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A longitudinal study of the etiology of separation anxiety

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Abstract

A longitudinal examination of the relation between separation experiences and the development of separation anxiety at age 3, 11 and 18 years was conducted. Three associative pathways (Rachman, S.J. (1978). *Fear and courage*. San Francisco: W.H. Freeman) were assessed. Conditioning events were not related to separation anxiety at age 3. Vicarious learning (modelling) in middle childhood (age 9 years) was the conditioning variable most strongly related to separation anxiety at age 11, accounting for 1.8% of the variance in symptoms. Separation experiences (hospitalisations) before the age of 9 were inversely correlated with separation anxiety at age 18. That is, more overnight hospital stays in childhood were related to *less* separation anxiety in late adolescence. However, none of these conditioning correlates remained significant predictors of separation anxiety in adjusted regression models. In contrast, certain “planned” separations in early–mid childhood were associated with lower levels of separation anxiety at later ages. Generally, the findings were consistent with predictions from the non-associative theory of fear acquisition. That vicarious learning processes appeared to modulate, albeit to a minor degree, the expression of separation anxiety during mid–late childhood suggests that there may be critical periods during which some individuals are susceptible to the interactive effects of both associative and non-associative processes. These findings serve to illustrate the complexity of fear acquisition, the relevance of developmental factors and the likely interplay between associative and non-associative processes in the etiology of fear and anxiety. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Fear of separation is common to many species (Kraemer 1985, 1992; McKinney, 1985; Mineka, 1982). Human infants may cry at their guardians departure from 8 to 24 months, with likelihood peaking around 13 months (Kagan, Kearsley & Zelazo, 1978) and decreasing from 30 months onward (Cox & Campbell, 1968; Gershaw & Schwartz, 1971). The anxiety is greater if the child is in an unfamiliar setting. This occurs despite differences in child-rearing practices across a variety of settings, including the United States, Guatemala and Israel (Kagan et al., 1978). Separation anxiety is seen in children with Down's syndrome, in the blind (who recognise the absence of their caretaker by sound) and is the same if the caretaker is male or female, or if the child was reared at home or in day care (Marks, 1987). It is easy to speculate on the adaptive value of this response (Marks & Nesse, 1994), and Bowlby (1973) and Marks (1987) have argued persuasively that separation from a caretaker increases the likelihood of negative outcomes for many species.

Retrospective reports suggest that separation anxiety is unrelated to the amount of previous time spent with the caretaker, and more importantly, appears to be unrelated to past aversive experiences during separation (Bowlby, 1973; Clarke & Jackson, 1983; Marks, 1987). This is consistent with a non-associative account of fear acquisition (Menzies & Clarke, 1995) that predicts that aversive associative learning is not a prerequisite for evolutionary-relevant fears. Consistent with this hypothesis, recent prospective data have demonstrated that evolutionary-relevant fears such as fear of height and water are largely unrelated to a history of direct aversive conditioning events (Poulton, Davies, Menzies, Langley & Silva, 1998; Poulton, Menzies, Craske, Langley and Silva, 1999). However, the primary focus of both of these prospective studies was on the role of direct conditioning events in fear development, and two other major associative pathways for fear acquisition were not systematically assessed. Specifically, the role of vicarious learning/modelling and the transmission of information has yet to be compared against a non-associative account of the development of evolutionary-relevant fear in a prospective study. A comprehensive test of the non-associative model requires that all three of the associative pathways described by Rachman (1977) (i.e. direct conditioning, vicarious learning and transmission of information) be evaluated against the non-associative account.

We were also interested in identifying experiential factors associated with decreases in levels of separation anxiety. It was hypothesised that learning not to fear separation would be associated with planned, safe and non-painful separations (e.g. pre-school attendance), whereas unpredictable, and potentially more aversive experiences (e.g. acute hospitalisations) would be associated with higher levels of separation anxiety (see Rachman, 1978: 254 for a discussion of "Learning not to fear").

Separation anxiety should be studied beyond the age at which it is normative, that is, after the age of 30 months (Marks, 1987). Presumably high levels beyond this age reflect a more extreme form of separation anxiety, one that may be qualitatively different and of clinical relevance. Accordingly, this study assessed a variety of separation experiences from birth through to age 18 years in a relatively large, unselected birth cohort and related these to measures of separation anxiety at ages 3, 11 and 18 years. Because low socio-economic status (SES) has been suggested to be a risk factor for separation anxiety (Bird, Gould, Yager, Staghezza & Canino, 1989), we also controlled for SES in analyses.

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 & 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 ($n=1037$), age 5 ($n=991$), age 7 ($n=954$), age 9 ($n=955$), age 11 ($n=925$), age 13 ($n=850$), age 15 ($n=976$), age 18 ($n=993$), age 21 ($n=992$), and most recently age 26 ($n=980$).

