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Panic termination and the post-panic period[☆]

Adam S. Radomsky^{*}, S. Rachman, David Hammond

University of British Columbia, Vancouver, BC, Canada

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Abstract

A comprehensive theory of panic must explain not only the cause(s) of episodes of panic but also why and when panic episodes terminate. Accordingly, we conducted a set of three studies on participants with panic disorder in order to investigate these aspects of panic episodes. In Study 1, we asked participants to monitor their panics prospectively, paying particular attention to the episodes' conclusions and the time period which followed. Results from Study 1 were consistent with earlier retrospective studies, showing that people engage in safety and other behaviors in an attempt to end their panics. We also collected information from the participants on beliefs about panic termination and the post-panic period. Study 2 was designed to determine if a post-panic refractory period occurs. Participants were asked to complete a hyperventilation exercise, and then to repeat the exercise a second time. Results from this study provide scant evidence of a post-panic refractory period. Study 3 was a more ecologically valid version of Study 2, in which participants were asked to re-trigger panics that occurred in their natural surroundings. Again, there was little support for a post-panic refractory period. Results are discussed in terms of cognitive-behavioral and biological theories of panic disorder. © 2002 Elsevier Science Inc. All rights reserved.

Keywords: Panic disorder; Fear reduction; Refractory period; Cognitive-behavioral theory; Biological theory

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^{*}Corresponding author. Present address: Department of Psychiatry, Concordia University, 7141 Sherbrooke St. West, Montreal, Quebec, Canada H4B 1R6.

E-mail address: radomsky@vaxz.concordia.ca (A.S. Radomsky).

1. Panic termination and the post-panic period

Episodes of panic are self-limiting; they come to an end. However, little is known about why episodes end when they do, or of the nature of the state which immediately follows a panic. The average duration of an episode has been estimated to last between 10 and 20 min (Barlow, 1988), or from 15 to 50 min (Taylor et al., 1986). The factors determining this duration—i.e., the factors that end a panic—should provide insight into what stops a panic and, more generally, might unearth some evidence on which to discriminate between the two leading theories of the disorder.

A predominantly psychological theory proposes that episodes of panic are caused by a catastrophic misinterpretation of one's bodily sensations (Clark, 1986). Several other psychological theories (see McNally, 1990) are consistent with Clark's cognitive model. The other theory, essentially biological, proposes that episodes of panic arise from the firing, or misfiring of a physiological suffocation alarm (Klein, 1993). Both theories are diathesis–stress models. In the biological model, the diathesis is the faulty alarm system (or sensitivity to suffocation) and the stress is a change in oxygen, carbon monoxide and/or carbon dioxide levels. In the cognitive model, the diathesis is the tendency to catastrophically misinterpret bodily sensations and the stress is the intrusion of particular of bodily sensations. Neither theory, however, addresses the question of why panic episodes come to an end.

1.1. Panic termination

In a retrospective interview study, Radomsky, Rachman, Teachman, and Freeman (1998) investigated the physiological, psychological and behavioral circumstances and conditions surrounding the end of panic episodes. A number of different types of panic triggers were reported (situational, physiological, cognitive, etc.). Participants also reported a number of offset cues (feeling calm, feeling exhausted, etc.), as well as a number of behaviors used to hasten the end of a panic (e.g., medicate, escape, breathing exercises, etc.). However, these results did not discriminate between the two theories of panic disorder. For example, the most common offset cue reported in the study—a reduction in bodily sensations—can be explained by either theory. A biological theory of panic could explain that the reduction in bodily sensations (especially dyspnea) simply indicates the “shutting off” of the suffocation alarm (presumably either spontaneously, or in response to lower concentrations of CO₂ in the bloodstream). Proponents of a cognitive theory could argue that reductions in bodily sensations remove the trigger for the faulty cognition that the person is threatened by an imminent catastrophic event. For example, a decrease in heart rate would weaken the cognition that the person is experiencing a heart attack. There are no longer any bodily sensations to misinterpret. That is, the diathesis (tendency to misinterpret bodily sensations) has no associated stress (bodily sensation). However,

this initial study was inconclusive because of its retrospective nature and it was felt that the collection of prospective data was required in order to clarify these results (Radomsky et al., 1998).

