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Psychological Precursors of Panic Attacks

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The ongoing experience of panic disorder was assessed in 20 female subjects, to determine psychological precursors to panic attacks. Measures of anxiety, threat, control, prediction of panic, and symptoms were assessed at hourly intervals during waking hours for one week. Measures were taken using a portable computerised diary which prompted for and stored responses. Patients' ratings of the prediction of panic attacks were the only significant precursors to panic attacks. This supports recent research that expectancy is important in panic onset. The data also suggested that anxiety levels follow a circadian pattern.

A variety of psychological factors have been identified as important in the onset and development of panic attacks. On the basis of psychophysiological data from a laboratory study of panic attacks, Lader & Mathews (1970) originally proposed that spiralling levels of anxiety resulted in panic attacks. This was supported in a recent interview study which found that patients with panic disorder report that feelings of anxiety not associated with anxious thoughts most frequently precede panic attacks (Zucker *et al*, 1989). Beck & Emery (1985) and Clark (1986) went beyond this to suggest that it was the misattribution of physical sensations to potentially catastrophic causes that was the basis of the mounting anxiety in the development of panic. The catastrophic nature of the misattributed cause refers to the physical and psychological threats that are perceived. The physical threat of death or incapacity and the psychological threat of going crazy or losing control arise from misattribution of ambiguous internal sensations. Ottaviani & Beck (1987) provide clinical evidence of the validity of this theory. The authors found that all of the 30 patients with panic disorder they interviewed reported a panic attack triggered through the misattribution of a physical sensation. Margraf *et al* (1987*a*) reported a case where a subject panicked after being given false heart rate feedback, suggesting that actual physiological changes may not even be necessary. Thus perceptions of threat may be important by themselves in development of panic. Beck & Emery (1985) indicate that threat may also be related to feelings of loss of control in that threats to individual autonomy can also be conceived of as loss of control. Barlow (1988) states that loss of control is one of two factors common to all successful panic provocation procedures, the other being high levels of subjective apprehension. In an experimental investigation, Sanderson *et al* (1989) found manipulating perceived control can determine a panic response to CO_2 provocation.

Another important factor in the onset of panic may be an increased expectation that a panic attack may occur (Kirsch, 1985; Reiss & McNally, 1985; Rapee *et al*, 1986; Barlow, 1988). Kirsch (1985) suggested that expectancies concerning fear lead to higher levels of experienced fear. Thus, higher estimation of the likelihood of panic attacks may also be related to the onset of panic so that increased expectancies may lead to maintenance of fear and further heightened expectancy (Turner *et al*, 1988). Rapee *et al* (1986) were able to mediate the experience of panic by manipulating expectancies concerning the symptoms experienced during CO_2 inhalation. Furthermore, there is some evidence that overprediction of panic is common for persons with claustrophobic fear (Rachman & Lopatka, 1986) and panic disorder (Telch *et al*, 1989).

The previously described studies have been based on laboratory studies or retrospective reports. Another approach to determining the precursors of panic has been to focus on the natural occurrence of panic attacks. Taylor and colleagues (Taylor *et al*, 1986; Margraf *et al*, 1987*a*) have used ambulatory monitoring and self-report measures to assess the experience of panic attacks with an event-based sampling criterion, the occurrence of a panic attack. Combined with heart rate data, this allowed for precise analysis of the phenomenology of panic attacks but provided no information on the psychological state before an attack. What was required was a sampling procedure based on fixed intervals that provided constant data concerning the psychological state before a panic attack. Kenardy *et al* (1988) demonstrated that such a strategy is useful in aiding the understanding of precursors of situational panic. They found a negative bias in cognitions, considerable physiological lability, and mounting subjective distress preceding situational panic attacks. In an attempt to assess the precursors of panic attacks as they occur naturally,

Kenardy *et al* (1989) employed a fixed-interval time sampling procedure over a limited time period. Only a few panic attacks were measured due to the relatively short sampling period.

The primary purposes of this study were:

(a) to assess the psychological factors that were important in panic disorder over an extended time period as precursors to panic onset
(b) to describe the ongoing process of panic disorder
(c) to demonstrate the utility of a real-time, computer-aided, self-report procedure in gathering such data.

The literature indicates that the psychological factors involved as precursors of panic may be anxiety, perceived threat and sense of control, expectancy concerning the occurrence of a panic attack, and perception of somatic symptoms. Our hypothesis was that the level of anxiety, perceived threat, expectancy of panic and number of somatic symptoms would be significantly higher before panic attacks, while sense of control would be lower, compared to matched control times.

