p. 216). The difficulty, of course, lies in determining what exactly makes some women more susceptible to PMS.

Partly inspired by the inconsistent evidence for biological factors, an alternative approach to PMS has explored the role of expectations and social roles. Both women and men have beliefs about menstruation and associated mood changes, and these beliefs might produce some of the effects. For example, when participants in one study (Koeske & Koeske, 1975) were asked to describe the causes for the mood state of a hypothetical, premenstrual woman, biology was used to explain negative, but not positive, moods. Similarly, Bains and Slade (1988) found that negative moods in the premenstrual week were attributed to the menstrual cycle, whereas positive moods occurring during the premenstrual week were attributed to environmental or personality factors. These expectations apparently affect women themselves. When women who were about to enter their premenstrual week were led to believe that they were in fact premenstrual, they reported more symptoms than

when they believed they were not yet premenstrual (Ruble, 1977). However, although expectations affect PMS, when both expectations and actual stage in the menstrual cycle are examined, both affect women’s symptoms (Klebanov & Jemmott, 1992; Olasov & Jackson, 1987).

Based on evidence like that sketched here, various authors (e.g., Blumenthal & Nadelson, 1988; Logue & Moos, 1986; McFarlane & Williams, 1990; Trunell, White, Pedersen, & Keye, 1989; Walker, 1995) have concluded that both biological factors and psychological–sociocultural factors have to be taken into account to fully explain the phenomena of PMS. Generally, we might assume that PMS depends on both the occurrence of some physical changes, and a particular pattern of response and interpretation of the physical changes.

SELF-PERCEPTION THEORY

The self-perception theory of emotion seems a good candidate source for an explanation of PMS, because it is directed precisely at describing how bodily activities and states generate emotional feelings. Self-perception theory (Bem, 1972; James, 1890; Laird, 1974; Ryle, 1949) holds that in knowing anything about ourselves, we are essentially in the same position as an outside observer who infers our psychological states from observing our actions. In this view, anything we know or feel about ourselves must be derived from our behavior and bodily states and the context in which they occur. In other words, feelings are the consequences of situated behaviors (and are not the causes of those behaviors): We feel happy because we smile, and angry because we clench our fists.² Another way of describing self-perception theory’s main point is that it is a description of what emotional feelings are feelings of. Just as the feeling of hunger arises from sensory information about stomach contractions and levels of blood sugar, emotional feelings are presumed to arise from proprioceptive information about the activities of muscles involved in expressive behavior, and the sensations arising from increased levels of autonomic activity. Note that the focus of the theory is on the actual, everyday feelings of emo-

²Perhaps because, as James (1884) pointed out, self-perception theory directly contradicts common sense, many conceptual objections to it are often raised, such as the fact that it doesn’t explain the origin of the behavior such as a smile that leads to a feeling of happiness, or that it seems to imply a greater degree of consciousness than is warranted, or that the size of the experimental effects are inadequate to explain intense emotions. We don’t have space to consider those questions here but they have been discussed in various earlier articles (e.g., Laird & Bresler, 1990, 1992). Briefly, the behaviors are assumed to be automatically produced, like keeping one’s balance, the processes that lead from behaviors to feelings are entirely nonconscious, much like the perceptual processes that generate the experience of depth, and the effect sizes are adequate, especially because different kinds of cues may combine to produce more intense experiences (Flack, Laird, & Cavallaro, 1999).

tions we all know so well, and how these feelings arise. Self-perception theory does not seek to redefine the nature of feelings, but to explain the feelings we all experience.

Consistent with self-perception theory, numerous studies (see reviews by Adelman & Zajonc, 1989; Capella, 1993; Izard, 1990; Laird & Bresler, 1990) have demonstrated that mood states can be induced by changes in people's bodily activities. In these studies, the behaviors necessarily precede and produce the feelings. For example, people who are induced to adopt facial expressions or postures of various emotions feel the corresponding emotions (Duclos et al., 1989), and people feel romantic attraction if they exchange mutual gazes (Kellerman, Lewis, & Laird, 1989; Williams & Kleinke, 1993). Autonomic arousal plays a similar role to expressive behavior. For example, increases in arousal lead to increased intensity of experiences of fear, anger, and passionate love (see Laird & Bresler, 1992; & Foster, Witcher, Campbell, & Green, 1998, for reviews). A lesser but still substantial number of studies has shown that preventing emotional behavior reduces the intensity of emotional experience (e.g., Duncan & Laird, 1980; Hazaleus & Deffenbacher, 1986; Laird et al., 1994).

In all the experiments of this type, a kind of "emotional illusion" is created, in which people misunderstand the origins of their behavior. For example, a smile or a sad posture that were adopted in response to an experimenter's request, or arousal produced by exercise are interpreted by the participants as representing their own emotional states (Zillman, 1983; Foster et al., 1998), and lead to the appropriate emotional experience. The converse effect also occurs: If expressions or arousal that were produced by an emotional stimulus are attributed to some neutral source, the emotional feeling is reduced or prevented.

In self-perception theory, the perception analogy is meant to be taken seriously. The process seems most similar to complex object perception, such as visual depth perception. In both cases there are underlying cues that can generate the experience, such as linear perspective or retinal disparity in depth perception, or proprioceptive cues from expressive behavior, or sympathetic arousal in emotional feelings. These cues combine to produce the experience, although the individual is ordinarily not aware of either the cues or the process by which the cues lead to the final experience, whether it is an experience of depth or affective feeling (Laird & Bresler, 1992). In addition, just as understanding the cues and processes of depth perception does not imply that the experience is any less real, self-perception approaches to emotion assume that the object of their study is ordinary emotion, as felt by everyone in their everyday lives.

