

Perceived Pubertal Status in Early Adolescent Girls: Relationships to Mood Intensity, Mood  
Variability, Energy, Restlessness, and Certainty about Self

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Running Head: PUBERTAL STATUS AND MOODS

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### Abstract

This study examines perceived pubertal change, moods, energy, restlessness, and certainty about self in early adolescent girls. Fifty-three girls aged 9.1 to 10.8 reported their moods, energy, and restlessness on twelve days over the course of one month. Intensity and variability of these daily measures were calculated. Measures of certainty about self and perceived pubertal status and timing were also obtained. Girls who felt they were experiencing pubertal changes reported more intense and variable (across the month) moods, and more variable restlessness than perceived pre-pubertal girls. However, perceived early timing of puberty was positively associated with certainty about self. The possibility that psychological uncertainty provoked by a new body is unconscious is discussed. Results also suggest that the measure of puberty used influences the conclusions one draws about pubertal status and moods. Perceived pubertal status defined as qualitative differences on four pubertal indices (and not defined as quantitative progression on the two indices of body hair and breast development) showed the relationships with the outcome variables reported above.

## Perceived Pubertal Status in Early Adolescent Girls: Relationships to Mood Intensity, Mood Variability, Energy, Restlessness, and Certainty about Self

Various theories have postulated links between the external physical changes of puberty and behavior during adolescence. These include psychodynamic models (see Adelson & Doehrman, 1980; A. Freud, 1969; S. Freud, 1905/1957; H. Lerner, 1987) as well as models that emphasize cognitive and social experience of the changes (Brooks-Gunn, 1987a; 1987b; R.M. Lerner, 1987; Richards & Petersen, 1987). The purpose of this study was to examine postulated links between pubertal change and mood intensity, mood variability, energy, restlessness, and certainty about self in early adolescent girls.

### How Might Pubertal Change Affect Moods and Behavior?

It has been suggested that pubertal change necessitates a new understanding of self (e.g. Brooks-Gunn, 1984; Erikson, 1950). This new understanding may have to do generally with becoming an adult; it may also have to do with emerging sexuality (e.g. Blos, 1965; Geleerd, 1961; Jacobson, 1961). We know little about the very early pubertal changes, and what they mean to individuals experiencing them. Does beginning breast development lead to uncertainty, discomfort, excitement, pride, or some of each? Some evidence suggests that, once begun, breast development is a source of both concern and pride (Petersen, Schulenberg, Abramowitz, Offer, & Jarcho, 1984; Rosenbaum, 1979), and that it is positively related to adjustment and body image (Brooks-Gunn, 1984). A mixture of emotions seems to surround menarche (Petersen, 1983; Rierdan & Koff, 1980; Ruble & Brooks-Gunn, 1982; Whisnant & Zegans, 1975). Other pubertal developments,

such as rapid skeletal growth, pubic hair growth, or development of acne, especially in their early stages, may also affect moods and behavior by provoking a new sense of self.

It has also been proposed that pubertal changes signalling a more adult status will elicit increased expectations (by others) for adult behavior (Conger & Petersen, 1984; Petersen, 1985; Richards & Petersen, 1987). Some studies suggest that parents react differently to children at different stages of puberty, although the link between pubertal change and specific parental expectations or behaviors is seldom studied directly. For example, Simmons, Blyth and McKinney (1983) found that early maturing girls in the sixth grade felt they had more independence than other girls. Parents may indeed be according these girls more independence as a result of the fact that they look older, but this was not assessed directly. Steinberg (1981) found that mothers defer more to sons as they progress through puberty. Differing standards, expectations, and reactions on the part of parents, peers and others toward an individual who is experiencing puberty could in turn affect that individual's perception of self and behavior. Initially, such changes may be contradictory and confusing; in the initial stages of puberty, one's moods and feelings may reflect this.

An individual's perception of pubertal timing is also important in behavioral and attitudinal responses to puberty. Neugarten (1969; 1970) argues that in adulthood, events occurring at unexpected times are more stressful, and more likely to precipitate crises in individuals, than those that are expected. Research on pubertal change and behavior has also demonstrated the importance of self-perceived pubertal timing; in many cases it is a more salient and more important predictor of behavior than pubertal status (e.g. Duncan, Ritter, Dornbusch, Gross, & Carlsmith, 1985; Jones & Mussen, 1958; Magnusson, Stattin, & Allen, 1985; Rierdan & Koff, 1985a; 1985b; Savin-Williams & Small, 1987; Simmons, Blyth, & McKinney, 1983; Steinberg, 1987; Tobin-Richards, Boxer & Petersen, 1983).

Empirical Evidence Regarding Puberty and Moodiness, Energy Level, Restlessness, and Certainty  
about Self in Girls

Brooks-Gunn (1984; 1987a) reviews what is known about the meaning of various pubertal events to adolescent girls, and their family and peers. As she points out, we know more about the experience of menarche than the experience of earlier pubertal changes such as breast development and pubic hair development. In addition, although adolescents are often accused of being moody and unpredictable (e.g. Hamburg, 1974; "Teen Rage", 1987), and such behavior is sometimes chalked up to the physical changes adolescents experience. Little research has addressed either of these claims directly. Here I reviews what we know about pubertal development and moodiness, energy levels, restlessness, and certainty about self, the dependent variables of interest in this study.

Moodiness

The term moodiness is used here to refer to intensity of and changes and fluctuations in mood rather than a gloomy or depressed state. According to one relevant study, adolescents' moods were more short lived and more extreme, in both positive and negative directions, than adults (Larson, Csikszentmihalyi, and Graef; 1980).

