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Evidence for a non-associative model of the acquisition of a fear of heights

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Abstract

Theories that fear results from previous traumatic experience (i.e. conditioning theories) have enjoyed widespread support for over half a century. Recent research, however, has cast doubt on the validity of these models in some specific phobias. Two studies on the etiology of height phobia have obtained findings consistent with a non-associative, evolutionary explanation of fear acquisition (Menzies and Clarke, 1993a, *Behaviour Research and Therapy*, *31*, 355–365; Menzies and Clarke, 1995a, *Behaviour Research and Therapy*, *33*, 795–805). Unfortunately, the retrospective nature of these studies limits the conclusions that can be drawn from these data. Like all retrospective research, these studies depend on adult subjects imperfect ability to recall conditioning events that may have occurred many years earlier. The present investigation overcomes these methodological shortcomings by examining the relationship between putative conditioning events before the age of 9 yr and the presence of height fear at ages 11 and 18 yr in a large birth cohort studied longitudinally. To our knowledge this is the first study that has prospectively examined the relationship between relevant traumatic events early in life and the onset of height fear in late adolescence. No positive relationship was found between a history of falls resulting in injury (i.e. fracture, dislocation, intracranial injury or laceration) before the age of 9 and fear of heights at age 11 or 18. Interestingly, falls resulting in injury between the ages of 5 and 9 occurred more frequently in those without a fear of heights at 18 ($P < 0.01$)—a finding in the opposite direction to that predicted by conditioning theory but consistent with non-associative theories of fear acquisition. In general, the results provide strong support for non-associative models of fear and are difficult to reconcile with conditioning theories.

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1. Introduction

Simple conditioning models of fear have failed to adequately explain the onset of clinically significant fears. Evidence that approximately two-thirds of cases result directly from aversive conditioning experiences has been presented (e.g. Ost, 1991; Ost and Hugdahl, 1981, 1983, 1985), yet other studies find: (1) equal numbers of conditioning events in both fearful and non-fearful groups (e.g. DiNardo et al., 1988; Menzies and Clarke, 1993a, 1995a); and (2) only a minority of cases can be attributed to Pavlovian conditioning events (Menzies and Clarke, 1993b; Jones and Menzies, 1995).

The program of research conducted by Ost and his colleagues cited above has been criticised on methodological grounds (e.g. Marks, 1987; Menzies and Clarke, 1994). It is apparent from the conditioning questions in their origins survey that no attempt was made to determine if the CS was effectively neutral prior to the proposed conditioning experiences, nor was identification of an independent UCS in the initial frightening encounter required. Indeed, these authors acknowledge that the UCS to the first anxiety attack could be identified in only a small number of 'conditioned' cases (Ost and Hugdahl, 1983). It is instructive that when an attempt was made to elicit this information, only 18% of 50 height-fearful *Ss* were defined as directly conditioned cases (Menzies and Clarke, 1993a). In a subsequent report, only 11% of a large sample of acrophobic patients were classified as directly conditioned cases (Menzies and Clarke, 1995a). These authors concluded their findings were consistent with non-associative, Darwinian accounts of fear acquisition. However, while methodologically superior to previous studies, Menzies and Clarke (1993a, 1995a) nevertheless relied upon retrospective self-reports to ascertain conditioning experiences—a practical, yet less than ideal methodology susceptible to bias and memory error (e.g. Henry et al., 1994).

Currently, the role played by conditioning processes in the acquisition of height fear remains uncertain. The present study was undertaken to shed light on the processes involved in the etiology of height fear by examining the frequency of falls in childhood (putative conditioning events) in those reporting fear of heights at ages 11 and 18. Specifically, the frequency of childhood falls in those developing a fear of heights will be compared with a 'no-fear' group in a large, unselected birth cohort. Based on the findings of Menzies and Clarke (1993a, 1995a), we hypothesised that there are no significant differences in the frequency of childhood falls between groups (height-fearful, and 'no-fear'). If the null hypothesis is upheld, presumptive evidence for the role of non-associative factors in the acquisition of height fear will be obtained. If rejected, the etiological role of conditioning processes in the acquisition of height fear will be confirmed.