Adopting or inhibiting emotional behaviors does not affect the feelings of all individuals equally, however. For example, when participants' facial expressions are manipulated into smiles or frowns, some participants report feeling happy or angry, but others do not (Laird & Crosby,

1974). This difference in response reflects broad differences in the kinds of cues that individuals use in constructing their emotional experiences, and other feelings, and these differences are consistent across a wide range of cues and feelings, and are stable over time (Bresler & Laird, 1983; Laird & Crosby, 1974). One kind of cue has been called "self-produced" (Laird & Berglas, 1975), although perhaps a better label would be "personal." Personal cues include a person's behaviors and actions and his or her appearance. People who are more responsive to personal cues are those who feel happy when smiling, sad when sitting in a slumped posture, and so on. Other people, however, seem to be relatively unresponsive to their own behavior; and instead, derive their feelings from interpretations of the situations that they find themselves in. Cues of this sort have been called "situational," and consist of our understandings about how most people in a particular situation would be expected to feel.

Most of the time in everyday life the two kinds of cues are consistent—we laugh at parties and scowl in response to insults. However, in some cases the two kinds of cues are discrepant, as when people are not laughing and talking animatedly at a party. If asked at that moment whether they were having a good time, people responsive to personal cues might say no, whereas those responsive to situational cues might respond to the common expectancy that people at parties are having a good time, and report that they were indeed enjoying themselves.

Various studies show that only participants who depend more on personal cues respond to experimental variations of expressive behavior, arousal, and action. Most commonly, response to personal cues has been assessed by asking participants to adopt facial expressions, and to report their feelings. People who report feeling happy when smiling and angry when frowning are identified as responsive to personal cues. They are then found, repeatedly, to be responsive to manipulations of other, different kinds of personal cues. For example, only participants who have been independently identified in the expression manipulation procedure as responsive to personal cues also report changes in feelings after manipulations of postures (Duclos et al., 1989) and gaze (Kellerman et al., 1989). Effects of expression-induced emotions on memory (Laird, Wagener, Halal, & Szedga, 1982; Schnall & Laird, 1999) and effects of misattribution of arousal on feelings of fear (Duncan & Laird, 1980) only occur for personal cue responders. People more responsive to personal cues also change their attitudes to match their speeches in induced-compliance procedures (Duncan & Laird, 1977; Rhodewalt & Comer, 1979), whereas those more responsive to situational cues change in response to a conformity procedure (Comer, 1975) and are more easily influenced by normative statements about how they should expect to feel (Kellerman & Laird, 1982; see Laird & Bresler, 1992 for a review of numerous other such studies).

In sum, self-perception research has demonstrated that the emotional feelings of many, although not all, people are a result of their bodily states and activities.

PMS AND SELF-PERCEPTION THEORY

As a woman progresses through her menstrual cycle, she may be in a similar situation to participants in self-perception experiments. That is, because of the hormonal changes associated with her cycle, her body may be producing behaviors and sensations that are like those of an emotional state, although no emotion-eliciting stimuli are present. However, if she misattributes these bodily sensations, she will experience emotions that have no external emotional cause. Thus, the woman may feel specific emotions in her premenstrual phase as the result of a misattribution process, just as, in an experiment, she might experience an emotional feeling because she has been induced to adopt a facial expression.³ However, only women who are more responsive to personal cues would show a greater potential for this misattribution and the resulting PMS. In our first study, we examined directly the occurrence of PMS in individual women, and later obtained a measure of their response to personal cues.

STUDY 1

A considerable amount of research has demonstrated that women are not completely reliable reporters about their susceptibility to PMS (e.g., McFarlane & Williams, 1990). Logue and Moos (1986) noted that in retrospective studies, where women are asked to describe symptoms from one or more past menstrual cycles, women tend to overestimate symptom prevalence in comparison with prospective studies. Consequently, asking women to rate symptoms concurrently as they are experienced during the menstrual cycle is the preferable method, especially when the purpose of this study is not made obvious to the participants (Rubinow & Roy-Byrne, 1984). To obtain reliable data in a longitudinal study of PMS, a time period of at least 2 months has to be covered (Blumenthal & Nadelson, 1988).

In this study, for 2 months women reported, every day, their mood and answered some health and activity questions that included whether they were menstruating. We predicted that women who were more responsive to personal cues would be more likely to experience cycle-related mood changes than women who were unresponsive to personal cues.

³The specific mechanisms by which hormonal changes affect the body and lead to emotional changes is unclear. Of course, as we discussed previously, the critical hormonal changes have not yet been identified, or even which hormones are important, so any attempt at describing a mechanism would be highly speculative.

Method

Participants

Participants were recruited by electronic mail with a brief description of this study. In the beginning of the study 25 female college students agreed to participate. However, over the course of the experiment, 10 participants either dropped out or had unusable data due to irregular menstrual cycles. The data of 15 women were analyzed.

Procedure

The women volunteers were told that they were participating in a study on daily mood variations in relation to external stimuli. Each woman was asked to come to the laboratory to fill out an initial questionnaire that contained questions concerning eating and exercise habits, health, and whether the woman was taking oral contraceptives. Then she was asked to start the daily questionnaire, which she received by e-mail, and to send it back each day by e-mail to the experimenter. The daily questionnaire consisted of questions asking how healthy the woman was feeling, how well she had slept and eaten, and whether she exercised. Embedded among these questions was one asking whether the woman was menstruating that day.

Following the health questions was an emotional rating scale with the adjectives *angry*, *confused*, *happy*, *anxious*, *sad*, *depressed*, *energetic*, and *irritable*. The instructions emphasized that it was important to describe the general mood of the day, rather than how the woman was feeling at that very moment. All questions were answered on a scale ranging from 1 (*not angry at all*) to 10 (*very angry*), with 1 being the lowest and 10 being the highest score. Each woman filled out a questionnaire every day for 2 months, or slightly longer if she had not yet completed two menstrual cycles.