Several questions are left unanswered by the Larson et al. (1980) study, however. Even though adolescents may experience more variable and intense moods than adults, they may be no more moody (or even less moody) than younger children, as suggested by Achenbach and Edelbrock (1981) who found no age differences in parents' reports of moodiness and sulking for 4 to 16 year old children. Variable and intense moods may be a characteristic of childhood and youth, without

being specific to adolescence. In addition, whether or not variability and intensity of mood are associated with pubertal development was not addressed.

Does moodiness vary by pubertal stage? The answer is not clear. Crockett and Petersen (1987) found no evidence of an association when adolescents were asked directly about changes in mood. Susman, Nottelmann and Blue (1983) found some evidence but only for boys: males who were more advanced pubertally showed a greater range of moods than other boys. Mood changes in this latter study were assessed by calculating change from five separate days of mood reports. It is not clear whether the results from Susman et al. (1983) reflect the impact of advanced development or early timing of development, since boys who were more advanced in the 10-14 year old age range may have been early developers for this sample.

In the present study, self-perceptions of pubertal status and timing are studied in relation to mood intensity and variability. It is expected that if the newness of pubertal change is unsettling, and if uncertainty is reflected in moods, that initial changes of puberty will provoke more intense and variable moods. Thus, girls who perceive themselves to be in the early stages of development are expected to show more intense moods and more fluctuation in moods than either girls who perceive themselves as pre-pubertal or girls who perceive themselves as mid-pubertal. Since the current sample is young, however, all girls experiencing some pubertal change may still be adapting to that change. Therefore, the strongest results are expected to emerge between perceived pubertal and pre-pubertal girls.

The effects of perceived pubertal timing will also be assessed. Perceptions of being early are predicted to be the most unsettling in this age group. Very few girls can be considered late developers at 9-10 years of age; at this age, early development is the most "off time" event. Girls who perceive themselves as early developers are predicted to be more intense and more variable in their moods than girls who perceive themselves as on-time or late.

### Energy

The little evidence that exists suggests that pubertal development may indeed affect activity levels. For example, in Larson et al. (1980), adolescents reported more extreme swings in alertness / drowsiness and activity / passivity, and lower levels of activation, than adults. However, the questions of whether adolescents have more swings in alertness and activity than younger children, or whether energy and activity levels are related directly to pubertal development, were not assessed.

Other studies suggest that energy levels may be linked to pubertal development. Sonis, Comite, Pescovitz, Rahn, Hench, Cutler, et al. (1985) found that parents of girls with true precocious puberty (TPP) were more likely to report problems with over-tiredness in their daughters than parents of normal girls of the same age. Similarly, in Susman et al. (1983) both boys and girls were more likely to rate themselves as tired (rather than energetic) if they were in the later stages of puberty. Neither of these studies addresses the causes of such differences, however. Perhaps pubertal status is a reflection of internal hormonal activity that affects energy levels. Alternatively, if cognitive or social factors in the interpretation of pubertal change affect moods, one's moods may in turn affect the amount or fluctuation of energy one feels.

This study will examine whether perceptions of pubertal status or timing are related to perceptions of energy levels. Because energy levels may be more directly linked to bodily metabolism than moods are, it is hypothesized that effects of perceived puberty will be small or non-existent. Rather, it is expected that direct measures of physiological activity, such as hormones, would be more important predictors of energy.

### Restlessness

Some data exist to support the belief that adolescents tend to daydream more and cannot concentrate for periods as long as adults (Larson et al., 1980). Self-reported concentration changed more dramatically over time for adolescents than for adults (Larson et al., 1980). But are short and variable attention spans characteristic of adolescents specifically? What evidence is there that lessened concentration, or fluctuation in concentration, is linked to pubertal change? Again, not much research addresses the issue. Stone and Barker (1939) documented more self-reported daydreaming and imaginative activity in post-menarcheal girls (ages 11 to 15.5) when they compared pre- and post- menarcheal girls of the same ages. Similarly, Sonis et al. (1985) found that girls with TPP were reported by parents to daydream a lot.

Perhaps restlessness and difficulty concentrating also reflect unsettled feelings about a changing body and changing status. If so, as argued above, girls who perceive that puberty is just beginning and / or girls who perceive themselves to be developing earlier than their peers, may show greater restlessness that is observed in more difficulty concentrating.

### Certainty about Self

Do physical changes of puberty lead to uncertainty about oneself, as suggested by some theorists (e.g. Brooks-Gunn, 1984; Erikson, 1950; Rosenbaum, 1979). Erikson (1950;1968) identified the major task of adolescence as the search for and establishment of an identity; he believed that physical changes were an important event precipitating the questioning of self that would lead to such exploration.

Few studies examining the question of identity development, and knowledge of self, have looked at children in pre- or early adolescence. Archer (1982) studied children in grades 6, 8, 10, and 12 and found diffusion (lack of exploration and lack of commitment regarding identity



alternatives) and foreclosure (commitment to an identity without exploration of alternatives) the most common identity statuses in 6th grade; these statuses decreased with grade but were present at all ages for the majority of children. Shirk (1987) compared 10, 13, and 16 year olds on self-doubt and found 10 year olds to have the highest level of self-doubt. It is impossible, however, to tell from this study whether 10 year olds have the same or higher self-doubt than younger children. And although younger children in these studies may have been undergoing initial pubertal changes, puberty was not measured or examined in relation to feelings about self; thus the role of pubertal development is left unclear.

It was expected in this study that the initial changes of puberty would set off some degree of self-examination, and thus questioning of self. Girls in the early stages of puberty, and girls developing at an earlier time than peers, were expected to feel less certain about who they were.