A secondary analysis examined Davey's (1989) hypothesis that 'latent inhibition' protects against the development of fear in the presence of conditioning experiences. That is, individuals who experience conditioning events later in life may have developed some resistance to the acquisition of fear due to previous 'safe' or non-traumatic exposure to height situations. Two groups were examined: those experiencing childhood falls: (1) before the age of 5, and; (2) between the ages of 5 and 9. If Davey is correct, those experiencing falls between ages 5 and 9 will be less likely to develop height fear than those who sustained falls at an earlier age.

2. Method

2.1. Participants

The sample consisted of members of the Dunedin Multidisciplinary Health and Development Study, a longitudinal investigation of young people's health, development and behaviour from birth to adulthood. The study and sample members have been described in detail elsewhere (Silva and Stanton, 1996). Briefly, the Dunedin sample has been assessed with a diverse array of psychological, medical and sociological measures with high rates of participation at age 3 (n = 1037), 5 (n = 991), 7 (n = 954), 9 (n = 955), 11 (n = 925), 13 (n = 850), 15 (n = 976), 18 (n = 1008), and most recently 21 (n = 992). The present data were from assessments conducted at ages 3, 5, 7, 9, 11 and 18.

2.2. Falls

At each assessment from age 3 to age 9, parents were asked to indicate if their children had sustained injuries as a result of a fall sufficient to warrant medical attention. Fall categories included: fall on or from stairs, steps, ladders or scaffolding; fall from or out of a building or other structure (e.g. balcony, bridge, window, roofs); fall into a hole or other surface opening (e.g. pit, quarry, shaft, tank, well); and fall from playground equipment, a cliff, tree or bank. This information was obtained as part of a more general injury questionnaire completed by parents at ages 3, 5, 7 and 9. It was structured so that a description of the injury was first elicited, followed by the circumstances of injury and the treatment sought. Where possible, details regarding the nature of the injury were verified by reference to Public Hospital inpatient and radiology files. Only serious falls resulting in a fracture, dislocation, laceration or intracranial injury were included in this study.

2.3. Height fear

At age 11, 792 study members were presented with a list of 'simple' fears that included heights as part of the Diagnostic Interview Schedule for Children (DISC; Costello et al., 1982). They were asked "Are you afraid of heights, and if yes, do you try to stay away from heights?". Study members who responded 1 (sometimes) or 2 (always) to the question concerning heights were classified as height fearful at age 11 (n = 55, 6.9%).

Height fear was assessed at age 18 using a modified version of the Diagnostic Interview Schedule (DIS; Robins et al., 1981). The four modifications made to the DIS for the Dunedin study were: (1) to limit questions to the assessment of DSM-III-R criteria only; (2) to limit the assessment of symptoms to those occurring within the past 12 months only; (3) to limit assessment to only the more commonly occurring diagnoses for this age group; and (4) to limit response options to 'no' coded 0, 'yes, sometimes' coded 1, and 'yes, definitely' coded 2. (For more details, see Feehan et al., 1994.)

At age 18, 936 study members were asked "In the last year have you had a strong unreasonable fear of heights?". If a positive response was elicited to this gate question the Study members were then asked to respond '0 = no,' '1 = yes, sometimes,' or '2 = yes,

definitely' to the following: (1) "Have you been very upset with yourself for having that fear of heights?"; (2) "Has an unreasonable fear of heights interfered with your ability to do your work?"; (3) "When you have to approach heights does it almost always make you extremely nervous or panicky?"; and (4) "Has the unreasonable fear of heights kept you from going to a party, social events or meeting?"

Study members who responded 'yes, definitely' to the gate question concerning the presence of a strong unreasonable fear of heights were classified as having a mild fear of heights at age 18 (n = 107, 11.4%). Those study members who responded 'yes, definitely' to at least one of the four supplementary questions were classified as having a moderate fear of heights at age 18 (n = 59, 6.3%). Those who responded with 'yes, definitely' to at least two of the four questions and reported that the fear had been present for at least 1 month or more were defined as height phobic (n = 13, 1.4%).

3. Results

To test the relationship between falls and height fear, Fisher's Exact test for 2 × 2 tables was employed. This test was used in preference to the Pearson chi-square test because of the small numbers in some cells.

As can be seen in Table 1, there was no significant difference in the probability of developing height fear at age 11 between study members who did and did not suffer a fall resulting in a serious injury before age 5. That is, there was no significant relationship between childhood falls up to age 5 and height fear at age 11.

Table 2 shows that there was no significant difference in the probability of developing height fear at age 18 between study members who did and did not suffer a fall resulting in a serious injury before age 5. That is, there was no significant relationship between childhood falls up to age 5 and height fear at age 18.