Using e-mail accounts ensured that these participants answered the questions daily, because the time and day of sending back the message to the experimenter was recorded. Three women elected, instead, to complete this study using paper questionnaires. Those participants were given 14 questionnaires every 2 weeks, and the completed questionnaires were picked up regularly by the experimenter. The experimenter also contacted these women frequently to make sure they were filling out the questionnaires each day. Prior to vacations, women who were responding on e-mail were given paper questionnaires to use for the duration of the vacation if a computer was not accessible. If at any time a participant failed to respond on a given day, she was asked to fill out a questionnaire for the missed day the next day. These day old responses were examined at the conclusion of the study, but did not appear to differ from the other responses. If more than 1 day elapsed,

the participants were asked to leave those days out. The experimenter contacted the participants frequently to answer any questions and to hold the participants' interest in this study. Of the 3 women who used the paper and pencil response format, 2 showed evidence of PMS, and 1 did not.

After each woman had provided data for 2 months, she was once again contacted and asked to come into the lab for the Undisguised Expression Manipulation Procedure. In past research, to test for individual differences in response to personal versus situational cues, participants' faces were manipulated into smile and frown expressions, and their subsequent feelings assessed. In many earlier studies this procedure was carefully disguised to ensure that participants were not responding to expectations rather than the expressions. More recently, an undisguised expression manipulation procedure has been found to predict equally successfully people's response to other, disguised self-perception tasks. For example, Laird et al. (1994) observed individual differences in the tendency for people to mimic facial expressions. Whether people mimicked was predicted by their response to the undisguised expression manipulation procedure. People who were identified as responsive to self-produced cues also were more likely to spontaneously mimic. In a second study, participants were prevented from mimicking while watching a happy, humorous movie. People responsive to personal cues enjoyed the movie less when prevented from mimicking, whereas people unresponsive to personal cues were unaffected. Note that although the participants were fully aware of the expression manipulation procedure, they were entirely blind to the nature and purpose of the manipulations of mimicry in the second study, and had no idea that their behavior was being observed in the first study. Thus, these results could not have been mediated by participant awareness of the expectations of the experimenters. Because this undisguised procedure works adequately, and requires much less deception, we employed the undisguised version in this study. First, participants were told that some people feel happier when they are smiling, and angrier when frowning; whereas other people do not feel anything at all, that both ways of responding are equally common, and that neither is better than the other. Then participants were asked to close their eyes and adopt the facial expression of a smile and to notice how they were feeling when doing it. When they felt they had identified their feelings, they reported them on emotion rating scales. Then participants were given the same instructions for adopting a frown for several seconds and describing their emotions. The mood rating scale for both facial expressions consisted of 8 items including the target emotions, *angry* and *happy*, rated on a 15 cm linear scale labeled *didn't feel at all* at the one end and *felt very strongly* at the other. Further items were *sad*, *afraid*, *disgusted*, *anxious*, *surprised*, and *interested*. Participants were asked to make a slash through the line to represent their feelings at the moment of producing the smile (or the

frown, respectively). This procedure was repeated for both facial expressions, so that each individual provided four expression manipulations score. The *happy* scores for the frown trials were subtracted from the *happy* scores for the smile trials, and the *anger* scores for the smile trials were subtracted from the *anger* scores for the frown trials, and these scores were combined, yielding a total score that could range between +40 and -40. The resulting scores were increasingly positive if the participants' feelings were consistent with their facial expressions, and negative if their feelings were inconsistent.

Following previous practice (e.g., Laird et al., 1994) the participants were divided into two groups on the basis of their expression manipulation scores. Participants whose expression manipulation scores were greater than 10 on both trials were assigned to the Personal Cue group, whereas those whose scores were below 10 on either trial were assigned to the non-Personal Cue, Situational Cue group.

Finally, at the conclusion of the experiment, a postexperimental questionnaire was given to determine if the participants had identified the purpose of the study. None of the women reported any suspicions that the study was directed specifically at PMS as opposed to other factors that affect mood.

Results

Each woman had provided approximately 480 data points, consisting of the eight mood descriptors for each of 60 days. As a first step in the analysis, multivariate analysis of variances (MANOVAs) were conducted on each woman's data separately, comparing her mood ratings of days during her premenstrual weeks with days during the other weeks, with each of the approximately 60 days serving as an observation.⁴ The multivariate F ratios were significant for 9 of the participants, with the F ratios ranging between $F(8, 53) = 3.96, p < .001, \eta^2 = .37$ and $F(8, 49) = 2.03, p < .05, \eta^2 = .25$. No mood variables were significantly associated with menstrual cycle for 6 of the women, with F ratios ranging between $F(8, 49) = 1.91, p = .08, \eta^2 = .24$ and $F(8, 53) = 0.65, p = .73, \eta^2 = .09$.

To assess the relationship between Cue Response and PMS, we compared the Personal Cue and Situational Cue groups on the size of their PMS effect, as measured by η^2 , in each participant's individual analyses comparing Premenstrual and non-Premenstrual days. As predicted, the Personal Cue group had a higher mean multivariate η^2 for PMS ($M = 0.22, SD = 0.10$), than the Situational Cue group ($M = 0.12, SD = 0.02$). Because the variances of the two

⁴Initial analyses revealed no differences between menstrual and intermenstrual weeks, so for subsequent analyses these two were collapsed and compared with the premenstrual weeks.

groups were significantly different, by Levine's test, we tested this difference with a *t* test that did not assume similar variances. The result was significant, $t(6.9) = 2.59$, $p = .036$, $\eta^2 = .33$. In sum, women who were more responsive to personal cues were significantly more likely to show substantial changes in their mood associated with their menstrual cycle.