The present study tries to fill in some of the gaps in the literature on pubertal change and moods, energy, restlessness, and certainty about self. First, it examines self-reports of puberty in order to explore the relationship between perceived changes in one's own body and psychological outcomes. Second, the sample is composed of very young adolescents (nine and ten year old girls). Much of the literature has either focused on older adolescents, or on a wide range of ages without examining the effects of pubertal change within age. A focus on young adolescents is necessary if it is indeed the case that initial changes of puberty are most likely to precipitate psychological adjustment. Third, fluctuations in mood and energy are assessed by repeatedly measuring subjects' levels of mood, energy and restlessness across time. Although this method of assessment seems most closely related to traditional definitions of moodiness, few studies have used this approach because of the time and expense involved in collecting repeated measurements.

## Method

### Sample

The sample consisted of 53 early adolescent girls (9.1 to 10.8 years of age). Seventy percent of the sample came from families with annual incomes over \$30,000; 29% from families with incomes between \$10,000 and \$30,000.<sup>1</sup> Most girls (85%) had parents in intact first marriages; 11% had divorced or separated parents; 4% had remarried parents. The sample was 81% white, 6% black, 4% Asian, and 9% other.

Families were recruited through pediatricians' offices in a midwestern suburban community. Families with girls in the 9 to 10 year age range were sent a letter describing a study on hormones and behavior in which they could participate. Included in the letter was a postcard they could return specifying whether or not they wished to participate. When post-cards were not returned, families were called to see if they wanted to take part in the research, and when they did not, they were politely asked the reason for their refusal. Answers to this question indicated that the primary reasons for non-participation were lack of the time, or hesitancy on the part of the child to collect the repeated urine and saliva samples needed for hormone assessment. The 53 girls and 56 boys (and their families) composing the entire sample represented approximately 17% of the population asked to participate. The present study only reports on the girls.

### Design

The data reported here were collected over a one month period. Three evenings a week for four weeks the subjects filled out brief questionnaires assessing their moods, energy and restlessness during the day. Each child also participated in an extensive interview once at the end of the four weeks. This interview was conducted in the subject's home, and a variety of psychosocial information was collected, as well as information about pubertal development.

### Measures

Mood intensity. The daily questionnaire asked about a variety of moods over the course of the day. Girls indicated how much they experienced each mood that day on five point Likert scales. Moods used in present analyses are: anger, impatience, confidence, nervousness, shame, happiness, pride, excitement, friendliness, and sadness. The meaning of each mood was not defined for the subject; thus, subjects responded according to their own interpretations of the meanings of these words.

Overall, most girls reported very positive moods. Two mood items ("ashamed" and "sad") were highly skewed (greater than 2.0) in the positive direction (toward "not at all ashamed" or "not at all sad"). Because of the tendency toward positive and away from negative feelings, mood intensity could not be inferred directly from the scale score. For example, a "3" on the "sad" scale, though seemingly indicating a moderate level of sadness, may in fact represent a fairly high level of sadness if "1" is the norm. Therefore, intensity for each day was defined as the absolute value of one's deviation from the modal response in the population. For each mood, a day's score was subtracted from the population mode for that mood, and its absolute value taken. An average intensity score for the entire month of participation was then calculated for each child.

While this procedure does not, and was not meant to, account for whether the intensity was in the positive or negative direction, in most cases deviations (especially if they were large) had to be in the direction of a negative mood simply because of the positive bias in the mood reports.

Mood variability within a day. Moodiness (i.e. change in mood) within each day was measured by asking children "How often did your moods change today?" ("1" = not at all, "5" = very often) and "My feelings seemed to change suddenly at times today" ("1" = not at all, "5" = several times).

A composite of these two items was taken by averaging them for each day. Reliability of the two items as calculated by Cronbach's alpha was .78. As with the mood intensity variables, daily moodiness scores were averaged over the month for analysis.

Mood variability across the month. The variance of each of the specific moods listed under "mood intensity" was calculated for each child. This index indicated how much feelings of anger, impatience, etc., fluctuated from day to day over the month.

Energy and restlessness. A composite of the following items was used to assess energy: "Today I was mostly tired ("1") / energetic ("5")", "Today I felt mostly like doing something very quiet / relaxing ("1") / very active ("5")", and "Today I had less energy ("1") / more energy ("5") than usual". Cronbach's alpha for the three items was .87. Daily energy scores were averaged over the month. In addition, variance in energy over the month was calculated.

The measure of restlessness was a composite of the following items, all on 5 point scales where "1" = never and "5" = almost always: a) "How often today did your mind wander from what you were supposed to be paying attention to?"; b) "Today, how often was it hard to sit still?"; c) "Today it was easy to pay attention to what we were learning in school" (with scores reversed for composite measure); and d) "Today I had a hard time trying to concentrate". Cronbach's alpha for these items was .63. Daily levels of restlessness were averaged for the month and variance in restlessness over the month was calculated.

Certainty about self. Items from Rosenberg's Stability of Self scale, along with some new items created for this study were used to measure certainty about self at the in-home interview at the end of the month of participation. Factor analyses (using an oblique rotation) of these items

indicated one reliable factor ("KNOWSELF", Cronbach's alpha equal to .71). It consisted of the following items and factor loadings: a) "I am sure of myself with friends." (.70), b) "I am sure of what kind of person I am." (.66), c) "I know what I am like. I am sure of it." (.53), and d) "When I have an idea or opinion I say it no matter what." (.43).