Method

The subjects were 20 women with panic attacks who were recruited through mass media announcements and therapist referral. Subjects had to be 18 to 50 years old, report at least three panic attacks in the previous week, be in general good health, not have current drug or alcohol abuse and not make any changes in medication for the two weeks before or during the study. Subjects found eligible by telephone interview were then sent a screening pack. Information from the screening pack was used to determine the presence of DSM-III-R panic disorder (American Psychiatric Association, 1987) and to recheck the telephone screen information. Based on this information, the subjects were invited to participate in the study and informed consent was obtained after the procedures were fully explained. Further screening then took place using the Structured Clinical Interview for DSM-III Upjohn version (SCID-UP; Spitzer & Williams, 1983). Subjects met both DSM-III (American Psychiatric Association, 1980) and DSM-III-R criteria for panic disorder.

Casio® PB-1000 (Casio Corporation) is a pocket computer which is 2.5 cm × 19 cm × 18 cm when folded. It weighs 440 g including batteries and RAM expansion pack. It is powered by 3 AA batteries. With the memory expansion pack it has a RAM of 40K bytes. It has a built-in clock and calendar. It has a 32 column by 4 line LCD touch sensitive screen and a keyboard. It can be programmed using C61-BASIC and HD61700 assembler.

The PB-1000 can be connected via a built-in interface to a 3.5 in. disk drive unit (MD-100) (Casio Corporation) allowing programs and data to be uploaded and downloaded to other peripheral devices and computers. In this study the data were downloaded via a serial interference to a Macintosh microcomputer.

Subjects were asked to report data (a) every hour from 07.00 to 23.00, and (b) when they felt they were having a panic attack. During the sampling period, the computer would signal the subjects on the hour. If the subject failed to respond within one minute, the signal repeated. This continued for 10 minutes after which the computer turned off automatically and no data were recorded for that hour. When a subject became aware that she was having a panic attack she was instructed to switch on the computer and answer questions about the panic attack. The definition of a panic attack was purposely left to the subject's discretion. The computer noted the time of any data entry.

The major variables in this study were generated from a set of questions to be rated by subjects, presented on a series of screen displays (Taylor *et al*, 1990). Anxiety, sense of control, sense of threat or danger, and prediction of panic were rated on 24-point visual analogue scales with end-points labelled 'none' (left) and 'extreme' (right). To make the concepts as clear as possible, they were presented as "How anxious do you feel?", "Sense of control?", "Sense of threat or danger?" and "Likelihood of panic this hour?". The control question necessitated using a reverse scale. Somatic symptoms were derived from the panic symptoms in DSM-III-R. They were presented in a yes/no format. Of the 13 symptoms, three (fear of dying, depersonalisation/derealisation, and fear of going crazy/losing control) were not considered somatic. The sum of the 'yes' ratings on the remaining 10 represented the somatic variable. Subjects were also presented with two screens requesting a choice of responses for where the subject was and who the subject was with. At instances when subjects reported a panic attack, they were told to complete the same questions, and they were also asked to enter the time they realised that they were having this attack, when it ended, to rate the intensity of the attack, and whether they attributed the attack to a specific situation; they were not asked if they anticipated that a panic attack would occur.

At 07.00, 15.00 and 23.00, in addition to the hourly questions, the computer asked about medication, caffeine and alcohol consumption during the previous eight hours.

The study procedures were reviewed at the intake appointment. Subjects read and signed an experimental subjects' bill of rights and an informed consent form. Subjects then completed baseline paper and pencil tests which included the Beck Depression Inventory (BDI; Beck *et al*, 1961), the State-Trait Anxiety Inventory (STAI; Spielberger *et al*, 1970), and the Fear Questionnaire (FQ; Marks & Mathews, 1979). When the pencil and paper tests were completed, subjects were interviewed using the Structured Clinical Interview for the DSM-III Upjohn version (SCID-UP; Spitzer & Williams, 1983).

Subjects were then given a demonstration computer. They were instructed in how to use the program, and allowed to practise entering responses. Once they felt comfortable with the program they were given a computer that was initialised and ready to start recording. Starting on the hour following initialisation, the computer signalled for the subject to make the first entry. On days two and five of the study, subjects returned to the laboratory to review

their progress and discuss any questions. On day eight subjects again returned to the laboratory. After completing the last entry subjects were debriefed regarding their impressions of the study. Subjects who desired treatment were referred.