Although the overall results were just what we had anticipated, the specific patterns were much more complex than the usual conceptions of menstrual cycle-related mood changes. Four of the women showed significant changes in mood that were consistent with usual conceptions of PMS; for example, significantly higher anxiety, anger, or sadness. Four showed significant *positive* mood changes, such as greater energy and happiness, during the premenstrual week. For each of the women who showed significant cycle effects, the mean differences between moods during premenstrual periods and moods at other times are presented in Table 1. Note that only the differences associated with significant effects are presented, for clarity, because the purpose of this table is to display the quite different patterns of response.

The particular patterns of association between mood and cycle varied widely among individual women. In addition to the fact that some women changed positively although others changed negatively, within these two groups the women also reacted quite differently. For example, in the conventional, negative mood group, one woman showed significant changes only in sadness, another only in anxiety, and a third only in reduced positive moods, whereas another showed very general increases in most negative moods and decreases in positive. Although PMS seems to be real, these differences in response suggest PMS takes many forms, including sometimes positive changes. Our assumption, however, was that changes in a single mood item, if significant, represented an important change in a woman's life experience.

A second predictor of menstrual cycle mood effect was discovered unexpectedly. To see if each woman's array of emotion ratings could be simplified, we performed factor analyses of each woman's data over the 60 plus days she reported. These factor analyses revealed that the women differed substantially in the number of factors with eigen values above 1 that were extracted. The largest number of factors was 4, and the lowest was 1. The number of factors extracted in this fashion has been used by Larsen and Cutler (1996) as a measure of individual differences in emotional complexity.

Women who experienced premenstrual changes, either positive or negative, had a significantly higher number of emotion factors extracted ($M = 2.60$, $SD = 0.52$) compared with women who did not experience premenstrual changes ($M = 1.82$, $SD = 0.75$), $t(11) = 2.34$, $p = .04$, $\eta^2 = .37$. It appears, then, that women whose emotional lives are more complex are more prone to mood changes, for better or worse, due to their menstrual cycle.

Response to personal or situational cues was not related to the number of factors extracted, $t(12) = 0.84$, $p = .41$, $\eta^2 = .07$.

Discussion

The daily measurements of mood demonstrated that some, but not all, women experienced mood effects associated with their menstrual cycle. The observation that 4 women felt more positively during their premenstrual week is inconsistent with broad cultural stereotypes about PMS, but in fact similar findings have been reported previously. Nichols (1995) found that a considerable percentage of her participants reported they usually or occasionally experienced positive premenstrual changes, a finding echoed by a number of others (e.g., Blumenthal & Nadelson, 1988; Chrisler, Johnston, Champagne, & Preston, 1994; Hamilton et al., 1984; Parlee, 1982).

TABLE 1
Significant Changes in Emotion Ratings from Nonpremenstrual to Premenstrual Periods for
Participants Showing Negative and Positive Changes

Subject No.	Ratings							
	Angry	Irritable	Anxious	Confused	Sad	Depressed	Energetic	Happy
7		1.78	1.09					
12							-0.72	-0.94
13	1.01	1.30	0.70			0.63	-2.41	-1.74
19			1.05					
8	-1.20		-1.09					
9					-1.51	-0.55	0.93	
16							1.70	
18	-1.51	-3.80		-1.68	-2.22	-1.33	2.22	3.35

Note. No data are presented for the group whose moods did not differ with their cycle. All change scores presented were significantly different at $p < .05$.

Both the positive and the negative menstrual changes appear to reflect self-perception processes, because the women who showed these changes were much more responsive to personal cues. Women who showed no menstrual cycle effects were relatively unaffected by the expression manipulation procedures. These results suggest that the experience of PMS may depend on a general sensitivity to bodily cues, which are interpreted as emotional.

The relation between emotional complexity and PMS was not anticipated, but is not entirely surprising. In one study, people who were more emotionally complex were also more responsive to personal cues (Pelusi, Schnall, Abrahamson, Laird, & Flack, 1997). Although the relation between complexity and response to personal cues was not significant here, the reason may have been the very small number of participants. In the earlier study, more complex people also scored higher on a measure of emotional intelligence (Pelusi et al., 1997). These results suggest that using personal cues is more complex than using situational cues alone. The same conclusion is implied by the observation that people who are more responsive to personal cues are also more field independent (Duncan & Laird, 1977; Edelman, 1984). This cluster of findings suggests that some people are more "emotionally complex," and score higher on emotional intelligence, and their emotional feelings are also more likely to be based on personal cues. Although this array of qualities seems to be desirable, emotional complexity and response to personal cues also appear to carry with them an increased susceptibility to PMS.

Of course, the number of women in the final sample was small and raises concerns, for two reasons. One was that we need to be cautious in drawing conclusions from such small groups. Study 2 employed a quite different design that permitted us to study much larger numbers. The second reason for caution was that we have to be concerned about the effects of self-selection on our sample. Those who completed this study and those who dropped out did not differ on any of the characteristics we had measured, but of course they could have differed on any number of others. However, because the cue-response comparisons were all within the group who completed this study, there does not seem to be any way that these results could have been due to this self-selection. The only question might be whether we can generalize these results to a broader population. For example, the proportions of our sample women who showed positive and negative effects of their cycle might be quite different from the general population.

We have interpreted the results of Study 1 as reflecting differences in how responsive women with and without PMS were to personal, bodily cues. Implicit in this interpretation is the assumption that the bodily states were the same, and the differences lay in how they were used to construct emotional experiences. That interpretation is consistent with many previous self-perception studies, in which bodily states were manipulated and necessarily were the

same for both personal and situational groups, and differences in feelings must have arisen from differences in constructive processes. However, differences between the personal and situational groups in constructive processes do not rule out differences in actual bodily processes as well. The results of Study 1 could have reflected real differences in bodily reactions due to the menstrual cycle. Study 2 directly examines the question of the role of constructive, interpretative processes.