Puberty. Self-perceptions of pubertal status were measured using the Pubertal Development Scale (Petersen, Crockett, Richards, & Boxer, 1988). Children answered whether development had "not begun", "barely begun", "definitely begun", or "been completed" on the following indices: growth spurt in height, breast growth, body hair growth, and skin changes. Derived "Tanner" stages were calculated according to Petersen et al.'s (1988) algorithm.<sup>2</sup> Using this method, 12 girls were classified as "pre-pubertal", 17 as "early pubertal", and 23 as "mid pubertal".

In addition to using the algorithm prescribed by Petersen et al. (1988), pubertal items were entered into cluster analyses to see which items naturally fell together, and best described groupings of girls in the sample. Cluster analysis resulted in a differentiation of individuals based on specific pubertal events. One group of girls was clearly pre-pubertal, with little development on any of the four indices (N=32). A second group reported development of body hair and skin changes with little breast development and moderate growth in height (N=14). The third group was relatively advanced in height and breast development, but not as developed as the second group on body hair or skin changes (N=6). Analyses were done with these three differentiated groups, to see if development on specific indices made more of a difference for moods than a simple progression on breast development, body hair growth, and menarche (as measured in the composites prescribed by Petersen et al., 1988). Analyses were also done collapsing the two groups of pubertal girls (N=20) and comparing them to the pre-pubertal girls (N=32) as derived by the cluster analysis.

For ease of presentation throughout the report, the pubertal development indices will be labelled as follows: 1) P-1: derived "Tanner" stages calculated from Petersen et al.'s (1988) prescribed algorithm, with categories of "pre-pubertal", "early pubertal", and "mid-pubertal"; 2) P-2: two categories of pubertal development derived from cluster analysis, with categories of "pre-pubertal" and "early pubertal"; and 3) P-3: three categories of pubertal development derived from cluster analysis, with categories of "pre-pubertal", "height and breast growth", and "body hair and skin changes".

Perceived pubertal timing was measured by one question asking: "Compared to other kids your age, do you think your body is changing: 1) before most kids, 2) the same as most kids, or 3) later than most kids". A "1" response was classified as early (N=10), "2" as on-time (N=33), and "3" as late (N=9).

### Analyses

Analyses of covariance, with age as the covariate, were used to examine the effect of pubertal status and timing on the outcome mood variables.<sup>3</sup> The design of the study minimized variation in age. However, age was used as a covariate in analysis in order to further control for any variations in mood that might be a result of even the small differences in age that existed in the sample. In general, the results of using age as a covariate showed that age within the range used in this sample was not related to the dependent variables. Only three out of 27 dependent variables were significantly related to age.<sup>4</sup> Post-hoc Sheffe comparisons were done for significant differences between pubertal status and timing groups.

Multivariate analyses of variance were used to see if there was an effect of pubertal status or timing on intensity or variability of all moods considered together (without reference to any specific kind of mood) and to examine whether or not effects differed for positive and negative

mood states. Since age did not emerge as a significant predictor of the dependent variables, it was not used as a covariate in multivariate analyses.

## Results

### Mood Intensity

Results of analyses of pubertal status and mood intensity are reported as significant if one of two criteria were met. First, if two or more mood states were related to pubertal status or timing at a significance level less than .05, these are reported whether or not the multivariate effect was significant. Since this study was exploratory in nature, it was considered potentially useful to identify specific moods related to pubertal stage even if all mood states were not. Secondly, if the multivariate analyses of pubertal status and several mood states, or the interaction of pubertal status and type of mood (positive or negative) was significant, even at a trend level (less than .10), this is reported along with any differences for specific moods.

Girls' perceptions of pubertal timing were not related to intensity of any of the moods over the course of the month. Perceptions of stage of development, apart from how girls felt that compared to other girls of their own age, were related to mood intensity (see Table 1) but only for the P-3 perceived puberty categories (i.e. those derived from cluster analysis). Based on this categorization, girls perceiving growth in height and breast development experienced more intense moods than the other two groups for confidence, nervousness, pride, and excitement. In addition, both groups of pubertal girls were more intense than perceived pre-pubertal girls on ratings of shame.

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Insert Table 1 about here

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Multivariate analyses showed that over all moods, the girls experiencing height and breast growth tended to be most intense. However, there was a significant interaction of perceived pubertal status and type of mood indicating that this relationship was primarily for positive moods. For overall negative moods, girls reporting body hair growth and skin changes showed slightly more intensity than perceived pre-pubertal girls (see Figure 1).

It is also evident from the analysis of the P-2 perceived pubertal categories that the perceived pubertal groups were both more intense in their moods than the perceived pre-pubertal group: when the height / breast and body hair / skin groups were combined and compared to the perceived pre-pubertal girls, the perceived pubertal group evidenced more intense shame ( $M_{pre} = .23$ ,  $S.D._{pre} = .27$ ,  $M_{early} = .53$ ,  $S.D._{early} = .58$ ;  $F(1,49)=5.89$ ,  $p<.05$ ;  $R^2=.11$ ) and sadness ( $M_{pre} = .41$ ,  $S.D._{pre} = .36$ ,  $M_{early} = .71$ ,  $S.D._{early} = .73$ ;  $F(1,49)=2.86$ ,  $p<.10$ ;  $R^2=.10$ ) as well as greater intensity over all the moods ( $M_{pre} = .71$ ,  $S.D._{pre} = .30$ ,  $M_{early} = .89$ ,  $S.D._{early} = .34$ ;  $F(1,49)=4.21$ ,  $p<.05$ ;  $R^2=.08$ ).