2.2. Dependent measures

The dependent variables consisted of measures of separation anxiety at ages 3, 11 and 18 years.

2.2.1. Age 3 assessment

Separation anxiety was measured at age 3 by observation during two independent assessments: one by a psychometrist and one by a medical doctor. The psychometrist's assessment lasted 20–80 min ($\bar{x}=46$ min, $SD=8.5$ min) and involved tests of language development, motor co-ordination and picture vocabulary. The medical assessment lasted an average of 35 min and involved a visual acuity test, anthropometric measurement and an interview about the study member's medical history.

Separation anxiety was rated on the basis of how well the study member was able to cope with separating from physical contact with their mother and sit on a chair in the same room as her. Ratings were made on a five-point scale derived from the Behaviour Profile used in the American Collaborative Study (American Collaborative Study on Cerebral Palsy and Mental Retardation, 1970; see Table 1).

2.2.2. Age 11 assessment

At age 11 study members were interviewed using version XIII–III of the Diagnostic Interview Schedule, Child Version (DISC-C; Costello, Edelbrock, Kalas, Kessler & Klaric, 1982), which contains a number of items clustered by disorder and based on *DSM-III* criteria. There were 20

Table 1
Five-point rating scale for age 3 separation anxiety measure

1	Shows no concern; eager to leave mother and sit on chair.
2	Shows very little concern; shows little cautiousness and sits on chair without preamble.
3	May show some initial reticence, which is felt to be entirely appropriate; separates from mother after some minimal reassurances and explanations.
4	More than usual amount of concern; more disturbed than most, but finally is able to separate; may need continuing reassurances.
5	Very upset, cries, clings to mother, may have tantrum or withdraw, refusing to look at examiner or talk to her.

separation anxiety items, including: “Do you worry that they [your parents] might go away and not come back?”, “Do you often ask your parents to stay close to you so you can go to sleep?”, and “Do you get upset and worried when you go away from home?”. All items were rated on three-point scales (0=no; 1=sometimes; 2=yes). An age 11 separation anxiety symptom scale was created by summing scores from these items. Higher scale scores represent greater levels of separation anxiety.

2.2.3. Age 18 assessment

At age 18 study members were administered a mental health interview consisting of items derived from version III-R of the Diagnostic Interview Schedule (Robins, Helzer, Cottler & Goldring, 1989; Robins, Helzer, Croughan & Ratcliff, 1981). Only items which gave *DSM III-R* classifications were used. There were 11 separation anxiety items, including “Do you worry that something bad might happen to you so you couldn’t see your parent(s) again?”, “Do you try to stay home to be with your parent(s)?”, “Would you get upset if you were at home by yourself for more than a short time?”, and “Do you often have bad dreams about being away from your parents?”. All items were rated on three-point scales (0=no; 1=sometimes; 2=yes). An age 18 separation anxiety symptom scale was created by summing scores from these items. Higher scale scores represent greater levels of separation anxiety.

2.3. Independent measures

2.3.1. Direct conditioning events

1. Separations from mother at age 3. As part of the age 3 assessment, the mother was asked to report the number, duration and reasons for separations between herself and her child from birth to 3 years. These were categorised as follows:
 - 1.1. never for >7 days;
 - 1.2. one separation of >7 days and <1 month;
 - 1.3. two separations of >7 days and <1 month;
 - 1.4. three or more separations of >7 days and <1 month;
 - 1.5. at least one separation of 3 or more months;
 - 1.6. n/a, mother figure changed in the last 2.5 years.
2. Hospitalisations at ages 3, 7, 9, 11 and 13. Either the mother (age 3, 7, 9 and 11 assessments) or the accompanying parent (age 13 assessment) was asked whether the study member had spent any time in hospital during the previous 2 years (data were not available for the age 5 assessment). If the study member had, the duration of each stay was obtained from the parent. From this information, the total number of days spent alone overnight in hospital by the study member was calculated at each age. Additionally, the total number of days of hospitalisation up to the age of 3 were categorised to allow for a comparable analysis to that for separations from mother prior to age 3. The groups were: 0 days; 1–7 days; 8–30 days; and >30 days of hospitalisation.
3. Parental separations at ages 13 and 15. As part of the age 13 and age 15 assessments, the accompanying parent was asked whether the study member had, during the previous 2 years, experienced a separation from either of their parents which lasted 3 or more months. This was a Yes/No question. Those study members who had experienced a parental separation solely

resulting from the death of a parent were excluded from the “Yes” group, as parental death was considered separately (see (4) below).