1.2. Refractory period

Radomsky et al. (1998) investigated the post-panic period and found that the majority of participants reported a panic-safe period immediately following an episode of panic. However, approximately half of participants in their sample also believed that they would nevertheless experience a second episode if they were re-exposed to the original trigger. Furthermore, approximately one-half of the participants reported a history of at least one set of repeated consecutive panic episodes. But, as refractory periods have been demonstrated in diverse areas of human biology including the periods following sexual responses in males (Kinsey, Pomeroy, & Martin, 1948) and neural firing (Hodgkin & Huxley, 1952), it is possible that a refractory period also ensues after the intense episodes that characterize panics.

If a post-panic refractory period does occur, it would be of considerable theoretical interest (both the psychological and the biological models would need to account for it), and could be put to therapeutic benefit (an ideal time perhaps for carrying out exposure exercises as the patient could be assured that the panic is unlikely to recur). Proponents of biological explanations could more easily accommodate a refractory period as such reactions are encountered in diverse biological systems, but a circumscribed period of unresponsiveness after a panic could present a problem for cognitive theories. It is possible that reduction in physiological sensations removes the basis for catastrophic misinterpretations, but to date, there is no direct evidence that panic offset results in immediate decreases in either. The possibility that a refractory period could occur in the presence of physiological sensations (e.g., panic has subsided, but heart rate is still rapid, breathing is still difficult) would present a problem for cognitive theorists.

The purpose of the present investigation, comprising three connected studies, was to examine the circumstances surrounding the conclusion of episodes of panic, and secondarily to find out if there is a post-panic refractory period. In Study 1, prospective data on panic behavior, onset and offset cues, and feelings of post-panic safety were collected. In Study 2, participants underwent a repeated panic provocation in order to test whether a post-panic refractory period is evident when panics are provoked in the laboratory. That is, do participants re-experience a panic episode when the laboratory-induced panic is immediately followed by a repeated laboratory provocation? Study 3 examined this question, but dealt with uncontrived panics that occurred outside of the laboratory. Participants were asked to recreate the conditions which triggered the initial uncontrived panic (to the best of their ability) within 5 min of the initial episode's conclusion, in order to test whether panic can recur shortly after a full panic episode concludes in everyday life.

2. Study 1

2.1. Method

2.1.1. Participants

Twenty-seven people who met DSM-IV criteria for panic disorder (APA, 1994) were recruited from the University of British Columbia Fear and Anxiety Laboratory register of research volunteers for participation in this study. Diagnoses were confirmed with the Anxiety Disorders Interview Schedule for DSM-IV (ADIS, DiNardo, Brown, & Barlow, 1994). Sixty-nine percent of the participants were female, and the total sample had a mean age of 35.1 (S.D. = 14.0). Participant psychometrics (Beck Depression Inventory—BDI, Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; Beck Anxiety Inventory—BAI, Beck, Epstein, Brown, & Steer, 1988; Anxiety Sensitivity Index—ASI, Reiss, Peterson, Gursky, & McNally, 1986; Agoraphobic Cognitions Questionnaire—ACQ, and the Body Sensations Questionnaire—BSQ, Chambless, Caputo, Bright, & Gallagher, 1984) are displayed in Table 1. Participants were offered CAD\$30 dollars and a book about panic disorder for their participation.

2.1.2. Measures

In addition to the measures above, a self-report Panic Record was given to participants to record their episodes of panic (see Appendix A). It included questions about panic onset and offset triggers, panic duration, sensations, and severity, whether or not the panic was expected, and panic behavior. The Panic Record also included questions about general feelings of safety, and predictions of feelings of safety for the post-panic period (e.g., how likely do you feel that another panic will occur within the following 30 min, 1 h, 24 h?). Most of these categories (e.g., onset and offset cues) were derived from our earlier work on the self-limiting nature of panics (Radomsky et al., 1998), while others were developed from earlier results specifically for the present study.

2.1.3. Procedure

After completing the ADIS-IV (DiNardo et al., 1994), participants completed a questionnaire package (including the measures above) and were given blank Panic Records (see Appendix A). These Panic Records were explained in detail by the

Table 1
Participant characteristics ($n = 27$)—Study 1

Scale	Mean	S.D.	Minimum	Maximum
BDI	16.8	13.0	0	46.0
BAI	24.8	15.2	0	55.0
ASI	31.8	14.7	2.0	59.0
ACQ	31.2	11.5	15.0	56.0
BSQ	44.6	14.8	21.0	77.0

experimenter, who went through the form item by item to ensure that participants understood how to fill out the form. Participants were instructed to monitor their panics for the following 6 weeks by filling out one Panic Record for each panic they experienced. Participants were then contacted weekly by telephone and asked to report the number of Panic Records filled out during the previous week. Participants returned to the lab after 6 weeks or after completing two Panic Records that met criteria (a minimum severity rating of three on a seven-point scale, a minimum of four panic sensations, and an episode that was unexpected).