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Insert Figure 1 about here

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Thus, girls who perceive their bodies as changing do show different levels of mood intensity than girls who do not, and the type of pubertal change makes a difference in the level, and the type, of intensity in mood. Girls experiencing height and breast growth show more intensity, especially on moods that are positive; girls with less visible body hair growth, and skin blemishes are more intense than pre-pubertal girls, especially in nervousness, shame and sadness.

Classification of pubertal development according to the PDS algorithm (P-1), which does not differentiate girls according to the particular type of pubertal growth that is occurring, was not related to mood outcomes.



### Mood Variability Within Day

No significant relationships emerged between perceptions of pubertal status or timing and child reports of moodiness within a day.

### Mood Variability Across the Month

There were no significant effects of pubertal timing on mood variability across the month; nor were there any effects of pubertal status as classified according to the PDS (P-1). However, when girls were classified according to type of pubertal development taking place (P-2 and P-3), there were some significant effects of perceived pubertal status on variability. See Tables 2 and 3 for means and standard deviations. Girls perceiving height and breast development were slightly more variable than other girls in confidence and excitement. Along with girls experiencing body hair and skin changes, they were more variable than perceived pre-pubertal girls in feeling ashamed. Girls experiencing body hair and skin changes were more variable than perceived pre-pubertal girls in sadness. Overall, there was an interaction between pubertal status and type of mood indicating that girls who perceived themselves to be developing on body hair and skin change indices were more variable in negative moods than perceived pre-pubertal girls (see Figure 2).

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Insert Tables 2 and 3 about here

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Collapsing the two pubertal groups into the P-2 categories showed that girls perceived to be experiencing some kind of pubertal development were more variable across the month in nervousness, shame, and sadness (see Table 3). This was also reflected in a multivariate effect of perceived pubertal status on all moods that approached significance; over all moods, girls perceived

to be in the early stages of puberty tended to be more variable in their self-report of mood ratings over a one month period than perceived pre-pubertal girls. The interaction of perceived pubertal stage and type of mood also approached significance and confirmed the interaction described above: perceived pre-pubertal girls were less variable than perceived pubertal girls on negative moods, but equally as variable on positive moods (see Figure 3). Thus, all girls showed a relatively high level of variability in their reports of positive moods, but only perceived pubertal girls showed high variability in reporting negative moods.

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Insert Figures 2 and 3 about here

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#### Energy and Restlessness

Perceived pubertal girls (as defined by cluster analysis; P-2) were more variable in their reports of energy over the month than perceived pre-pubertal girls ( $M_{pre} = .96$ ,  $S.D._{pre} = .76$ ,  $M_{early} = 1.39$ ,  $S.D._{early} = 1.05$ ;  $F(1,49)=3.65$ ,  $p<.10$ ;  $R^2=.08$ ). Perceived pubertal girls were also more variable in feelings of restlessness over the month than perceived pre-pubertal girls ( $M_{pre} = .30$ ,  $S.D._{pre} = .27$ ,  $M_{early} = .59$ ,  $S.D._{early} = .44$ ;  $F(2,49)=6.01$ ,  $p<.05$ ;  $R^2=.21$ ). No other pubertal composite was related significantly to levels or variability of energy or restlessness.

#### Certainty about Self

Perceived pubertal timing, but not perceived pubertal status, was significantly related to feelings of knowing oneself ( $M_{early} = 4.08$ ,  $S.D._{early} = .98$ ,  $M_{ontime} = 3.44$ ,  $S.D._{ontime} = .97$ ;  $M_{late} = 2.69$ ,  $S.D._{late} = .56$ ;  $F(2,48)=6.08$ ,  $p<.01$ ;  $R^2=.21$ ). Girls who perceived themselves as early developers felt that they knew themselves better than girls who perceived themselves as on-

time; in turn, girls who perceived themselves as on-time felt more like they knew themselves well than girls who perceived themselves as being late.

## Discussion

### Perceived Pubertal Status and its Relation to Early Adolescent Girls' Moods, Energy, Restlessness, and Certainty about Self

According to girls' own reports of moods, pubertal development (status, not timing) is related to mood states. Girls experiencing puberty were more likely to report intense and variable moods, and more variable feelings of energy and restlessness (across the month) than perceived pre-pubertal girls. The moods of girls experiencing height and breast growth tended to be most intense, especially on positive moods. Girls experiencing less visible body hair growth, and some skin changes, tended to be more intense in their negative moods than perceived pre-pubertal girls. Girls who felt they were experiencing some type of pubertal development were more variable in negative moods across the month primarily because pre-pubertal girls showed very low levels of negative mood variability. Positive mood variability was similar across pubertal status groups.

Why do we find this interaction of pubertal status and mood type, suggesting that perceived pre-pubertal girls have more stable and consistent negative moods than perceived pubertal girls, but show more similarities to perceived pubertal girls on variability of positive moods? The answer to this question may lie in the way in which individuals responded to positive and negative mood items. Distributions of mood state reports tended to be skewed in the positive direction for most moods - whether positive or negative. However, the tendency to endorse a positive pole was especially great for negative mood items. For negative moods such as "angry" and "ashamed", the extreme positive pole ("not at all ashamed") was almost always the modal response, and the

distribution of responses was very highly stacked toward that positive end. For positive moods such as "happy" or "confident", the modal response was more likely to be less extreme (a "4" indicating "happy" rather than a "5" indicating "very happy"), and the distribution was more likely to be spread among the various responses. In other words, it was more unusual for a person to deviate from the mode on a negative item than a positive item. This might indicate that movement from the mode on a negative response is somehow a more extreme move than movement from the mode on a positive response. It may be more extreme for an individual to say she was "somewhat angry" (rather than "not at all angry") than to say she was "somewhat happy" (rather than "very happy").