As can be seen in Table 3, there was no significant difference in the probability of developing height fear at age 11 between study members who did and did not suffer a fall resulting in a serious injury between ages 5 and 9. That is, there was no significant relationship between childhood falls between ages 5 and 9 and height fear at age 11.

As shown in Table 4, study members who suffered a fall resulting in a serious injury between ages 5 and 9 were significantly less likely to develop a mild or severe height fear at age 18. When only study members with a severe height fear at age 18 were examined, this relationship was no longer significant.

It is also noteworthy that none of the 55 study members who completed the DIS at age 18 and had sustained a fall resulting in a serious injury before age 5 developed a height phobia at age 18. Similarly, none of the 60 participants who completed the DIS at age 18 and suffered a fall resulting in a serious injury between ages 5 and 9 had developed a height phobia at age 18.

Finally, of the 752 study members who completed the DISC at age 11 and DIS at 18, 52 had a height fear at age 11 and 94 had a height fear at age 18. Of the 52 *S*s at age 11, only 18 (34.6%) remained fearful of heights at age 18. That is, of the 94 *S*s who reported a fear of heights at age 18, the majority (n = 76, 80.9%) had not been fearful of heights at age 11.

Table 1
The relationship between serious childhood falls up to age 5 and self-reported height fear at age 11 in a longitudinal birth cohort

	Fall resulting in serious injury before age 5		
	Yes (n = 49)	No (n = 703)	P-value
Height fear at age 11			
No	47 (95.9%)	653 (92.9%)	
Yes	2 (4.1%)	50 (7.1%)	0.57

Note: 752 participants completed the Accident Questionnaire at age 5 and the DISC at age 11.

Table 2
The relationship between serious childhood falls up to age 5 and self-reported height fear at age 18 in a longitudinal birth cohort

	Fall resulting in serious injury before age 5		
	Yes (n = 55)	No (n = 820)	P-value
Height fear at age 18			
No	51 (92.7%)	725 (88.4%)	
Mild or severe	4 (7.3%)	95 (11.6%)	0.51
Severe	4 (7.3%)	49 (6.0%)	0.57

Note: 875 participants completed the Accident Questionnaire at age 5 and the DIS at age 18.

Table 3
The relationship between serious childhood falls between the ages of 5 and 9 and self-reported height fear at age 11 in a longitudinal birth cohort

	Fall resulting in serious injury between ages 5 and 9		
	Yes (n = 54)	No (n = 713)	P-value
Height fear at age 11			
No	50 (92.6%)	665 (93.3%)	
Yes	4 (7.4%)	48 (6.7%)	0.78

Note: 767 participants completed the Accident Questionnaire at ages 7 and 9 and the DISC at age 11.

Table 4
The relationship between serious childhood falls between the ages of 5 and 9 and self-reported height fear at age 18 in a longitudinal birth cohort

	Fall resulting in serious injury between ages 5 and 9		
	Yes (n = 60)	No (n = 789)	P-value
Height fear at age 18			
No	59 (98.3%)	687 (87.1%)	
Mild or severe	1 (1.7%)	102 (12.9%)	0.01*
Severe	1 (1.7%)	56 (7.1%)	0.17

* Two-sided P-value < 0.01 (df = 59).
Note: 849 participants completed the Accident Questionnaire at ages 7 and 9 and the DIS at age 18.

4. Discussion

The study of height fear constitutes an ideal paradigm for testing the validity of different models of fear acquisition. Height fear appears very early in life and in numerous land dwelling animals (Menzies and Clarke, 1993a). Further, falls are the most common accident occurring to children up to the age of 9 (Gafford et al., 1996). No evidence of a positive relationship was found between putative aversive conditioning events up to the age of 9 and height fear at age 11 and height fear or phobia at age 18. In contrast, falls from a height resulting in significant injury between 5 and 9 yr occurred with greater frequency in those without a fear of heights at 18—a finding in the opposite direction to that predicted by conditioning. Additionally, none of those who had developed a height phobia at age 18 had a history of a serious fall before the age of 9.