4. Parental deaths before age 11 and between ages 11 and 18. At the age 26 assessment, study members who had experienced the death of a parent were asked how old they were when their parent died. From this information, two groups were formed:
 - 4.1. parent died before age 11 ($n=21$); and
 - 4.2. parent died between age 11 and age 18 ($n=30$).

2.3.2. Vicarious conditioning or modelling events

1. Mother’s fear at age 7 and age 9. At the age 7 and age 9 assessments mothers were asked, “Are you scared to be alone or when there are no friends near you?”, and “Are you frightened of going out alone or of meeting people?”. These were Yes/No questions. For the purposes of analysis, each question at each assessment was dealt with separately.
2. Mother’s separation anxiety at the age 5 assessment. At the age 5 assessment the study member’s teacher was asked to indicate (Yes or No) whether the mother was unduly anxious about her child starting school.
3. Overprotective mother. At the Age 5 assessment teachers were also asked to indicate (Yes or No) whether the study members mother was overprotective.

2.3.3. Transmission of information

1. Separation threats as punishment between age 5 and age 9. At the age 5, age 7 and age 9 assessments mothers were asked, “Yesterday, how many times did you say you’ll send (the study member) away or that you will have to go away if (the study member) is naughty?”. From this information, two groups were formed:
 - 1.1. study members whose mothers had (on at least one assessment between age 5 and 9 years) threatened them with separation ($n=34$); and
 - 1.2. study members who had never been threatened with separation ($n=860$).

2.3.4. Protective events

1. Preschool attendance before age 5. At the age 5 assessment, parents were asked if their child had attended preschool facilities and if so, from what age and how many half-days they had attended. Two variables were created describing:
 - 1.1. the age at which children were separated from their mother in a regular and planned manner due to attendance at preschool; and
 - 1.2. the length of time (in half-days) spent at preschool up to age 5 years.
2. Planned versus unplanned separation experiences. At the age 9 assessment, the parents of study members were asked a series of questions about the circumstances surrounding admission of their child to hospital in the previous 2 years. They were asked “Was the admission acute or planned?” Response options were 1=acute; 2=planned; 3=not sure.

2.3.5. Social deprivation control variable.

1. Socio-economic status (SES). For prediction of age 3 and age 11 measures, the study member's SES was determined by the father's occupation at the time of the study member's birth and was classified according to the six-point Elley and Irving (1972) scale. If there was no information regarding the father's occupation at the time of the study member's birth, SES was determined by the father's occupation when the study member was three. If this was not available, the mother's occupation when the study member was three was used. If this was not available, the occupation held by the mother's father for the majority of his working life was used. The distribution of study members in SES codes, from highest code to lowest, was: code 1: $n=123$ (12.0%), code 2: $n=113$ (11.0%), code 3: $n=160$ (15.6%), code 4: $n=380$ (37.1%), code 5: $n=186$ (18.2%), and code 6: $n=61$ (6.0%). For prediction of age 18 outcomes, the study member's SES was determined using the highest SES level of either parent (as classified by Elley & Irving, 1972) averaged across assessments from birth through to age 15. These ranged from 1 (highest) to 6 (lowest) ($\bar{x}=3.25$, $SD=1.14$).

2.4. Statistical analysis

In situations where there were missing data from study members for certain measures, cases were excluded from analyses using those measures.

The distribution of data for the separations from mother, hospitalisation and symptom scale variables were positively skewed; in fact the mode was typically the lower bound (for example, most study members scored zero on the symptom scale variables). Data for all such variables were therefore inversely transformed ($1/[x+1]$) for the purposes of linear regression analyses. The inverse transform was chosen ahead of other transforms (e.g. logarithmic, square root) because it produced the most normal, linear and homoscedastic data.

Dichotomous variables were created for separation anxiety at age 3 by parsing out those study members for whom *both* the doctor and the psychometrist endorsed 4s or 5s on the behavioural ratings (see Table 1) from the remainder. Thus, study members were categorised as either separation anxious ($n=54$) or not separation anxious ($n=970$). A series of 2×2 χ^2 tests using this dichotomous variable and the age 3 independent variables (separations from mother and hospitalisations) compared reference groups (never separated for >7 days and no hospitalisations, respectively) to other groups according to their level of separation anxiety.

Correlations between the age 3 dependent variable, age 11 symptom scale and the age 18 symptom scale were determined using the Spearman's rank correlation test.

Correlations between the separation anxiety symptom scale at age 11 and the independent variables measured up to the age 11 assessment, and the separation anxiety symptom scale at age 18 and the independent variables measured up to the age 18 assessment were also determined using the Spearman's rank correlation test. Independent variables were then entered into linear regression equations with the symptom scales with which they were correlated at a level of significance of $p < 0.25$. The independent variables were entered in a step-wise fashion such that the independent variable that was correlated most strongly with separation anxiety was entered first, followed by the independent variable that was correlated next most strongly, and so on.