The finding, then, that perceived pubertal girls are more likely to have intense and variable responses on negative moods than perceived pre-pubertal girls suggests that they are more willing to report deviation from the norm even for moods on which such movement is not easily made. One might suspect, therefore, that the negative moods of perceived pubertal girls are distinctly more intense and variable than perceived pre-pubertal girls. Positive moods are somewhat more intense and variable, primarily for girls experiencing height and breast development, but the difference is not as great as it is with negative moods because of the fact that swings on scales of positive moods are less extreme events to report. Thus, perceived pre-pubertal girls also experience some variation for the positive moods.

Why, then, might these relationships exist? Do swings in and intensity of mood emerge at puberty because of the adaptation required by the individual to a changing body (Brooks-Gunn, 1984; Erikson, 1950)? Does the appearance of sexual physical changes reawaken sexual feelings that are difficult to deal with, resulting in erratic behavior as the child attempts to integrate such feelings with a world in which they cannot be easily expressed (e.g. Blos, 1965; Geleerd, 1961; Jacobson, 1961; Kestenberg, 1967a; 1967b)? In this study, perceived pubertal development

and moods did not support my predictions: perceived pubertal stage did not relate to consciously experienced feelings of knowing oneself. It is possible, however, that uncertainty aroused by physical change is more subtle, or unconscious, than the uncertainty that would be expressed in response to direct questioning about self. Girls experiencing puberty may, on the surface, feel pleased or proud that it is occurring (Brooks-Gunn, 1984; Rosenbaum, 1979). They may be anxious for pubertal events to occur (Rosenbaum, 1979). The finding that perceived early (in timing) developers reported feeling that they knew themselves more than other girls suggests that, in fact, ways the experience of puberty is positive in some ways. That girls are anxious for pubertal events is also suggested by examination of how parent and child reports of pubertal timing corresponded in the current sample (see Miller, Tucker, Pasch, & Eccles, 1988). The girls seemed to be applying a different standard of timing than parents: they expected development to occur earlier, and therefore were more likely to think they were one stage (of timing) behind where their parents thought they were. Late development may, therefore, seem consciously unsettling. However, at a subconscious level, these girls may still be adjusting to a changing body and what that means for their own identity within the family and peer group; this more subconscious adjustment may in turn be reflected in mood states.

Alternatively, pubertal status may be reflecting hormonal activity. If pubertal girls are experiencing higher levels of, or more fluctuation in, pubertal hormones than perceived pre-pubertal girls, these internal events may ultimately be responsible for the fluctuations in mood and restlessness. Even the differences that emerge between the two perceived pubertal groups might be explained in this way. Girls experiencing primarily height and breast growth tended to report the most intense and variable moods; compared to girls experiencing body hair and skin changes they reported more variation on positive moods. Girls experiencing body hair and skin changes tended to show more intensity and variability on negative moods than pre-pubertal girls. Since breast

growth is primarily associated with estrogenic activity (Katchadourian, 1977; Root, 1973), and body hair and sebaceous gland activity are associated with androgens (Johnson & Everitt, 1984; Katchadourian, 1977; Root, 1973), it is possible that the two perceived pubertal groups are experiencing different hormonal events. Very broadly, estrogens have been associated with positive moods and well-being (e.g. Benedek, 1952; deLignieres & Vincens, 1982; McEwen, 1982; Southam & Gonzaga, 1965), and androgens have been linked more to negative mood states such as aggression and anger (e.g. Rubin, Reinisch, & Hasket, 1981; Velle, 1982). If greater intensity and variability on negative moods indicates a definite, and unusual, willingness to report negative moods, it may be that girls experiencing secondary sexual development linked primarily to androgenic activity are being affected by this activity in their moods. Since variation on positive moods, unlike that on negative moods, can potentially mean a move into a more positive direction than the norm, girls experiencing secondary sexual development linked primarily to estrogenic activity may be likely to experience more positive feelings than the norm due to the effects of that estrogen.

Additionally, it may be that pubertal girls in general experience more variability and fluctuation in hormone, since early in pubertal development hormone rhythms and cycles are not consistent (Grumbach, 1980; Katchadourian, 1977; Nathanson, Towne, & Aub, 1941; Yen & Jaffe, 1978). Fluctuation and variability in hormone concentrations and / or pulsatile activity may be reflected in variable moods, energy or restlessness; this may explain the tendency for both pubertal groups to exhibit more swings, and more intensity on these variables. Some early work in this area, however, suggests that the relationship between hormone variability and mood variability is not as simple and straightforward as this latter hypothesis would suggest (Miller, 1988).

As predicted, pubertal status was more strongly related to intensity and variability of mood, and variability of restlessness, than it was to measures of energy level or variability. However,

pubertal status did have a small relationship to energy. This may indicate that subtle, and perhaps subconscious, adjustments to a new physical self can be reflected in energy levels as well as moods; it may also indicate a relationship between pubertal status and underlying hormonal activity that affects energy levels.