To our knowledge, this is the first study that has prospectively examined the relationship between traumatic events early in life and the onset of height fear in late adolescence. It represents an attempt to overcome some of the problems associated with retrospective methodologies (e.g. Henry et al., 1994; Menzies and Clarke, 1994) and can lead to more confident statements regarding the importance of non-associative processes in the development of height fear. Our findings are consistent with suggestions by other researchers, most notably Menzies and Clarke (1993a, 1995b), that the acquisition of height fear is most likely due to non-associative processes—not conditioning events (also see McNally and Steketee, 1985).

Non-associative theorists suggest that fear of some stimuli can develop without direct or indirect (vicarious) traumatic experience with the feared stimuli. These models differ from Seligman's (1971) earlier 'prepared learning' explanation in which at least one relevant CS–UCS pairing was required for fear acquisition. The present data are problematic for Seligman's position, since height fear should be over-represented in those who have experienced even a single severe fall. Other recent findings on the origins of biologically-neutral fears are also problematic for preparedness theory. Using an undergraduate student population, Harris and Menzies (1996) failed to find any history of relevant associative learning events in the development of a mixed set of fears deemed to be evolutionary-relevant (e.g. water, heights, rats, spiders). In contrast, 42% of fears deemed to be evolutionary-neutral (e.g. cars, dentists), involved a history of relevant associative learning events prior to onset (see also Poulton et al., 1997). Menzies and Harris (1997) have recently replicated their findings in a mixed clinical group of specific phobics. The absence of any conditioning episodes (direct or indirect) in evolutionary-relevant fears is difficult to reconcile with preparedness accounts.

The present findings are consistent with the non-associative model of Menzies and Clarke (1995b), which argues that only evolutionary-neutral phobias require relevant associative learning events for acquisition. Menzies and Clarke (1995b) suggest that most members of a species will show fear to a set of evolutionary-relevant stimuli on their first encounter (see also Menzies, 1995). The level of fear to a given stimulus will largely depend on individual differences due to genetic inheritance. The initial fearful response should diminish over time with repeated safe exposure to the feared stimuli—however, this may not occur when insufficient non-traumatic exposure occurs or in individuals who are slow to habituate (Clarke and Jackson, 1983). Further, Menzies and Clarke suggest that dishabituation may occur to previously mastered fears in the presence of severe, non-specific stressors. While Menzies and

his colleagues have reported data consistent with such dishabituation in several retrospective studies (Harris and Menzies, 1996; Jones and Menzies, 1995; Menzies and Clarke, 1993a,b, 1995a; Menzies and Harris, 1997), future research in the present cohort should attempt to explore this possibility.

The present finding of a small protective effect for falls between 5 and 9 yr and height fear at 18 was extremely interesting. It may partially be explained by Davey's (1989) theory of latent inhibition. He argues that non-fearfuls may have had more safe exposure to the CS than fearfuls prior to the traumatic conditioning episodes, thus protecting them from conditioning through latent inhibition. Our findings indicate that individuals who sustained injurious falls later in life were not only more unlikely to develop a fear of heights—they were significantly less likely to do so. It may be that 'exposure' to the feared outcome (i.e. fall and injury) innoculates some individuals against the development of a height fear (cf. Andrews et al., 1993). Alternatively, the finding may simply reflect the protective value of non-associative height fear. According to Menzies and Clarke's (1993a, 1995a, 1995b) model, height fear arises in the absence of traumatic associative learning and serves to protect the individual from future dangerous encounters with heights. Those individuals with a low level of fear should experience more serious falls according to this model, since they are more likely to engage in risky behaviours near height stimuli.

Currently, it appears that conditioning processes are not critical in the development of a fear of heights. However, it may be that a number of the study members who went on to develop a fear of heights experienced traumatic conditioning events after the age of 9. Nonetheless, and especially as height fear is assumed to have an early age of onset, these findings provide strong evidence in support of a non-associative theory of fear acquisition.

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References

Andrews, G., Page, A. C., & Neilson, M. (1993). Sending your teenagers away. Controlled stress decreases neurotic vulnerability. *Archives of General Psychiatry, 50,* 585–589.

Clarke, J. C., & Jackson, J. A. (1983). *Hypnosis and behavior therapy: The treatment of anxiety and phobias.* New York: Springer.

Costello, A., Edelbrock, C., Kalas, R., Kessler, M., & Klaric, S. (1982). *National Institute of Mental Health Diagnostic Interview Schedule for Children.* Rockville, MD: National Institute of Mental Health.