2.2. Results

Twenty-three of 27 participants completed at least one Panic Record that met criteria for inclusion in our analysis (see above), and 20 of the 27 participants completed at least two records that met criteria, giving a total of 43 Panic Records. Results from Panic Records #1 and #2 were not combined for the purpose of analysis. The mean duration of panics reported on the first Panic Recorded was 39.7 min (S.D. = 38.7). The mean duration of panics recorded on the second Panic Record was slightly longer at 51.4 min (S.D. = 63.9). A paired-samples *t*-test revealed that this difference was not significant, $t_{19} = .81$, ns.

Participants reported a variety of triggers that they felt were responsible for the onset of panic episodes and these are displayed in Fig. 1. Almost half of the participants indicated (on Panic Records #1 and #2) that their panic was triggered by situational factors, while one quarter of participants said that the panic was spontaneous. Slightly fewer reported that physiological sensations triggered the panic. A minority of participants said that the episode was caused by their thoughts or emotional state.

Participants also reported several different factors that signaled the end of their panic episodes and these are displayed in Fig. 2. The most common signal that the panic had ended was a reduction in bodily sensations. The other frequently endorsed offset cue was a reduction in panic cognitions. Participants also endorsed a sense of feeling of calm, exhaustion, and positive emotion as other offset cues.

The Panic Records also illustrated a variety of panic behavior used to hasten the end of a panic. These results are displayed in Fig. 3. The most common panic behavior was making an effort to calm down. Participants also engaged in breathing exercises, distraction, and efforts to refocus. A smaller number used medications or left the situation (escape), and a few participants used visualization or did nothing.

According to the Panic Records participants felt somewhat (though not entirely) safe immediately following the panic. Participants reported a mean safety rating (“how safe do you feel now?”) of 3.4 (S.D. = 1.4, on a 0–7 scale, where 0 represents not at all safe and 7 represents completely safe) on Panic Record #1 and the identical safety rating of 3.4 (S.D. = 1.9) on Panic Record #2.

When asked, “how likely do you feel that another panic will occur in the following 30 min,” a mean probability rating of 2.0 (S.D. = 1.6, on a 0–7 scale, where 0 represents not at all likely and 7 represents completely likely) was found