Analysis of the data was with reference to a reported panic period. A panic period was a time period during which a panic attack was reported to have occurred. Panic periods equal the time from the beginning to the end of a panic attack, or if several attacks occurred sequentially within an hour, the time from the beginning of the first to the end of the last panic attack. There were 116 panic periods which included 151 panic attacks. A pre-panic hour was defined as the hour immediately before a panic period occurred. A control period was defined as an hour matched for time of day on either the day before or the day following the panic period.

Testing of the main hypotheses of the study examined differences between the pre-panic period hour and the control hour. Only subjects having more than one panic period were included. For each of five outcomes (anxiety, sense of control, threat, likelihood of a panic attack, and panic symptoms) an analysis of variance (ANOVA) was used, with subject and panic periods nested within subjects. The α-level for each test was set to 0.01 to control for Type I error rate using a Bonferroni adjustment (Hall & Bird, 1985). Responses on the scales were standardised to a mean of 0 and a standard deviation of 1 for each subject in order to remove scaling biases in the use of the scales.

Circadian cyclicity in the hourly ratings of anxiety, sense of control, threat, likelihood of a panic attack and number of somatic symptoms was analysed on a subject-by-subject basis by using the ratings as dependent measures in multiple regressions employing a three-parameter (mean, amplitude, and phase) cosine model.

Results

Subjects ranged in age from 19 to 44 years (mean age 30.9 years, s.d. 7.9). The duration of experiencing panic attacks ranged from 1 to 20 years (mean 7.2, s.d. 5.9). As required, all subjects reported at least three panic attacks in the week preceding their participation in the study (mean 6.0, s.d. 3.8, range 3–14).

Table 1
Where subjects were and who they were with at time of report

	No. of reports	Percentage of total
Where		
at home	917	45.9
work/school	374	18.7
in bed	187	9.4
in a vehicle	235	11.8
in a restaurant	34	1.7
elsewhere	252	12.6
Companion		
none	681	34.1
partner	463	23.2
friend	175	8.8
other family member	280	14.0
co-worker	285	14.3
other	115	5.8

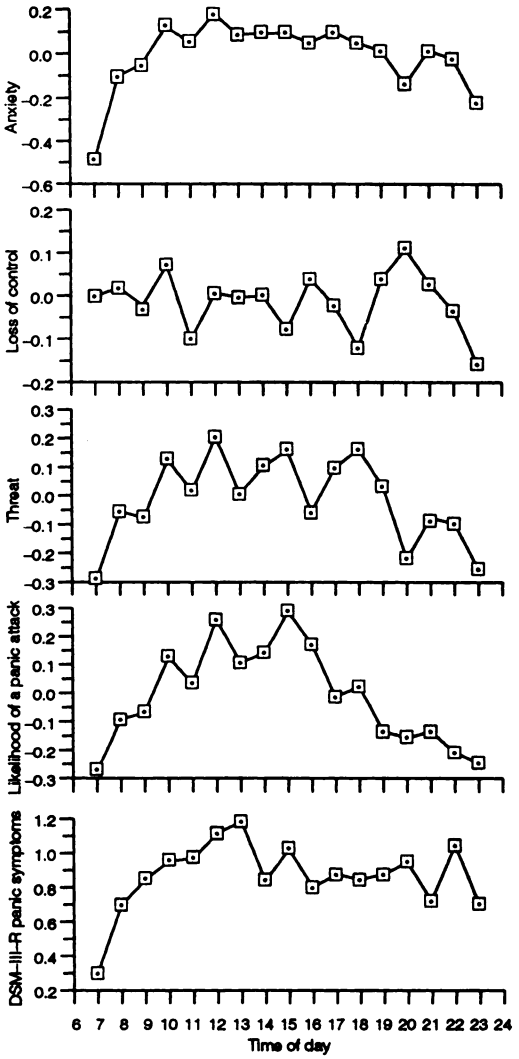

Fig. 1 Mean hourly ratings over seven days for each of the major study variables. (Note: subjects only reported between the hours of 07.00 and 23.00 inclusively and ratings have been standardised.)

Nine subjects reported taking an average of 15.2 (s.d. 19.4, range 2–63) doses of alprazolam over the sampling period. One subject reported taking nine doses of clonazepam. Two subjects were taking desipramine. No association was found between drug use and panic frequency over the sampling period.