STUDY 2

In the self-perception interpretation of PMS, at least three conditions would be required to produce emotional effects in a woman:

1. Her body must be providing appropriate physical cues.
2. She must be responsive to those cues.
3. The cues must not be attributable to some nonemotional source, including her cycle.

In our first study, we explored the impact of the first two factors, and in the second study we added the third factor.

The general procedure was adopted from Schwarz and Clore (1983) who examined the effects of external factors, such as the weather, on moods and life satisfaction. They found that as long as the weather was not made salient, people reported more negative moods if the weather was bad. However, simply asking about the weather before obtaining the mood and satisfaction measures was sufficient to dispel weather effects. Apparently, when reminded that the weather may bias their judgment, the respondents discounted those influences on their mood and reported higher life satisfaction and happiness. In our second study, we used a very similar experimental procedure, except that the factor that was made salient, or not, was the menstrual cycle. Women were asked two questions that highlighted their current stage of their cycle. The experimental manipulation consisted of whether these questions were asked before or after they reported their current mood and life satisfaction.

In accordance with the self-perception approach to PMS, we expected that women would be more likely to mistake premenstrual bodily changes for emotions and experience negative emotions if they were, first of all, responsive to personal cues, and second, not aware of being in the premenstrual phase of their cycle. Reminding them of their premenstrual status was expected to diminish PMS, as a kind of discounting effect. Both effects should only occur for women who were responsive to personal cues. In contrast, we expected that women who were more responsive to situational cues would be relatively unaffected by their menstrual cycle, and by the reminder.

Method

Participants

The participants were 149 undergraduate volunteers, recruited from an introductory psychology class. To not reveal the purpose of this study, all students in the class were asked to fill out a questionnaire, but only the data of the female participants were analyzed. The data of 20 women were excluded because they had either only filled out part of the questionnaire, or they were unable to predict their next period.

Procedure

Following a class lecture, participants were asked to volunteer to stay in the classroom and to fill out a questionnaire describing their emotional feelings and their life satisfaction. No identifying information was requested on the questionnaire, and students were seated with sufficient spacing so their responses were not readily observable by others. Each questionnaire consisted of two pages: On one page, the emotion rating scale, participants were asked to rate 9 mood adjectives (*angry, happy, anxious, relaxed, sad, depressed, irritable, confused, tense*) on 12 cm long rating scales by making a slash on the line that represented their momentary feelings. The end points of these scales were labeled *didn't feel at all* and *felt very strongly*. These brief scales were adapted from Plutchik (1980) and have been used to accurately identify emotional changes in the elderly (Plutchik, McCarthy, & Hall, 1975) and in college students (Duclos et al., 1989; Plutchik, 1965), as well as in many other self-perception studies (Laird & Bresler, 1992). Participants also rated how satisfied they were with their life, from *not satisfied at all* to *very satisfied*. All scales were scored by measuring from the *didn't feel at all* end, yielding raw scores that could range from 0 to 17. Means and standard deviations of these scores appear in Table 2, and intercorrelations in Table 3.

TABLE 2
Means and Standard Deviations of Mood and Life Satisfaction Measures for all Participants

	<i>M</i>	<i>SD</i>
Depressed	3.49	4.42
Angry	3.59	4.61
Tense	6.74	5.55
Irritated	4.74	5.11
Anxious	8.46	5.30
Sad	4.17	5.11
Relax	7.27	5.15
Happy	10.64	5.40
Confused	5.10	5.07
Change	9.00	4.47
Life	11.20	4.32

The other page contained the questions to establish where the women were in their menstrual cycle. Although we wanted participants to be aware of their stage of the menstrual cycle, we did not want them to recognize that this was our research focus. To help conceal that purpose, men in the class also filled out the materials, and this study was introduced simply as an exploration of moods during an ordinary day. In addition to the questions about menstrual cycle, some distractor questions were included. These were, "Has anything happened today to affect your mood to an unusual degree? Can you very briefly describe the nature of the event, and what effect it had?" and "When did you last exercise? What did you do?" The critical cycle questions were (for women) "When did your most recent menstrual period begin?" and "When do you expect your next period to begin?"

The experimental manipulation consisted of which of these sheets of paper was on top and was responded to first. Giving the participant the mood rating scale first was the "unreminded" condition, because they described their feelings before being asked about their cycle. Participants who answered the questions on menstruation, life events, and

TABLE 3
Intercorrelations of Emotional Feeling and Life Satisfaction Variable With Effects of Reminder Condition Removed

	<i>Depressed</i>	<i>Angry</i>	<i>Tense</i>	<i>Irritated</i>	<i>Anxious</i>	<i>Sad</i>	<i>Relax</i>	<i>Happy</i>	<i>Confused</i>	<i>Change</i>	<i>Life</i>
Depressed		.58	.54	.69	.24	.76	-.27	-.55	.56	.22	-.35
Angry			.51	.75	.32	.49	-.37	-.40	.34	.10	-.27
Tense				.56	.43	.43	-.51	-.43	.40	.14	.14
Irritated					.34	.53	-.42	-.49	.38	.20	-.31
Anxious						.17	-.40	-.18	.22	.12	-.09
Sad							-.26	-.49	.43	.11	-.27
Relax								.55	-.25	-.19	.36
Happy									-.38	-.18	.46
Confused										.22	-.29
Change											-.58
Life											

Note. $r > .227, p < .01$.

exercise first were the “reminded” group. Participants were randomly assigned to one of the two experimental conditions.

As part of the packet of materials, after the first two pages the participants received the instructions and response scales for the undisguised expression manipulation procedure that was described earlier. The major change was that the instructions were written, but the rating scales and the scoring procedures were the same.