3. Results

3.1. Age 3

A total of 653 (63.2%) study members had never been separated from their mother for more than a week prior to age 3, 265 (25.7%) had experienced one separation of more than a week but less than a month, 51 (4.9%) had experienced two separations of more than a week but less than a month, 21 (2.0%) had experienced three or more separations of more than a week but less than a month, 16 (1.5%) had experienced at least one separation of 3 months or more, and 27 (2.6%) had experienced a change of mother figure in the preceding 2.5 years. The number of days study members spent alone overnight in hospital at age 3 ranged from 0–63 (\bar{x} =1.97, SD =7.27) and was distributed as follows: 0 days: n =828 (79.9%), 1–7 days: n =140 (13.5%), 8–30 days: n =51 (4.9%), and >30 days: n =17 (1.6%).

Crosstabulations between separations from mother and separation anxiety, and hospitalisations and separation anxiety are presented in Table 2. No significant relations were found. χ^2 tests were used to test whether the $SES \times$ separations from mother and $SES \times$ hospitalisations interactions were related to age 3 separation anxiety (results not shown). Study members with high SES (codes 1 and 2) were found to have less separation anxiety if they had experienced at least one separation of 3 months or more than if they had experienced no separations of greater than a week [$\chi^2(1)$ =8.07, p <0.01]. However, caution is required when interpreting this result as the number of high SES study members classified as separation anxious was low (n =8). Finally, when gender differences in the age 3 separation anxiety ratings (see Table 1) made by both doctors [$F(1,1026)$ =3.56, p =0.06] and psychometrists [$F(1,1028)$ =0.50, p =0.48] were examined, no significant sex differences were found.

Table 2

The relationship between early separation experiences and separation anxiety at age 3 in a longitudinal birth cohort; 2×2 χ^2 tests were conducted between the referent groups (never separated from mother; 0 days hospitalised) and the other groups for the dichotomous separation anxiety variable (Fisher's Exact test was used where cell $ns < 5$)

Separations	Separation anxious	Not separation anxious	χ^2
<i>(a) Separations from mother at age 3 (column %)</i>			
Never for >7 days	31 (57.4)	615 (63.6)	–
Once for 7–30 days	19 (35.2)	243 (25.1)	2.16, NS
Twice for 7–30 days	1 (1.9)	50 (5.2)	0.87, NS
More than twice for 7–30 days	1 (1.9)	19 (2.0)	0.00, NS
Once for 3 months or more	1 (1.9)	14 (1.4)	0.11, NS
NA; mother changed in last 2.5 years	1 (1.9)	26 (2.7)	0.07, NS
<i>(b) Hospitalisations at age 3 (column %)</i>			
No hospitalisations	44 (81.5)	776 (80.1)	–
1–7 days in hospital	7 (13.0)	131 (13.5)	0.02, NS
8–30 days in hospital	2 (3.7)	49 (5.1)	0.20, NS
More than 30 days in hospital	1 (1.9)	13 (1.3)	0.09, NS

3.2. Age 11

Separation anxiety symptom scale scores ranged from 0 to 22 (\bar{x} =1.34, SD =2.76). Separation anxiety at age 3 was not correlated with the age 18 symptom scale (r =0.033, p =0.362). Females reported significantly more separation anxiety symptoms at age 11 than males [$F(1,790)$ =23.79, p <0.001].

Descriptive results of the independent variables collected between ages 3 and 11 are as follows. Hospitalisations at age 7 ranged from 0 to 130 (\bar{x} =1.22, SD =7.92), at age 9 ranged from 0–92 (\bar{x} =0.61, SD =4.04) and at age 11 ranged from 0–30 (\bar{x} =0.29, SD =1.60). Twenty-five mothers (2.7%) said they were afraid of being alone at the age 7 assessment and, similarly, 25 mothers (2.7%) said they were afraid of being alone at the age 9 assessment. Nine mothers admitted this fear at both assessments. Coincidentally, the exact same number of mothers (56, 6.0%) said they were afraid of going out alone at the age 7 and age 9 assessments, of which 22 reported this fear at both assessments. At the age 5 assessment, teachers rated 56 (5.4%) mothers as being separation anxious and 67 (6.5%) mothers as being overprotective.

Mother's fear of going out alone at ages 7 and 9 and mother's fear of being alone at age 9 were positively correlated with separation anxiety at age 11, as was experiencing a parental death prior to the age of 11 (see Table 3, column 1).