The mean score at outset for the sample on the BDI was 16.2 (s.d. 8.8, range 1–37) indicating that most subjects were

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at least mildly depressed. Mean STAI-Trait score was 48.7 (s.d. 5.32, range 39–58) indicating that most subjects were at least moderately anxious. The mean score for the FQ was 46.8 (s.d. 22.6, range 4–93) indicating a generally high level of avoidance.

Subjects made a total of 2091 out of a possible 2382 hourly reports (range 114–128 each). The mean completion rate was 87.7%.

Reports were most frequently made while the subject was alone and at home (Table 1). It is interesting to note that somatic symptoms of the DSM-III-R panic criteria are a common experience in these subjects. Subjects reported symptoms during 41.7% of hourly reports. During 5.6% of the hourly reports not associated with panic attacks, subjects reported four or more of the DSM-III-R panic symptoms. Overall, subjects reported a mean of 0.86 (s.d. 1.36, range 0–10) DSM-III-R panic symptoms during the hourly reports not associated with panic attacks.

The relationship of the self-ratings to time of day was examined by combining all hourly ratings not associated with panic attacks across subjects. As can be seen from Fig. 1 there appears to be a similar pattern of increasing levels in the morning and declining levels in the evening for anxiety, likelihood of having a panic attack, threat and panic symptom count, but not for ratings of control. This suggests a circadian cyclicity in these measures of psychological state.

An examination of the data on an individual basis using a three-parameter cosine regression model indicates strong circadian cyclicity for anxiety and little cyclicity for control (Table 2). Of the variance in the hourly reports of anxiety, 7% is explained by a model that assumes a circadian (24-hour) cyclicity where the cycle peaks (has its 'acrophase') in the late afternoon (15.46). None of the subjects had an acrophase for their anxiety ratings before 12.00. Alcohol, nicotine and benzodiazepine usage was examined to rule out their effect on circadian changes in anxiety. Alcohol use was highly negatively correlated with amplitude of cyclicity, which reflects the amount of change in the cycle during the day (Spearman's $r = -0.88$). In other words, alcohol users showed suppressed variation in the cycle during the course of the day. No other drug was associated with the amplitude of the cycle.

Table 2
Analyses of individual patterns of cyclicity

Measure	R^2	Acrophase (hour.min)
Anxiety	0.072	15.46
Prediction of panic	0.036	7.30
Control	0.021	13.42
Threat	0.032	9.36
Somatic symptoms	0.039	15.39

From a multiple regression using a three parameter cosine model (mean, amplitude, and phase) to predict anxiety. The R^2 relates to the level of prediction by the three parameter regression model on the relevant measure. The acrophase refers to the time at which the daily cycle (modelled by the three parameter cosine model) reaches a maximum.

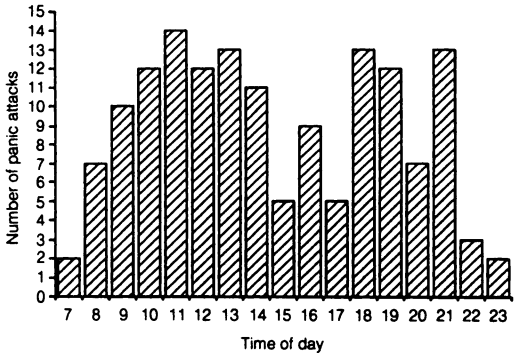

Fig. 2 Mean number of panic attacks per subject per hour.

Panic attacks

A total of 151 panic attacks were reported over the sampling period. The mean number of panic attacks per subject was 7.55 (s.d. 7.4, range 0–28). Two of the 20 subjects did not report any panic attacks. Overall, panic attacks were reported as occurring at all hours of the recording period; however, they tended to occur more frequently at midday and in the middle evening (see Fig. 2).

Panic attacks were reported as lasting an average of 19.4 minutes (s.d. 14.4, range 2–73). They were reported most commonly when the subject was alone (41.1%), with other family members (22.5%), or with a non-family member partner (16.6%). Subjects were usually at home (39.7%) or in a vehicle (25.8%) during panic attacks. The majority of panic attacks (61.6%) were attributed to the situation. Mean number of DSM-III-R panic symptoms reported during a panic attack was 5.9 (s.d. 2.3, range 1–12); however, 15.9% of panic attacks had fewer than four symptoms.