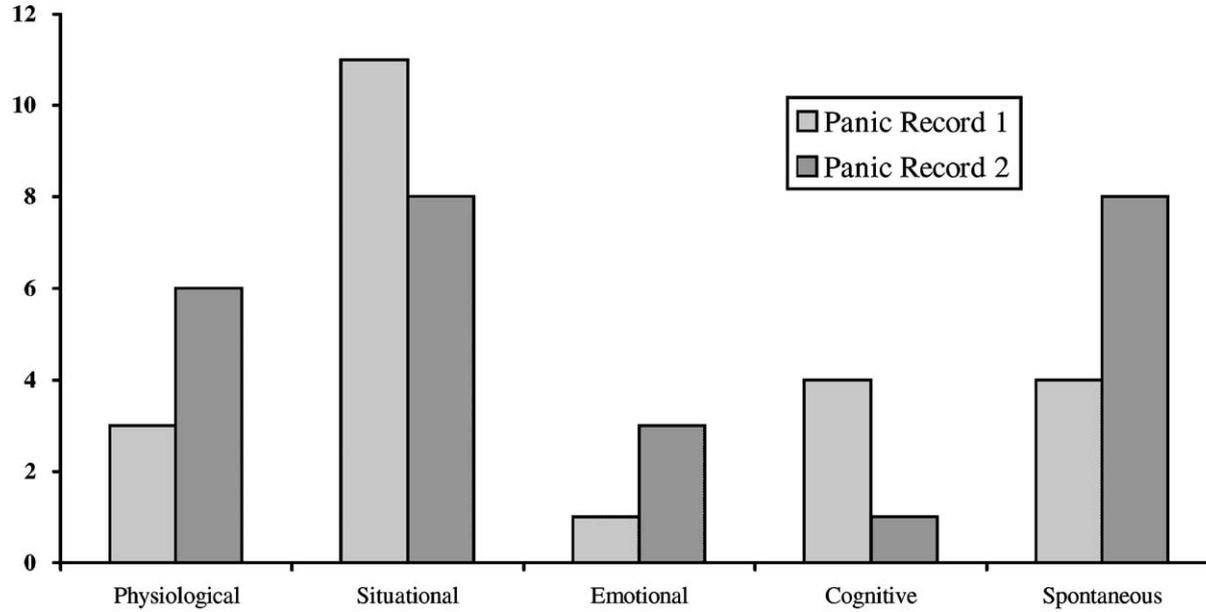


Fig. 1. What triggered the episode of panic? Number of endorsements made by participants for each type of panic trigger—Study 1.

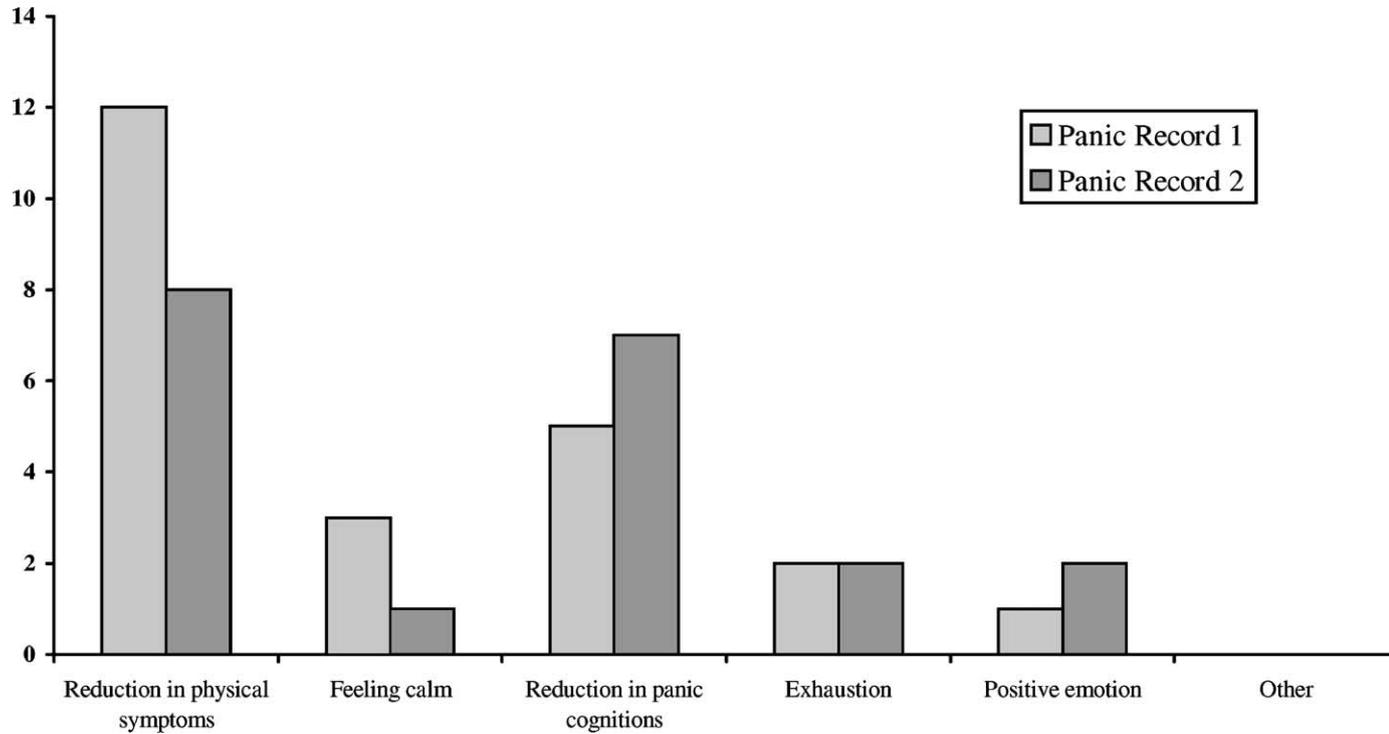


Fig. 2. How did you know the panic had ended? Number of endorsements made by participants for each type of offset trigger—Study 1.