The combined total variance (R^2) explained by those variables entered into the regression equation with the separation anxiety symptom scale was 2.5% (see Table 3, column 3). Mother's fear of going out alone at age 9 accounted for 1.8% of the variance. This contribution to the variance was significantly different from zero [$F(1,653)$ =11.74, p <0.01]. However, this contri-

Table 3

Regression analysis of age 11 separation anxiety symptom scale scores on those independent variables which, when correlated with the age 11 separation anxiety symptom scale, produced correlation coefficients with significance levels of p <0.25

Independent variables	Spearman's r value (p value)	R^2 change (%)	Cumulative R^2 change (%)
Mother's fear of going out alone at age 9	0.119 (0.001)	1.8	
Mother's fear of being alone at age 9	0.097 (0.007)	0.2	2.0
Mother's fear of going out alone at age 7	0.076 (0.035)	0.0	2.0
Parent died before age 11	0.070 (0.049)	0.1	2.1
Hospitalisations at age 11	-0.068 (0.066)	0.1	2.2
Mother's fear of being alone at age 7	0.059 (0.100)	0.0	2.2
SES	0.057 (0.108)	0.2	2.4
Hospitalisations at age 9	-0.054 (0.146)	0.1	2.5

bution failed to remain significant after controlling for the number of variables entered into the equation (and hence the number of potential post hoc tests) [$F(7,647)=1.68$, NS]¹. No other variable made a contribution to the variance which significantly differed from zero.

3.3. Age 18

Separation anxiety symptom scale scores ranged from 0 to 18 ($\bar{x}=1.36$, $SD=2.56$). Separation anxiety at age 3 was not correlated with the age 18 symptom scale ($r=0.003$, $p=0.926$), however, the age 11 and age 18 symptom scales were correlated ($r=0.160$, $p<0.001$). As for age 11, females reported significantly more separation anxiety symptoms at age 18 than males [$F(1,933)=49.62$, $p<0.001$].

Descriptive results of the independent variables collected between ages 11 and 18 are as follows. Hospitalisations at age 13 ranged from 0–25 ($\bar{x}=0.39$, $SD=1.85$). Seventy-nine (9.7%) study members reported having experienced a long (3+ months) separation from one or both of their parents in the 2 years prior to the age 13 assessment, while 136 (14.8%) reported having experienced a similar type of separation in the 2 years prior to the age 15 assessment.

Overnight stays in hospital prior to age 3 and age 9 were negatively correlated with separation anxiety at age 18 (see Table 4, column 1). That is, as the total number of days spent alone overnight in hospital increased, the likelihood of reporting separation anxiety symptoms at age 18 decreased. In contrast, the loss of a parent between the age of 11 and 18 and lower SES were positively associated with separation anxiety at age 18.

The variables entered into the regression equation with the separation anxiety symptom scale

Table 4

Regression analysis of age 18 separation anxiety symptom scale scores on those independent variables which, when correlated with the age 18 separation anxiety symptom scale, produced correlation coefficients with significance levels of $p<0.25$

Independent variables	Spearman's r value (p value)	R^2 change (%)	Cumulative R^2 change (%)
SES	0.105 (0.001)	1.2	
Hospitalisations at age 3	-0.089 (0.006)	0.8	2.0
Hospitalisations at age 9	-0.086 (0.018)	0.7	2.7
Parent died between age 11 and age 18	0.071 (0.029)	1.0	3.7
Mother's separation anxiety at age 5	-0.060 (0.072)	0.5	4.2
Hospitalisations at age 7	-0.054 (0.123)	0.2	4.4

¹ A test suggested by Larzelere and Mulaik (1977) was used. The F ratio is calculated to be $r^2(N-p)/[(1-r^2)(p-1)]$, where r is the regression coefficient, p is the number of variables entered into the regression equation and N is the number of cases.

explained a total of 4.4% of the variance (see Table 4, column 3). In the unadjusted regression model, four variables made significant individual contributions to the variance. Lower SES [1.2%: $F(1,710)=8.27$, $p<0.01$] and a parental death between the ages of 11 and 18 [1.0%: $F(1,707)=7.65$, $p<0.01$] were positively related to age 18 separation anxiety scale scores, while hospitalisations at age 3 [0.8%: $F(1,709)=6.15$, $p<0.05$] and age 9 [0.7%: $F(1,708)=5.21$, $p<0.05$] were negatively related to age 18 separation anxiety scale scores. However, no contribution to the variance remained significant after adjusting for the number of variables entered into the regression equation (all $ps>0.10$).

3.4. Overcoming separation anxiety

The influence of timing and duration of planned separations (i.e. preschool attendance before age 5) on later separation anxiety was investigated in two ways. Initially, the age at which children were first enrolled in pre-school was grouped into; never, those first attending before the age of 3 years, those first attending between 3 and 4 years and those who first attended preschool after the age of 4 years. A one-way ANOVA showed significant group differences in separation anxiety symptom scores at age 11 among the attendance groups [$F(3,777)=3.390$, $p<0.05$]. Post hoc tests revealed that children who first attended preschool before age 3 years had significantly more separation anxiety symptoms than those who first attended between age 3 and 4 years ($p<0.01$), and those who first attended after age 4 years ($p<0.05$). There were no significant preschool group differences in separation anxiety symptoms reported at age 18.