Psychological state in the hour before panic was examined. In comparing pre-panic and control periods, only the likelihood of panic rating had a significant main effect ($F = 8.299$, 1.74 d.f., $P < 0.01$). Self-reported likelihood of panic ratings was significantly higher for all subjects at

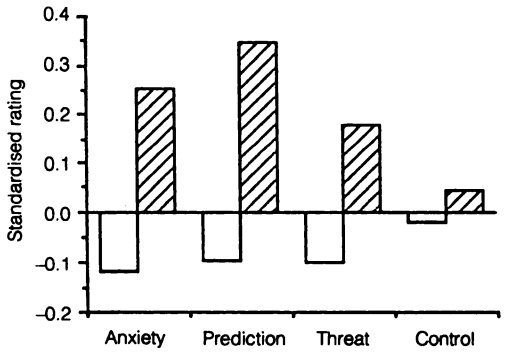

Fig. 3 Mean ratings for anxiety, prediction, control and threat for pre-panic (▨) v. control (□) hours.

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pre-panic hours than control hours (see Fig. 3). The mean number of somatic symptoms was slightly, but not significantly, higher in pre-panic than control hours. In the three hours before the panic hour, the level of prediction did not change radically before the panic attack but rather appeared to increase slowly in contrast to the level of prediction at the control hours.

Discussion

The major finding of this study is that naturally occurring panic attacks are preceded by significantly higher ratings of the likelihood of panic compared to matched times but not, contrary to our expectation, by significantly higher ratings of anxiety, threat, somatic symptoms, or a lower sense of control. Thus the hypothesis that there would be a general disturbance in psychological state before panic onset was not confirmed. It should be noted that likelihood ratings were not elevated at all pre-panic times and elevated ratings of prediction did not precede all panic attacks. This study demonstrates that expectancy as measured by elevated ratings of panic likelihood is the most consistent characteristic of the psychological state before panic attacks in subjects with panic disorder. Furthermore, the pattern in the rating of panic likelihood in the three hours preceding panic suggests that the process is long term.

These findings are consistent with laboratory studies suggesting that increased expectation is associated with panic onset (Rapee *et al*, 1986; van der Molen *et al*, 1987; Rachman, 1988). The data also support Barlow's (1988) position that an underlying apprehension is a precursor to panic. Furthermore, expectancy has been posited as the psychological process that underlies panic disorder (Rachman, 1988). Expectancy can be thought of as developing from a conditioned fear of panic attacks. Expectancy may be mediated by the presence of situational cues that signal 'safety' via an inferred lessening of the likelihood of the occurrence of panic. Panic disorder may be seen as being maintained because of a failure to extinguish the feared consequence of the panic attack through elevated levels of expectancy. Thus when feared consequences do not occur it is seen as a function of the presence of safety signals. So, following non-occurrence of a panic attack the likelihood of further panic attacks is not re-evaluated, because the elevated level of expectancy was validated by a 'near miss'. Further research is required to investigate the cues that lead to changes in the prediction of panic.

An interesting benefit of the method used in this study was the ability to examine time of day effects. Panic attacks appear to be less frequent in the early morning and late evening. This finding may relate to the detected circadian pattern of self-reported anxiety, threat and panic prediction with lower levels in the early morning and evening and higher levels during the day. There has been one other report in the literature of a non-significant circadian trend for anxiety (Cameron *et al*, 1986). This circadian pattern may be explained to some extent by environmental factors. However, the presence of such a pattern could also suggest some interaction of underlying biological mechanisms with psychological state. For example, urinary epinephrine has been found to follow a similar circadian pattern (Cameron *et al*, 1987). Further investigations into these circadian patterns are called for as this finding could have major implications for both the assessment and conceptualisation of psychological state. Of further interest is the strong association between alcohol usage and a suppressed circadian cyclicity in anxiety. This finding provides strong support for the importance of considering alcohol intake, and for that matter any drug intake in any investigation of anxiety.

Finally, this study uses a new method to assess naturally occurring events and experiences in real-time. It provides for accurate analysis of ongoing experience measured in real-time without concerns about subsequent alterations to self-report data by the subject. Furthermore, this method allows for the elimination of two steps in the process of analysis, those of coding raw data and data entry, thus saving time and costs as well as further improving accuracy. Based on the experience of this study the method should prove to be valuable both in single-case and multi-case studies.

Conclusion

The ongoing experience of subjects with panic disorder was assessed in a way that allowed for examination of precursors to panic attacks. While there is evidence that expectancy is elevated before panic attacks, the precursor conditions for panic may well be related to a complex of social/environmental, biological, and psychological factors both at a state level and at the level of an ongoing process.

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