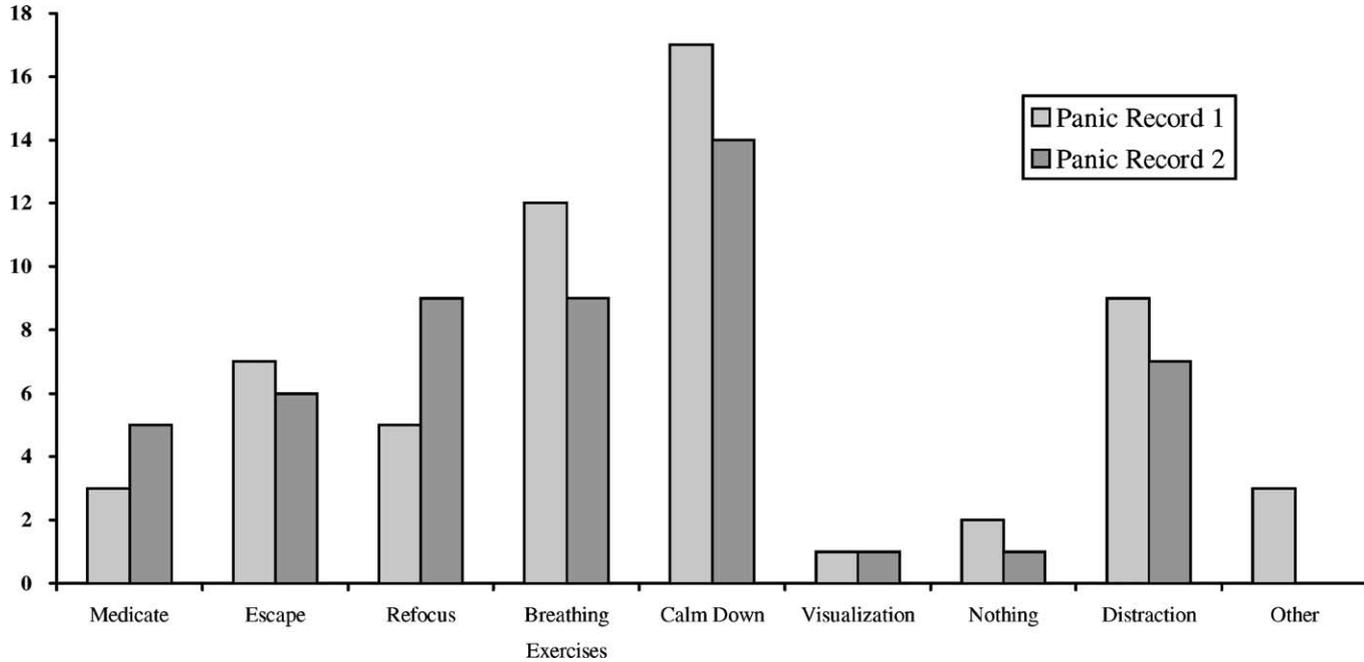


Fig. 3. What did you do to end the panic? Number of endorsements made by participants for each type of behaviour used to end an episode of panic—Study 1.

for the first record and a mean of 2.2 (S.D. = 2.3) for the second. These ratings remained relatively constant for the following 1 h ($M = 1.8$, S.D. = 1.9 for Panic Record #1; $M = 2.2$, S.D. = 2.2 for Panic Record #2), and 24 h periods ($M = 2.6$, S.D. = 2.3 for Panic Record #1; $M = 2.2$, S.D. = 1.0 for Panic Record #2).

3. Study 2

3.1. Method

3.1.1. Procedure

After completing Study 1, participants were asked to participate in Study 2. One participant from Study 1 refused to participate in Study 2 because he was unwilling to attempt the hyperventilation exercise for fear of experiencing a panic. Participants first completed a 3 min hyperventilation exercise in the laboratory with the experimenter, after which they were asked to fill out the Respiratory Task Questionnaire (RTQ)—a modified version of the Panic Record used in Study 1. These RTQ forms were explained in detail by the experimenter, who went through the form item by item to ensure that participants understood how to fill out the form. Participants were then randomly assigned to one of two groups: a no delay condition and a delay condition. The “no delay” group completed a second 3 min hyperventilation exercise with the experimenter immediately following completion of the RTQ, while the “delay” group waited 45 min before undergoing the second exercise. During this delay, participants were encouraged to relax and to read some magazines. All participants completed a second RTQ upon completion of the second hyperventilation exercise.