#### Effects of Perceived Pubertal Timing

Perceived pubertal timing was not related to intensity or variability of moods, or levels or variability of energy or restlessness. Given the literature suggesting that off-time events in general (e.g. Neugarten, 1969; 1970), and off-time puberty in particular (e.g. Duncan et al., 1985; Jones & Mussen, 1958; Magnusson et al., 1985; Rierdan & Koff, 1985a; 1985b; Savin-Williams & Small, 1987; Simmons et al., 1983; Tobin-Richards et al., 1983) are stressful and more likely to precipitate crises than on-time events, why were there not more effects of self-reported pubertal timing on mood intensity and variability? Again, it seems that fluctuations in mood are not necessarily a result of consciously feeling different (different in comparison to one's own child body, or different in comparison to peers). The girls themselves may not even be aware that the fluctuations in mood are taking place. Evidence for low self-awareness of mood changes is suggested by the fact that studies asking adolescents directly about intensity or changes in mood do not find evidence for mood changes or a link between moodiness and pubertal status (e.g. Crockett & Petersen, 1987; Stapley & Haviland, 1987). However, studies assessing mood change indirectly, as in the present study and in Larson et al. (1980), have found such evidence.

If, in fact, the relationship between pubertal development and intensity and variability in moods is due to either subconscious adaptation to a new body or internal hormonal events associated with pubertal status, conscious feelings of timeliness would not necessarily be expected to relate to intensity and variability of mood in the same way as pubertal stage. Conscious feelings of

timeliness seem, rather, to have their effect on more conscious psychological constructs: in this case certainty about self. Girls who perceived themselves as early developers were most sure of themselves; girls who perceived themselves as late were least sure of themselves. As described earlier, there may be conflicting processes going on at different levels of awareness for the early adolescent girl. Early development may be exciting, reassuring, and / or evoke pride; it may also, whether the individual is aware of it or not, induce feelings of newness and uncertainty that are reflected in moods.

#### Measurement of Puberty

This study suggests that alterations in mood, energy, and restlessness do occur in conjunction with pubertal development, but the effects depend on how pubertal development is defined. Were pubertal status assigned to the girls in this study based only on an algorithm using one's total score on breast development, body hair growth and menarcheal status, as prescribed by Petersen et al. (1988), perceived pubertal status would have had no significant relationship to intensity or variability of moods, energy, or restlessness. When girls were categorized according to "natural groupings" based on perceived height growth, breast development, body hair growth, and skin changes, differences emerged between groups on the dependent variables.

What are the reasons for these differences? One possibility is that a girl's experience of puberty is not best defined as continuous development on the indices of breast development, body hair growth and menarche. Little research has addressed the meaning of specific pubertal changes (other than menarche) to girls who experience them (Petersen, 1980); the little data that do exist indicate that breast development is an important and positive event for girls (Brooks-Gunn, 1984; Rosenbaum, 1979). Breast development is certainly more visible and public than pubic hair



growth, so to the extent that it is the public components of pubertal development that affect one's self-image, we would expect the type of results found in this study.

The data reported in the current study suggest that specific constellations of pubertal events are indeed important to girls, and, additionally, that pubertal development based on indicators apart from breast, body hair, and menarcheal development may be important. The continuous development algorithm employed by the PDS may wash out specific patterns of pubertal change that relate more closely to an individual's subjective experience of the entire pubertal experience.

Another difference between the two ways of defining puberty is the number of girls they classify as pubertal. The algorithm prescribed by Petersen et al. (1988) results in more girls being classified as pubertal than the technique based on natural groupings of several variables. The girls classified as pubertal using the cluster analysis technique may be thought of the "most pubertal" girls in the sample. Perhaps pubertal changes, although early, need to be quite distinct to have effects on moods and behavior.

An additional possible explanation for the differing results of different pubertal definitions may have to do with hormonal development. It is possible that the pubertal status categories derived through cluster analysis are related to internal hormonal changes more directly than the categories derived by the PDS, and that it is actually the hormonal events underlying the external manifestations that are causing more intense and variable mood states.

### Summary

This study examined relationships between perceived pubertal development and moods, energy, restlessness and certainty about self in a way that had not been done before. The data suggest that perceived bodily changes may in fact be related to moods and energy, although not necessarily in a way that is consciously experienced by the individual. Further research can refine and expand upon

these findings by giving more attention to a child's experience of pubertal change, as well as exploring how contextual factors (e.g. familial, demographic) affect these relationships.

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## Footnotes

<sup>1</sup> One percent of income data was missing.

<sup>2</sup> The algorithm works as follows: Sum ratings of breast development and body hair growth (1=no development, to 4=development completed). No menarche with a total score of "2" for breast and body hair growth is classified as "pre-pubertal"; no menarche with a total score of "3" for breast and body hair growth is classified as "early pubertal"; no menarche with a total score of "4 or more" for breast and body hair growth is classified as "mid-pubertal"; menarche with a total score of "7 or less" for breast and body hair growth is classified as "late pubertal"; menarche with a total score of "8" for breast and body hair growth is classified as "post-pubertal".

<sup>3</sup> Because of literature documenting that analysis of variance and non-parametric tests such as the Mann Whitney U and the Kruskal Wallis test yield essentially the same results, and because of the need to use a powerful statistical technique due to relatively low sample sizes, analysis of variance was used even in those cases where group variances were not equal. This choice of a powerful technique was considered appropriate given the exploratory nature of the study. Results of analyses using analysis of variance when variances of pubertal status groups were equal, but substituting non-parametric tests where variances were unequal were performed; essentially the same results emerged using this method of analysis.

<sup>4</sup> Intense anger ( $F(1,51)=4.16, p<.05$ ) and intense nervousness ( $F(1,51)=3.75, p<.10$ ) as defined by distance from the mode were related to age of the child. Older girls showed more intense anger and nervousness. Age was also a significant predictor of variance in restlessness ( $F(1,49)=7.06, p\leq.01$ ), with older girls reporting more variation.