In this and previous studies using this procedure, the expression effect scores were skewed in a positive direction because there is little reason for people to feel strongly opposite to the expressions. In this study, the general shape of the distribution was roughly bimodal, with one mode slightly above zero, and the other at approximately 15. This distribution suggests 2 distinct groups, so following previous research (e.g., Laird et al., 1994), the participants were divided into 2 groups. The median of the distribution fell in the “saddle,” at +8, and participants with scores above 8 were assigned to the “Personal Cue group” ($N = 76$), and those with scores at or below 8 constituted the “Situational Cue group” ($N = 52$).

Women were assigned to one of two groups, depending on where they were in their cycle on the day of data collection. Following other researchers (e.g., Rubinow et al., 1984), and Study 1, *premenstrual* was defined as the 7 days preceding expected menstruation. Women in this phase ($N = 33$) were compared with the women in all other phases of their cycle ($N = 95$).

Results

The basic form of this study included three independent variables: Cycle Stage, Cue Response group, and Reminder condition; and the predictions are, in effect, of three-way interactions. Specifically, we expected that in the Unreminded condition, women who were responsive to Personal Cues and were in their premenstrual week, would report more negative feelings and less positive feelings than women not in their premenstrual week, whereas women who were unresponsive to Personal Cues would not differ as a function of where they were in their menstrual cycle. The Reminder condition was expected to reduce negative feelings and increase positive feelings in women who were premenstrual and responsive to Personal Cues, relative to the women who were not premenstrual. The effects of the Reminder on Personal Cue women who were not premenstrual was expected to be more complex. In at least two studies, people more responsive to personal cues have been found to use cultural and situational expectations about how they would be expected to feel as comparison standards, and as a consequence have produced mood effects that were opposite to the situational expectations. In one study, this led to a “reverse” placebo effect (Duncan & Laird, 1980), and in another to a negative impact on self-esteem because of comparison with a positive stan-

dard (Wilcox & Laird, 2000). Because of the cultural expectations about mood effects of menstrual cycle and their own experiences, the Reminder condition was expected to have a mild contrast effect in the Personal Cue group. As a result, we expected Personal Cue Reminded participants to report increased negative and reduced positive feelings.

The expected patterns of relations between Cue Response and menstrual status were quite different as a function of Reminder group, which would produce a three-way interaction. However, the interaction terms are relatively weak tests of the predictions of this study (Hays, 1981, p. 414). Consequently, more direct planned two-way analysis of variances (ANOVAs) that focused on the experimental predictions were conducted.

The first question was whether the members of the Personal Cue group were more likely to experience premenstrual symptoms. Our expectation was that the reminder would affect premenstrual symptoms, so the differences between Personal and Situational Cue groups are most clearly seen in two-way ANOVAs examining only the participants in the Unreminded condition. These ANOVAs were carried out on each of the nine emotion ratings, and the rating of *life satisfaction*. For five of the ratings, *angry*, *irritated*, *sad*, *depressed*, and *tense*, there were significant interactions between cue group and cycle stage. In every case, in the Situational Cue group the women who were premenstrual differed relatively little and nonsignificantly from those who were not premenstrual. However, in the Personal Cue group, women who were in their premenstrual week were substantially more angry, irritated, sad, depressed, and tense than the women in other stages of their cycle (See Table 4 for means and F ratios for the Cue Group by Cycle Stage interaction). The women who were more sensitive to personal cues showed the classic symptoms of PMS, whereas the Situational Cue group did not.

The specific prediction in these analyses was for differences between premenstrual and other conditions in the Personal Cue group, but no differences in the Situational Cue group. To ensure that the results presented in Table 2 were not reflecting meaningless differences in the Situational Cue group, we also performed planned comparisons testing the specific prediction of no differences in the Situational Cue group, and greater negative and lesser positive feelings in the premenstrual, Personal Cue group, in contrast to the nonpremenstrual, Personal Cue group. These comparisons were significant for *angry*, $F(1, 58) = 5.64, p < .05$; *depressed*, $F(1, 58) = 6.28, p < .05$; *irritable*, $F(1, 58) = 5.70, p < .05$; and *tense*, $F(1, 58) = 13.08, p < .05$. These results parallel quite closely those presented in Table 4, and thus, the results do appear to represent differences in the impact of menstrual status on the Personal Cue women.

The next question was whether these effects of menstrual cycle on feelings could be reduced by leading the women to correctly attribute their bodily states to their being premenstrual. Because the Situational Cue group had

TABLE 4
Ratings of Mood for Personal and Situational Cue Responding Participants in Premenstrual or Other Weeks in Unreminded Condition

Rating	Situational		Personal		MSE	Interaction <i>F</i>	<i>p</i>	η^2
	Nonpremenstrual	Premenstrual	Nonpremenstrual	Premenstrual				
Depressed	4.72	2.70	11.70	5.63	15.29	7.16	.01	.11
Angry	4.75	3.75	2.39	6.63	19.82	4.27	.04	.07
Tense	8.81	6.25	3.70	10.25	20.44	12.58	<.01	.18
Irritated	6.28	4.60	3.91	8.63	24.34	5.20	.03	.08
Anxious	8.75	11.30	8.48	5.63	26.48	3.42	.07	.06
Sad	5.19	3.45	2.39	5.50	17.16	4.23	.04	.07
Relax	6.09	5.95	8.64	5.63	24.26	1.05	.31	.02
Happy	9.53	11.45	11.93	9.31	21.52	2.96	.09	.05
Confused	4.56	7.10	3.86	5.13	23.05	0.22	.64	<.01
Change	7.47	7.75	9.02	9.00	22.70	0.02	.90	.01
Life	12.00	10.75	12.41	9.50	18.86	0.45	.50	<.01

Note. *df* for all *F* ratios = 1, 58.

shown no evidence of premenstrual tension, the effects of the reminder on feelings was tested in the Personal Cue group alone. The effect of Reminder was also examined in the Situational Cue group in a separate set of analyses.