3.2. Results

Of the 25 participants who completed the first hyperventilation exercise, 9 reported experiencing an episode of panic during the breathing challenge. All nine participants who panicked during the first exercise, panicked again during the second exercise. Of these, four were in the “delay” condition and five were in the “no delay” condition. There were no differences between the groups on any measures.

Immediately following the first provoked panic, the nine participants reported feeling somewhat, though not very safe ($M = 4.4$, S.D. = 1.5, on a 0–7 scale, where 0 represents not at all safe and 7 represents completely safe). Participants predicted that they were not very likely to experience another panic within the 30 min following the first provocation ($M = 1.6$, S.D. = 1.5, on a 0–7 scale, where 0 represents not at all likely and 7 represents completely likely), or 1 h ($M = 1.8$, S.D. = 2.0). Participants predicted that they were somewhat more likely to experience another episode within the following 24 h ($M = 3.2$, S.D. = 1.9, on a 0–7 scale). It should be noted that after the first provocation, participants did not know that there would be a second hyperventilation exercise.

Hence, their feelings of relative safety were not groundless; they were not asked how likely they would be to experience a second panic if provoked.

Reports of safety were slightly lower and predictions about probability of re-panicking were slightly higher following the second hyperventilation exercise. Participant RTQ scores indicated that they felt less safe immediately following the episode ($M = 3.4$, $S.D. = 2.1$). Predictions of the likelihood of future panics also tended to increase from the first provocation. Participants endorsed a mean panic likelihood rating of 2.3 out of 7 ($S.D. = 2.1$) for the following 30 min, increasing to 3.1 ($S.D. = 2.2$) for the following hour, and 3.2 ($S.D. = 1.7$) for the following 24 h.

Although the duration of the provoked panics was not recorded, participants were asked to wait until the panic had subsided before completing the Respiratory Task Questionnaire. Using this measure, none of the provoked panics persisted beyond approximately 2–3 min.

4. Study 3

4.1. Method

4.1.1. Participants

Eleven people who met DSM-IV criteria for panic disorder (APA, 1994) were recruited from the University of British Columbia Fear and Anxiety Laboratory register of research volunteers for participation in this study. Participation in Study 1 or Study 2 had no effect on selection for participation in Study 3. All participants were female. Other participant characteristics including psychometric characteristics (ACQ, BSQ, and BDI) are displayed in Table 2. Participants were paid CAD\$30 and given a book about Panic Disorder for their participation.

4.1.2. Procedure

After completing the ADIS-IV (DiNardo et al., 1994), participants were given blank Panic Records. These Panic Records were explained in detail by the experimenter, who went through the form item by item to ensure that participants understood how to fill out the forms. Participants were instructed to take the Panic Records home and to live their lives as normally as possible. They were asked to fill out a Panic Record immediately after an episode of panic had ended, and then

Table 2
Participant characteristics ($n = 11$)—Study 3

Measure	Mean	S.D.	Minimum	Maximum
Age	30.5	9.7	19.0	51.0
BDI	16.4	12.1	3.0	30.0
ACQ	38.2	13.3	22.0	57.0
BSQ	49.7	14.8	27.0	70.0

to recreate the circumstances that led to or triggered the episode, to the best of their ability, within 5 min of the termination of the naturally occurring episode of panic. Participants were instructed to remain in this situation either for 15 min, or until they experienced a second panic (which was explained as possible, but not certain to occur), and then to fill out a second (modified) Panic Record form. Finally, participants were asked to mail both Panic Records back to the lab.

4.2. Results

Of the 11 participants who participated in the study, 8 experienced a (second) panic episode within 5 min of re-exposure to the panic-triggering situation. Only three participants reported some difficulty in recreating the triggering situation. (Two of these participants experienced a second panic nonetheless.)

Participants' scores indicated that they felt more safe immediately following the second episode than they did immediately following the first episode ($M = 3.3$, $S.D. = 1.9$ on a 0–7 scale for Panic #1 and $M = 4.5$, $S.D. = 1.1$, on a 0–7 scale for Panic #2). For the second (provoked) panic, participants endorsed a mean panic likelihood rating of 2.5 out of 7 ($S.D. = 1.6$) for the following 30 min, increasing to 2.8 ($S.D. = 2.3$) for the following hour, and 4.3 ($S.D. = 2.6$) for the following 24 h.