Table 1  
Means and Standard Deviations for Three Perceived Pubertal Status Groups (P-3) and Mood Intensity

Pubertal Status	Pre			Hair/Skin			Height/Breast			R <sup>2</sup>	F
	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N		
Angry	.68	(.39)	32	.87	(.61)	14	.77	(.60)	6	.10	.32
Impatient	.94	(.67)	32	1.32	(.82)	14	.82	(.66)	6	.08	1.90
Nervous	.53	(.44)	32	.73	(.56)	14	1.05	(.79)	6	.15	2.47*
Ashamed	.23	(.27)	32	.59	(.63)	14	.39	(.46)	6	.13	3.45**
Happy	.51	(.38)	32	.69	(.26)	14	.76	(.75)	6	.08	1.15
Confident	.92	(.60)	31	.76	(.32)	14	1.73	(.47)	6	.27	8.13****
Proud	1.12	(.73)	32	.96	(.41)	14	1.94	(.81)	6	.16	4.56**
Excited	1.26	(.63)	32	1.00	(.49)	14	1.65	(.44)	6	.10	2.52*
Friendly	.52	(.37)	32	.73	(.28)	14	.52	(.47)	6	.09	1.15
Sad	.41	(.36)	32	.73	(.77)	14	.66	(.70)	6	.10	1.41
All moods	.71	(.30)	31	.84	(.32)	14	1.03	(.38)	6	.11 <sup>a</sup>	2.91*
Positive moods	.86	(.40)	31	.83	(.20)	14	1.32	(.39)	6	.15 <sup>a</sup>	4.1**
Negative moods	.56	(.32)	32	.85	(.55)	14	.74	(.52)	6		

<sup>a</sup> Since multivariate analyses did not control for age, the R<sup>2</sup> in these cases does not represent an age component.

\*p≤.10.    \*\*p≤.05.    \*\*\*p≤.01.    \*\*\*\*p≤.001.

Table 2  
Means and Standard Deviations for Three Perceived Pubertal Status Groups (P-3)  
and Mood Variability Across the Month

Pubertal Status	Pre			Hair/Skin			Height/Breast			R <sup>2</sup>	F
	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N		
Angry	.61	(.64)	32	.75	(.74)	14	1.15	(1.51)	6	.05	1.11
Impatient	.76	(.77)	32	1.05	(1.02)	14	.78	(.93)	6	.02	.57
Nervous	.58	(.69)	32	1.09	(1.16)	14	1.16	(1.22)	6	.08	1.81
Ashamed	.27	(.44)	32	.77	(.98)	14	.91	(1.26)	6	.13	3.46**
Happy	.57	(.61)	32	.77	(.57)	14	.76	(.58)	6	.03	.68
Confident	.88	(.72)	31	.77	(.62)	14	1.61	(1.08)	6	.11	2.82*
Proud	.90	(.73)	32	.94	(.69)	14	1.31	(1.19)	6	.03	.69
Excited	1.13	(.91)	32	.95	(.35)	14	1.83	(.85)	6	.12	2.90*
Friendly	.43	(.58)	32	.59	(.42)	14	.70	(.91)	6	.04	.56
Sad	.40	(.42)	32	1.02	(1.25)	14	.98	(1.24)	6	.12	2.97*
All Moods	.66	(.47)	31	.87	(.58)	14	1.12	(.93)	6	.08 <sup>a</sup>	1.95
Positive moods	.79	(.58)	31	.80	(.38)	14	1.24	(.77)	6	.09 <sup>a</sup>	3.38*
Negative moods	.52	(.46)	32	.94	(.90)	14	1.00	(1.14)	6		

<sup>a</sup> Since multivariate analyses did not control for age, the R<sup>2</sup> in these cases does not represent an age component.

\*p≤.10.      \*\*p≤.05.

Table 3  
Means and Standard Deviations for Two Perceived Pubertal Status Groups (P-2)  
and Mood Variability Across the Month

Pubertal Status	Pre			Early			R <sup>2</sup>	F
	Mean	S.D.	N	Mean	S.D.	N		
Angry	.61	(.64)	32	.87	(1.01)	20	.03	.98
Impatient	.76	(.77)	32	.97	(.96)	20	.02	.72
Nervous	.58	(.69)	32	1.11	(1.31)	20	.08	3.65*
Ashamed	.27	(.44)	32	.81	(1.04)	20	.13	6.94***
Happy	.57	(.61)	32	.76	(.55)	20	.03	1.39
Confident	.88	(.72)	31	1.02	(.85)	20	.01	.52
Proud	.90	(.73)	32	1.05	(.72)	20	.01	.57
Excited	1.13	(.91)	32	1.21	(.67)	20	.01	.03
Friendly	.43	(.58)	32	.62	(.59)	20	.03	.89
Sad	.41	(.42)	32	1.01	(1.21)	20	.12	6.06**
All moods	.66	(.47)	31	.94	(.69)	20	.06 <sup>a</sup>	3.08*
Positive moods	.79	(.58)	31	.93	(.54)	20	.06 <sup>a</sup>	2.92*
Negative moods	.52	(.46)	32	.95	(.95)	20		

<sup>a</sup> Since multivariate analyses did not control for age, the R<sup>2</sup> in these cases does not represent an age component.

\*p≤.10.    \*\*p≤.05.    \*\*\*p≤.01.

Figure Captions

Figure 1. Perceived pubertal status (P-3) and intensity of positive versus negative moods.

Figure 2. Perceived pubertal status (P-3) and variability of positive versus negative moods.

Figure 3. Perceived pubertal status (P-2) and variability of positive versus negative moods.