In the Personal Cue group, the results were as expected. In general, the women who were premenstrual had the highest ratings for the negative feelings if they had not been reminded, and the reminded group had the lowest ratings. The reminder reduced feelings of *depression* and *tenseness*, and at marginal levels of significance, of *anger* and *irritation* (see Table 5).

In addition, the reminder had a significant effect on ratings of life satisfaction. The women who were premenstrual and not reminded were least satisfied with their lives, whereas when reminded they were most satisfied.

These changes reflect both shifts toward more positive feelings among Reminded, Premenstrual women, and slight increases in negative feelings in the Reminded, Nonpremenstrual women.⁵

The same analyses were carried out for the Situational Cue group, but none of the main effects or more important, the interaction between Cycle and Reminder, were significant. Indeed, only two of the interaction *F*s exceeded 1.0 (and all *F*s < 2.24). Not surprisingly, because this group had shown no effects of their cycle on their feelings, they also were unaffected by a reminder about their cycle.

Discussion

This study confirmed the two, mutually supportive predictions of the self-perception theory interpretation of PMS. First of all, among the women who had not been reminded of their stage in their menstrual cycle, only those women who were responsive to personal cues showed effects of their cycle on their mood. This result is of course precisely the same as that of the first study, although from a quite different perspective and method, and with much greater numbers of participants. Note that this result is relatively unique in the PMS literature, where few personality differences between those who do and do not suffer from PMS have been observed. Both of these studies indicate that being responsive to bodily cues increases susceptibility to PMS.

The second set of results supports the misattribution interpretation of the differences between personal and situational cue groups as well as the misattribution interpretation of PMS, although these results are certainly less robust. When these women were reminded of being premenstrual, the mood differences between stages in their cycle tended to disappear. Thus, apparently the occurrence of PMS is not simply a function of the stage of the personal cue woman's cycle and the resultant hormonal variations. In addition to being premenstrual and responsive to personal cues, a woman must also have available an alternative understanding of her bodily cues. Even knowing that she is premenstrual is sufficient to reduce the occurrence of PMS, apparently because she now correctly attributes her bodily sensations to nonemotional, hormonal influences.

A conceptually similar effect was observed by Rodin (1976; Study 2), in a study in which women were exposed to anxiety-producing threats and then asked to perform a number of cognitive tasks that were sensitive to the disruptive effects of anxiety. Women who were premenstrual, and reminded of that fact, were significantly less disrupted by the threats than were women who were intermenstrual or premenstrual and

⁵Because the expectations were for changes, in opposite directions, in both the Premenstrual and Nonpremenstrual groups as a function of the Reminder, the planned-comparison tests of the separate effects did not seem appropriate here. However, they were conducted. The reminder did increase *life satisfaction* significantly in the Premenstrual group, $F(1, 19) = 4.68, p < .05$, and marginally *irritability*, $F(1, 19) = 3.28, p < .07$.

TABLE 5
Effects of the Reminder on Personal Cue Participants Who are in Their Premenstrual or Other Weeks

Rating	Nonpremenstrual		Premenstrual		MSE	Interaction <i>F</i>	<i>p</i>	η^2
	Unreminded	Reminded	Unreminded	Reminded				
Depressed	1.70	4.59	5.63	4.04	18.91	3.69	.06	.05
Angry	2.39	3.58	6.63	3.64	21.87	2.80	.10	.04
Tense	3.70	7.02	10.25	6.95	24.39	6.27	.02	.08
Irritated	3.91	4.50	8.63	4.45	24.70	3.21	.08	.04
Anxious	8.48	8.40	5.63	8.41	26.11	1.10	.30	.02
Sad	2.39	4.34	5.50	6.41	19.64	0.19	.66	<.01
Relax	8.64	7.84	5.63	8.77	28.86	1.89	.17	.03
Happy	11.93	10.67	9.31	11.09	24.37	1.32	.25	.02
Confused	3.86	5.67	5.13	5.64	26.49	0.27	.64	<.01
Change	9.02	10.27	9.00	6.50	19.42	2.54	.12	.03
Life	12.41	10.93	9.50	13.41	16.74	6.06	.02	.08

Note. *df* for all *F* ratios = 1, 72.

unreminded of that fact. Rodin's interpretation of these results was that the arousal produced by the threats was reattributed to the effects of being premenstrual, and hence was not interpreted as disruptive anxiety. The common feature of both Rodin's study and ours is the fact that presumed bodily cues for unpleasant feelings can be discounted if they are attributed, correctly in this study or incorrectly in Rodin's study, to the menstrual cycle.

In contrast to our finding that awareness of menstrual cycle reduced reported symptoms, Gallant, Hamilton, Popiel, Morokoff, and Chakraborty (1991) found that making participants aware they were in a study of premenstrual tension very slightly increased PMS-like symptoms. Perhaps the difference is that our participants were divided into those responsive to and unresponsive to personal cues. When combined, the discounting effects among the personal cue group might be obscured by the lack of response among the participants who were low in response to personal cues. Indeed, in some circumstances people who are unresponsive to personal cues show positive placebo effects, endorsing whatever they believe is expected of them (Duncan & Laird, 1980). Gallant et al.'s (1991) results might reflect the combined effects of no changes in reminded personal cue participants, and a mild placebo effect in the situational cue group. In fact, among our participants, the situational cue group showed small, nonsignificant tendencies toward more negative moods when reminded that they were premenstrual.