5. Discussion

5.1. Panic triggers and panic termination

On the whole, these results are similar to the retrospective findings on panic termination of Radomsky et al. (1998). In the area of onset cues, the main difference between the earlier results and current findings is the number of participants reporting that the panic was triggered by their emotional state. In the earlier study, 64% of participants cited emotional state as triggering the panic, compared to approximately 5% in the present study. This difference might be accounted for by the addition of “spontaneous” as an additional category in the present study, accounting for approximately 25% of responses. In the first study, the “spontaneous” responses may have been captured by the “emotional state” option, previously the most vague of the five choices. It should also be noted that, unlike the previous study, the onset and offset categories of the Panic Record in Study 1 were “forced choice” rather than the multiple endorsement strategy of the earlier retrospective reporting study. These prospective results show a similar distribution to the retrospective data (Radomsky et al., 1998). Furthermore, both physiological and psychological onset cues were reported. These results do not clearly discriminate between the two prevailing theories of panic although they do shed light on what participants identify as their panic triggers. It could be argued that the comparatively few spontaneous onsets provide some slight evidence for

the biological theory of panic (Klein, 1993), as cognitive theorists would have welcomed more cognitive and/or physiological sensation related onsets.

The current findings on offset cues are also consistent with our previous results. Participants tended to think that their panics ended because of a reduction in their bodily sensations and/or because of reductions in their fearful cognitions. These reports are consistent with Clark's (1986) cognitive theory. The biological theory garners some slight support from reports of exhaustion, but the offset value of a decline in physical symptoms can be accounted for equally well by either theory. Other offset triggers include the beliefs that panics ended because of exhaustion, because the panicker reached a state of "feeling calm" or a state in which they felt a "positive emotion".

Results on panic behavior confirmed the findings of earlier research. Inclusion of a new panic behavior (distraction) was commonly endorsed, though this had little effect on the distribution of endorsements of pre-existing panic behavior categories. Panic behavior was divided between behavior targeting cognitions and bodily sensations, providing potential support for both biological and psychological models of panic.

It is interesting to note that among our clinical sample, psychometric self-report data indicate that some participants obtained very low scores on some measures (e.g., a score of 0 on the BAI, and 2 on the ASI). The University of British Columbia Fear and Anxiety Laboratory register includes participants with diagnoses of varying severity, and with varying treatment histories (from none at all, to many courses of multiple types of previous treatment). What was important to the current investigation was presence of a diagnosis of Panic Disorder and presence of clinically significant episodes of panic. All participants satisfied these conditions and reported the presence of at least one (but usually many more than one) panic episode.

5.2. *Refractory period*

Despite participants' beliefs in a panic-safe period after conclusion of a panic episode (Radomsky et al., 1998), these results do not support the occurrence of a post-panic refractory period in panic disorder. All of the participants in Study 2 who panicked after the first hyperventilation exercise re-panicked after the second. There was no difference between incidence of panic episodes in the "delay" and "no delay" conditions. After recently experiencing a panic, all of the nine participants were very likely (completely likely) to re-panic; they appeared to anticipate another episode.

There are however, some problems with using hyperventilation in the laboratory as a method of panic provocation. This induction method appears to produce panics which are different from naturally occurring panics (e.g., in the present studies, the duration of "natural panics" was 40–50 min, but for laboratory-induced panics, it was less than 3 min). Papp, Klein, and Gorman (1993) have even argued that hyperventilation is more likely a symptom than a cause of panic (it increases, rather than decreases the amount of oxygen in the bloodstream). This

method of producing panic is less direct than CO₂ challenges, straw breathing, etc. Also, the question addressed in deliberately provoked panics is somewhat different from spontaneous panics (i.e., will you re-panic under provocation?).

It is interesting to note that predictions about the likelihood of experiencing an episode of panic for the period following the second breathing challenge increased on the RTQ—even when participants did not know that a second provocation was about to occur. While we did not specifically ask participants to predict the amount of fear that they would experience following hyperventilation exercises, it is possible that under-predicting their response on the first challenge might have led to an over-prediction of fear following the second. This would be consistent with previous work in the area of prediction of fear (see [Rachman, 1994](#)) which indicates that an under-predicted fear experience will tend to be followed by an inflation of subsequent fear predictions.