We then investigated the relation between duration of attendance and later separation anxiety by grouping the 93% of the cohort attending preschool into tertiles. Four groups were compared: Non-attenders, $n=65$ (6.7%); Attenders for 1–144 half-days $n=307$ (31.3%); Attenders for 144–200 half-days, $n=302$ (30.8%); and Attenders for >200 half-days, $n=306$ (31.2%). A one-way ANOVA with duration of attendance (grouped as above) as the independent variable and separation anxiety symptoms at age 11 as the dependent variable was significant [$F(3,773)=3.66$, $p<0.05$]. Consistent with our earlier finding, post hoc tests revealed that those who attended preschool for less than 144 half-days had significantly fewer separation anxiety symptoms at age 11 than those attending for 144–200 days. There were no significant group differences in separation anxiety symptoms reported at age 18.

When we examined the relation between planned and acute hospitalisation occurring in the two years prior to the age 9 assessment and the separation anxiety symptom scores at age 11 and 18, a different pattern emerged. That is, there was no significant difference between those experiencing planned versus acute hospitalisation in the number of separation anxiety symptoms reported at age 11 [$F(1,197)=0.133$, $p=0.72$] but there was a difference at age 18 [$F(1,200)=6.17$, $p<0.05$]. Specifically, and as predicted, those experiencing unplanned (acute) admissions had higher levels of separation anxiety 9 years later compared to those who reported planned hospitalisations.

4. Discussion

Putative aversive conditioning experiences occurring during the first three years of life (i.e. separations from mother and overnight hospitalisations) were not related to separation anxiety at

3 years, the age at which normative separation anxiety has begun to dissipate (Cox & Campbell, 1968; Gershaw & Schwartz, 1971). Analyses revealed one interaction between social class and separation experiences and age 3 separation anxiety: the likelihood of separation anxiety at age 3 was *reduced* by the experience of a lengthy separation (>3 months) in individuals from high SES backgrounds. Previously, it has been suggested that the experience of brief, non-threatening separations early in life may immunise against the stressful effects of later more protracted separations (e.g. Marks, 1987; Stacey, Dearden, Pill & Robinson, 1970). The present results suggest that separations of longer duration, occurring in the context of appropriate support or resources (i.e. high SES), may also buffer against the development of later separation anxiety. It was also noteworthy that there were no differences in the ratings of separation anxiety symptoms observed for boys and girls at age 3, as might be expected from a non-associative perspective.

Study members self-reported separation anxiety at age 11 was correlated with their mother's separation fear measured when the cohort were aged 7 and 9, as was having had a parent die before the age of 11 years (all $ps < 0.05$). However, when all independent variables with a correlation of $p < 0.25$ were entered into a stepwise linear regression, they accounted for a relatively small amount of the variance in age 11 separation anxiety scores (2.5%). Only mothers "fear of going out alone" (as opposed to "being alone") made a significant contribution with all variables in the model, and this relation was no longer significant after adjustment for the number of variables entered in the regression equation.

Interestingly, separation anxiety at age 18 was negatively correlated with the number of overnight stays in hospital occurring before the age of 3 years and in the 2 years prior to the age 9 assessment. That is, more separations due to hospitalisation during childhood reduced the likelihood of reporting separation anxiety symptoms in late adolescence. This finding suggests that "inoculation" effects of early separation events may not be restricted to experiences of short duration as previously suggested (cf. Marks, 1987), but extend to lengthy separations in the context of high SES, as mentioned previously. In contrast, having experienced parental death between 11 and 18 and lower SES were significantly and positively related to separation anxiety at age 18. However, none of the significant separation anxiety correlates remained as significant predictors in the regression analyses after adjustment for the number of variables entered into the models (after Larzelere & Mulaik, 1977). At both age 11 and 18, females reported significantly more separation anxiety symptoms than males, a finding consistent with previous research for a number of anxiety disorders (Craske, 1999) as well as depressive disorders (e.g. Weissman et al., 1993). The present findings indicate that the observed sex differences emerged at some time between age 3 and age 11, but the processes responsible for this sex differentiation remain to be elucidated.