Could these results reflect some kind of experimenter bias? In this study, the women were, of course, explicitly aware of the nature and purpose of the expression manipulation procedure. However, they could not have used that knowledge to produce these results, for a number of reasons. First of all, they had all completed the PMS measures before they encountered the expression manipulation procedure. Because any one woman only experienced one of the reminder conditions, and could not have known that others

were receiving a different order of measures, she could not have known how to respond. Finally, it would have been very unlikely to discern the complex pattern of predictions, to know how they should respond.

In sum, the pattern of results was quite complex, and followed very precisely the predictions of the self-perception model of PMS, and confirmed the results of Study 1 with a much larger sample.

GENERAL DISCUSSION

Both studies provide consistent evidence that premenstrual mood changes may be the result of normal self-perception processes that ordinarily lead to veridical experiences of emotion. In both Study 1 and Study 2, only those women who were identified as more responsive to personal cues showed significant associations between their cycle and their moods. The two studies employed quite different methodologies, with compensating strengths and weaknesses, so the convergence of their results is particularly powerful. The individual difference variable that predicts PMS in both studies is derived from—and indeed central to—self-perception theory. The basic prediction that guided both studies, that response to personal cues would predict the occurrence of PMS, seems unlikely to have been derived from any other perspective. Consequently, the results of these two studies suggest that a self-perception approach to PMS may be productive.

The first requirement for the occurrence of PMS seems to be that a woman has to be responsive to her bodily states and responses. Consistent with this view, a quite different line of research also indicates that women who are more in touch with their bodily cues are more likely to experience premenstrual mood changes: Women who experience PMS also judge pain stimuli as more aversive than women who do not show PMS (Kuczmierczyk et al., 1986). In a recent

study (Genov, Pietrzak, Bemis, & Fortunato, 1999) we also found that people who were more responsive to personal cues, as measured by the same procedure as reported in this article, demonstrated greater pain detection sensitivity and lower pain tolerance. Responding to personal cues seems to have some cost, in increased sensitivity to pain, and greater propensity for PMS.

An alternative possibility is that women who are more responsive to personal cues also have different hormonal or other bodily responses. In this case, susceptibility to PMS would not be due to how one perceives the bodily states, but in the nature of those states themselves. However, the effects of the reminder manipulation in Study 2 argue against this possibility. Participants were randomly assigned to the reminded or unreminded conditions, so we must assume that among the personal cue group actual hormonal and bodily states were the same. However, the reminder that changed how these bodily states were interpreted was sufficient to prevent the emotional feelings of PMS. Of course, the possibility remains that personal and situational cue women do differ in their physiology, but this physiology must in its turn lead to feelings through a process that is susceptible to the discounting effect.

In sum, the results of these two studies suggest that to experience PMS, a woman must be responsive to personal cues from her body, and not have available some alternative, nonemotional interpretation of these cues (including the correct recognition that they are due to monthly hormonal fluctuations). In these studies we have only assumed the presence of the third necessary condition, the bodily states. Indeed, in the current state of knowledge, it would have been difficult to assess the existence of these cues, because no one seems to be quite sure what they might be. There is ample evidence that these bodily states are produced during and by a woman's menstrual cycle, and that they have effects beyond those produced simply by expectations (Klebanov & Jemmott, 1992; Olasov & Jackson, 1987). They probably have something to do with the rise and fall of progesterone, estrogen, or some related hormone (Schmidt et al., 1998). However, whatever these bodily changes turn out to be, they appear to work their emotional effects at least in part through the medium of self-perception processes. That is, hormones are involved in producing emotional feelings because of the way in which the hormonal effects are interpreted and experienced.

The menstrual cycle produces a wide variety of emotional effects, and in Study 1 these effects were specific to particular individuals: Some women were sad, others anxious, others irritable, and some even happy. At the moment, it is unclear what factors lead to one or another emotional response. One possibility is that the effects of hormonal changes are relatively unspecific, perhaps producing something like changes in sympathetic arousal symptoms. Many studies have shown that arousal is an ambiguous cue that contributes to the experience of many (though not all) emotions. It may even be "trans-

ferred" from one emotion to another (Zillman, 1983). Perhaps, then, the hormonal cycle exaggerates a woman's most common emotion, or perhaps only the emotion that is most dominant in that era of her life. We do not, in fact, even know whether the effects of menstrual cycle are constant for each woman. It may be, for example, that a woman who is susceptible to menstrual cycle mood changes will experience a sad mood for 1 or 2 months, and then shift to a happy response a few months later.

The variety of emotional responses that are associated with the menstrual cycle seem very likely to have contributed to the uncertainty about the reality of PMS that has haunted previous research. Particularly if one looks at aggregate data from many women, the real distress of some would be lost among the experiences of those who responded positively or not at all.

Although cognitive, attributional factors seem to play an important role in the experience of PMS, it is crucial to emphasize that PMS is not just in the woman's head. Those attributional processes are based on real experiences, of real bodily changes. We do not intend to suggest for a moment that women mistakenly experience PMS, or that PMS provides a convenient way of explaining away negative emotions, such as anger or irritability, that may be considered inappropriate and inconsistent with the stereotype of women as generally agreeable and well-behaved. Rather, we propose that for the multiple reasons discussed previously, some women do indeed experience mood changes related to their menstrual cycle, and denying those women the reality of their emotional feelings could just as much be seen as an oppressive means of social control of women, as is sometimes suggested for the construction of the phenomenon of PMS itself (cf. Walker, 1995).

The implications of these studies for the potential understanding of PMS are certainly the most important. However, the results bear on self-perception theory as well. Establishing a connection between laboratory effects and the emotional life of people in the real world is probably the strongest kind of support for any theory of emotions. The self-perception processes that generate emotional experience have been demonstrated many, many times in the laboratory. In the two studies of PMS reported here, we have seen evidence of comparable processes in the everyday emotional lives of women.

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