Laboratory-induced panics are less ecologically valid, less severe, and of shorter duration than spontaneous panics, so we used uncontrived panics (Study 3) to provide information about the post-panic period that follows naturally occurring episodes. In Study 3, the majority of participants experienced a second panic within minutes of the termination of an initial, *naturally occurring* panic episode. Together, results from Studies 2 and 3 provide negligible support for occurrence of a post-panic refractory period—contrary to the beliefs of many participants. This discrepancy between the apparent self-report of a post-panic safe period in the absence of such a period supports continued research using multiple methods of data collection in a variety of domains (e.g., self-report, observation, laboratory provocations, etc.).

These results, while providing fresh information on beliefs about panic termination and the post-panic period, do not enable us to tease apart biological and psychological models of panic disorder with any confidence. Information about offset cues and panic behavior can be used to support either type of theory. Absence of evidence for a refractory period is perhaps a disappointment for the suffocation alarm theory ([Klein, 1993](#)) but it was never explicitly predicted that the firing of this emergency system will be followed by a higher threshold for re-triggering the system so soon after the conclusion of a panic.

Finally, one is obliged to reconsider whether attempts to explain why episodes of panic come to an end, why indeed they are self-limiting, can help to discriminate between the primary theories of panic, biological or cognitive. Our conclusion is that unless and until biological and cognitive theorists make specific, explicit predictions and/or deductions about why panic episodes end, little progress can be expected.

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Appendix A. Panic Record

A panic is the sudden onset of intense apprehension, fear, or terror, often associated with feelings of impending doom. Some of the most common symptoms experienced during an episode are dizziness, shortness of breath, chest pain or discomfort, and trembling or shaking.

1. DATE: _____ START TIME: _____ STOP TIME: _____

2. WAS THE PANIC EXPECTED: YES / NO 3. WHERE DID THE PANIC OCCUR? _____

4. SEVERITY OF EPISODE: 0-----1-----2-----3-----4-----5-----6-----7 (circle)
nonc extreme

5. WHAT TRIGGERED THE EPISODE OF PANIC? (check only one)

Physiological sensations _____ The situation _____
My emotions/mood _____ Spontaneous panic _____
My thoughts _____

6. SENSATIONS: (circle one for each)

	Not at all	Somewhat	Extreme
Pounding Heart	0-----1-----2-----3-----4		
Tight/Painful Chest	0-----1-----2-----3-----4		
Shortness of Breath	0-----1-----2-----3-----4		
Dizzy	0-----1-----2-----3-----4		
Trembling	0-----1-----2-----3-----4		
Sweating Choking	0-----1-----2-----3-----4		
Nausea	0-----1-----2-----3-----4		
Unreality	0-----1-----2-----3-----4		
Numbness/ Tingling	0-----1-----2-----3-----4		
Hot/ Cold Flash	0-----1-----2-----3-----4		
Fear of dying	0-----1-----2-----3-----4		
Fear of going crazy	0-----1-----2-----3-----4		
Fear of losing control	0-----1-----2-----3-----4		

7. DID YOU DO ANYTHING TO HELP END THE EPISODE ? (check all that apply)

Medicate _____ Escape _____ Try to relax / Calm down _____
Breathing exercises _____ Refocus _____ Visualization _____
Stay in situation / Nothing _____ Distraction _____ Other _____

8. HOW DID YOU KNOW THE PANIC HAD ENDED ? (check only one)

My physical symptoms decreased _____ Feeling calm _____
My thoughts changed _____ Exhaustion _____
My mood improved / I felt happy _____ Other _____

9. IMMEDIATELY FOLLOWING THE EPISODE, DID YOU FEEL SAFE FROM HAVING ANOTHER PANIC ? 0-----1-----2-----3-----4-----5-----6-----7
not at all safe moderately extremely safe

10. HOW LIKELY DID YOU FEEL THAT ANOTHER PANIC WOULD OCCUR ...

	not at all	moderately	extremely likely
Within the following 30 minutes:	0-----1-----2-----3-----4-----5-----6-----7		
Within the following hour:	0-----1-----2-----3-----4-----5-----6-----7		
Within the following 24 hours:	0-----1-----2-----3-----4-----5-----6-----7		

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