Overall, we struggled to find strong evidence for a relation between environmental (i.e. associative-conditioning) events and separation anxiety assessed at ages 3, 11 or 18 (cf. Bowlby, 1973; Marks, 1987; Bird et al., 1989). The conditioning variable most strongly related to separation anxiety at any age involved a vicarious-modelling measure obtained in late childhood: namely, mothers fear of going out alone, which predicted 1.8% of the variance in age 11 separation anxiety scores. This variable appears more closely related to agoraphobic fears than separation fears per se. As might be expected, the latter item (i.e. fear of being alone) did not account for a significant amount of variance in age 11 separation anxiety after the former had entered the stepwise linear regression model. Finding that exposure to fearful adult behaviour may have contributed to separation anxiety symptoms at age 11 is clearly consistent with an associative model. Furthermore,

from an evolutionary perspective, the ability to learn fear via associations with adult fear as the unconditioned stimulus appears preferable (in terms of survival or avoidance of pain or injury) to actually experiencing a traumatic event (Bowlby, 1973; Thorpe & Salkovskis, 1997). At the same time, the facilitative effect of exposure to fearful adult behaviour does not fully refute the non-associative model which explicitly acknowledges that associative-learning events can play a role in evolutionary-relevant fear onset (Menzies & Clarke, 1995: 43). Moreover, clearly the majority of the variance was not attributable to our measures of associative acquisition for separation anxiety. Thus, while some fears, like those of the dentist, are strongly related to conditioning events (e.g. Davey, 1989; Poulton et al., 1997a), others, such as separation fear or anxiety, may be largely innate or spontaneous (e.g. Bowlby, 1973; Marks, 1987; Menzies & Clarke, 1995).

That innate fears can be modified by environmental factors has been recognised for some time (e.g., Hall, 1897; Valentine, 1930, see also Marks, 1987). The challenge is now to establish the relative contributions of associative and non-associative factors in the development of frequently occurring fears (Poulton, Waldie, Menzies, Craske & Silva, 2001). This is not straightforward, as exemplified in the present study where the modelling finding was not particularly strong and may have been due to either associative events at age 9 (i.e. vicarious learning) or to genetic effects simply because the “model” was the mother of the study member. Recent research using a genetic design has suggested that separation anxiety may be largely due to environmental effects, not additive genetic effects (Topolski et al., 1997) whereas earlier data provided strong evidence for the specificity of heritable effects for separation anxiety. That is, at age 7 years monozygotic twins were more concordant than dizygotic for separation distress, emotional reactivity, and being fearful/inhibited, but not for fearfulness (Goldsmith & Gottesman, 1981; also see Silove, Manicavasagar, O’Connell & Morris-Yates, 1995). Further developmental-genetic research is required to clarify this issue.

Learning not to fear separation is an important developmental task (Bowlby, 1973). Our findings suggest that successfully overcoming the anxiety associated with separation may be dependent upon both the timing and the nature of the separation experiences. Planned separations between age 3 and 5 years were associated with lower levels of separation anxiety in late childhood. However, planned separations occurring earlier than age 3 conferred no special benefit. Clearly, a developmental approach to the understanding of the impact of these events and the processes involved in desensitisation/habituation to separation is an advantage. The importance of a developmental perspective is further reinforced when the impact of planned or acute hospitalisations were considered. Interestingly, these experiences did not influence separation anxiety in the years immediately following this experience but did manifest post-puberty when our cohort members were aged 18.

4.1. Continuity of ratings of separation anxiety between age 3 and 18 years

Separation anxiety at age 3 was unrelated to its counterparts measured at age 11 or 18. However the age 11 and age 18 measures were correlated. This finding might be explained by a methods effect, in that the age 3 measure was based on behavioural observations, and the age 11 and 18 scores were based on self-report. Alternatively, this might reflect a discontinuity in separation anxiety between the ages of 3 and 11, since children experience significant cognitive development around age 9 or 10 that may relate to fear appraisal processes (Marks, 1987). It also remains

possible that the separation anxiety phenotype may change during development and that measures obtained in early childhood are not directly comparable to measures obtained at later stages of development (cf. Sroufe, Carlson, Levy & Egeland, 1999).

The finding that separation anxiety at age 11 and 18 were significantly correlated, albeitly not strongly ($r=0.160$) raises questions about the level of persistence of separation anxiety between these two ages. Further interrogation of the data revealed that ca. 40% of those with one or more separation anxiety symptoms at age 11 also had one or more symptoms at age 18. This can be interpreted as indicating moderate levels of stability in reporting given the length of time between assessments and the developmental periods covered (e.g. Krueger, Caspi, Moffitt & Silva, 1998; Poulton, Trainor, Stanton, McGee, Davies & Silva, 1997b). However, it is also clear that the majority of individuals appear to “grow” out of their separation anxiety by age 18 suggesting that recent findings about continuity of separation anxiety between childhood and adulthood based on retrospective reports should be interpreted cautiously (e.g. Manicavasagar, Silove, Curtis & Wagner, 2000). It remains possible that our measure of separation anxiety at age 18 inadvertently captured aspects of other fears, notably panic or agoraphobic fears. However, when we examined the patterns of comorbidity at age 18, Study members with persistent separation anxiety (i.e. at age 11 and 18) were significantly more likely to meet criteria for any psychiatric diagnosis in the previous 12 months (59.1%) than those who reported symptoms of separation anxiety at age 18 for the first time (39.4%), [$\chi^2(1)=8.95$, $p<0.01$]. This argues against separation anxiety simply being a non-specific marker of psychological distress at age 18, and raises interesting questions about potential differences between childhood onset versus adolescent-onset separation anxiety that should be addressed by future research.