Davey, G. C. L. (1989). Dental phobias and anxieties: Evidence for conditioning processes in the acquisition and modulation of a learned fear. *Behaviour Research and Therapy, 27,* 51–58.

DiNardo, P. A., Guzy, L. T., Jenkins, J. A., Bak, R. M., Tomasi, S. F., & Copland, M. (1988). Etiology and maintenance of dog fears. *Behaviour Research and Therapy, 26,* 241–244.

Feehan, M., McGee, R., Nada Raja, S., & Williams, S. M. (1994). DSM-III-R disorders in New Zealand 18-year-olds. *Australian and New Zealand Journal of Psychiatry, 28,* 87–99.

Gafford, J. E., Silva, P. A., & Langley, J. D. (1996). Injuries. In P. A. Silva & W. R. Stanton (Eds.), *From child to adult: The Dunedin Multidisciplinary Health and Development Study*. Auckland: Oxford University Press.

Harris, L. M., & Menzies, R. G. (1996). Origins of specific fears: A comparison of associative and non-associative accounts. *Anxiety, 2*, 248–250.

Henry, B., Moffitt, T. E., Caspi, A., Langley, J. D., & Silva, P. A. (1994). On the "Remembrance of Things Past": A longitudinal evaluation of the retrospective method. *Psychological Assessment, 6*, 92–101.

Jones, M. K., & Menzies, R. G. (1995). The etiology of spider phobia. *Anxiety, Stress and Coping, 8*, 227–234.

Marks, I. M. (1987). *Fears, phobias and rituals: Panic, anxiety and their disorders*. New York: Oxford University Press.

McNally, R. J., & Steketee, G. S. (1985). The etiology and maintenance of severe animal phobias. *Behaviour Research and Therapy, 23*, 431–435.

Menzies, R. G. (1995). The uneven distribution of fears and phobias: A non-associative account. *Behavioural and Brain Sciences, 18*, 305–306.

Menzies, R. G., & Clarke, J. C. (1993a). The etiology of fear of heights and its relationship to severity and individual response patterns. *Behaviour Research and Therapy, 31*, 355–365.

Menzies, R. G., & Clarke, J. C. (1993b). The etiology of childhood water phobia. *Behaviour Research and Therapy, 31*, 499–501.

Menzies, R. G., & Clarke, J. C. (1994). Retrospective studies of the origins of phobias: A review. *Anxiety, Stress and Coping, 7*, 305–318.

Menzies, R. G., & Clarke, J. C. (1995a). The etiology of acrophobia and its relationship to severity and individual response patterns. *Behaviour Research and Therapy, 33*, 795–805.

Menzies, R. G., & Clarke, J. C. (1995b). The etiology of phobias: A non-associative account. *Clinical Psychology Review, 15*, 23–48.

Menzies, R. G., & Harris, L. M. (1997). Mode of onset in evolutionary-relevant and evolutionary-neutral phobias: Evidence from a clinical sample. *Depression and Anxiety*, in press.

Ost, L. G. (1991). Acquisition of blood and injection phobia and anxiety response patterns in clinical patients. *Behaviour Research and Therapy, 29*, 323–332.

Ost, L. G., & Hugdahl, K. (1981). Acquisition of phobias and anxiety response patterns in clinical patients. *Behaviour Research and Therapy, 19*, 439–447.

Ost, L. G., & Hugdahl, K. (1983). Acquisition of agoraphobia, mode of onset and anxiety response patterns. *Behaviour Research and Therapy, 21*, 623–632.

Ost, L. G., & Hugdahl, K. (1985). Acquisition of blood and dental phobia and anxiety response patterns in clinical patients. *Behaviour Research and Therapy, 23*, 27–34.

Poulton, R., Thomson, W. M., Davies, S., Kruger, E., Brown, R. H., & Silva, P. A. (1997). Good teeth, bad teeth and fear of the dentist. *Behaviour Research and Therapy, 35*, 327–334.

Robins, L. N., Helzer, J. E., Croughan, J., & Ratcliff, K. S. (1981). National Institute of Mental Health Diagnostic Interview Schedule: Its history, characteristics, and validity. *Archives of General Psychiatry, 38*, 381–389.

Seligman, M. E. P. (1971). Phobias and preparedness. *Behavior Therapy, 2*, 307–320.

Silva, P. A., & Stanton, W. R. (1996). *From child to adult: The Dunedin Multidisciplinary Health and Development Study*. Auckland: Oxford University Press.