4.2. *Methodological issues*

There are two major methodological advantages of the present study. The first involves the use of a longitudinal sampling design. Events were recorded close in time to their actual occurrence, from birth to age 18. The regular sampling of a single birth cohort across development should minimise the problems of faulty memory associated with retrospective recall over longer periods (e.g. Henry, Moffitt, Caspi, Langley & Silva, 1994). Further, because the same individuals were assessed for 18 years, we were presumably able to detect associations between events occurring early in life and outcomes at a much later age. That is, we were able to control for incubation or sensitisation effects hypothesised to influence fear acquisition (e.g. Davey, 1997; Mineka & Zinbarg, 1995).

Another strength of the study relates to the measures used to assess separation anxiety. At age 3, we created a composite index of separation anxiety based on behavioural observations made by two trained raters. The ratings were made at different times during the assessment day and did not confound stranger fear with separation anxiety. That is, fear of strangers differs from distress at the separation from the caretaker. The two fears summate if the child is separated from its caretaker in the presence of a stranger, and correlate slightly (Sroufe, 1974). Many tests for one of these two fears have compounded both situations (Marks, 1987). Observers (one medically trained doctor and one psychometrist) in this study were trained to rate separation anxiety and fear of strangers on different scales according to predefined protocols (see the American Collaborative Study on Cerebral Palsy and Mental Retardation, 1970).

However, several limitations must also be acknowledged. First, no measures of modelling or transmission of information were available at the age 3 assessment. Thus, we cannot rule out the possibility that either of these “less direct” associative pathways may have played a role in the development of separation in early childhood. Second, hospitalisation data was not available between the ages of 3 and 5, making it possible that we missed critical associative events occurring during this time that may have been related to later separation anxiety. Third, more extensive sampling of potential sources of anxious modelling and transmission of information would have allowed us to rule out genetic effects and ensure a more comprehensive assessment of these constructs (e.g. family friends, siblings, school peers). Additionally, detailed observational measures of various aspects of parent child interactions may have been useful (e.g. Whaley, Pinto & Sigman, 1999). Fourth, our modelling measures were often based on single items that, in some cases, more closely resembled agoraphobic-type versus separation fears. Use of more “robust” and specific measures of parental separation anxiety would have been of benefit. Fifth, it is likely that many of the positive separation experiences leading to a reduction in separation anxiety might occur the presence of same age or older siblings. Unfortunately, we were unable to test this hypothesis because the necessary data were not collected. Sixth, it should be noted that in the present study we assumed separation experiences (e.g. hospitalisations) were aversive. However, this may not have been so in all cases. We were unable to determine if hospitalised study members actually experienced a reliable UCS (e.g. pain) along with the CS (separation), although this seems highly probable in the event of hospitalisation (e.g. Stacey et al., 1970; Pynoos, Steinberg & Piacentini, 1999).

4.3. Conclusion

The present study attempted to provide a more comprehensive test of fear acquisition theory by comparing three associative paths and a non-associative pathway in the development of separation anxiety. We found that separation anxiety was largely, but not entirely, independent of associative factors. Depending on age, either vicarious-modelling processes (before age 11) or conditioning events (parental death between age 11 and 18) and socioeconomic circumstances were significantly correlated with self-reported separation anxiety. However, these correlates did not remain significant predictors in adjusted regression models. One of the more interesting findings was that associations were not in the hypothesised direction. Specifically, more separation experiences up to the age of 9 were associated with less separation anxiety symptoms at age 18. This is more consistent with an inoculation model of association. It was also clear that, depending on age, planned separations can facilitate the learning of how not to fear separation.

Although the present findings are consistent with the operation of a non-associative pathway in the development of separation anxiety, they do not exclude the involvement of associative processes. These findings reflect both the complexity and dynamic nature of the fear acquisition process (Rachman, 1978; Mineka & Zinbarg, 1995; Pynoos et al., 1999) and indicate the need to take into account developmental and intra-individual factors as well as person×environment interactions in the understanding of fear etiology (Poulton et al., 2001). The challenge for future research is to determine the relative importance of these factors, alone and in combination, for the development of fear.

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