Memory for emotional stories in high and low depressed children

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Cognitive theories of depression emphasise a vicious circle linking depressed mood and biased recall towards negative information. In line with this, depressed adults show selectively enhanced recall for negative information. This recall bias is held to be mediated by increased accessibility of negative self-referent schemas formed as a result of adverse early experiences. Given this, surprisingly few studies have examined depression-related recall biases from a developmental perspective. Clinically depressed children have been found to show enhanced recall of negative adjectives, particularly when self-referent, but to date there is no evidence for similar recall biases in non-clinically depressed groups. The current study addressed this by investigating high and low non-clinically depressed children's (aged 5–11 years) recall of emotional stories. High depressed children showed enhanced recall of negative stories, relative to positive stories, compared to the low depressed group. This did not vary with age group. We conclude that, when child-oriented materials are used, depression-related biases in recall towards negative information are observable even in a non-clinical sample of children from 5 years of age.

One of the more influential theories of depression has been put forward by Beck (Beck, 1976; Beck, Rush, Shaw, & Emery, 1979). According to this, individuals who later become depressed have had early experiences that result in the formation of dysfunctional schema about the self and the world. Later in life, the experience of matching stressors can activate these schema which then bias cognition, including recall, in a negative manner that maintains depression. More recent cognitive theories have built on these ideas (e.g., Teasdale, 1983) and empirical investigations have examined whether depressed adults do indeed differ from controls in their memory for emotional information.

Both studies comparing the performance of clinically depressed patients with controls, and studies using non-clinical participants with high versus low levels of depression, have indicated that depressed adults show biased recall towards negative information relative to non-depressed adults (e.g., Bradley & Mathews, 1983, 1988; Derry & Kuiper, 1981; Kuiper & Derry, 1982). These studies have typically used single word stimuli and the findings have been most robust for trait adjectives that participants have endorsed as

self-descriptive. This is consistent with suggestions that depressed individuals have elevated levels of negative self-referent schematic content which facilitates retention and recall of congruent information (Beck et al., 1979).

Only a handful of studies have begun to test similar propositions with children. Given that Beck argues that the formation of dysfunctional schemas in childhood underlies adult depression, and given that depression in childhood is a strong predictor of adult depression (Harrington, Fudge, Rutter, Pickles, & Hill, 1990), it is surprising that this is the case. Indeed, investigations of recall biases for negative information lag behind a growing literature on other aspects of cognition in childhood depression. Depression in children, as in adults, has been shown to be associated with negative biases in attributional style, lower self-esteem, and general cognitive impairment as indexed by performance on block design and digit span tasks (Gladstone & Kaslow, 1995; Kaslow, Brown, & Mee, 1995; Kaslow, Rehm, & Siegel, 1984). One might hence expect that the bias in memory towards recall of negative information observed with depressed adults would also be found to be characteristic of depressed children.

To date there are only four published studies of which we are aware that have examined memory bias for emotional information in depressed children (Hammen & Zupan, 1984; Hughes, Worchel, Stanton, Stanton, & Hall, 1990; Neshat-Doost, Taghavi, Moradi, Yule, & Dalgleish, 1998; Zupan, Hammen, & Jaenicke, 1987). Two of these published studies examined recall of emotional trait adjectives in clinically depressed children and controls. The results revealed enhanced recall for negative (versus positive) adjectives (Neshat-Doost et al., 1998; Zupan et al., 1987), in line with the adult studies. In the Zupan et al. (1987) study, depressed children only exhibited this negative recall bias following self-referential encoding of the adjectives. Another of the published studies also examined recall of emotional trait adjectives (Hammen & Zupan, 1984), this time with non-clinically depressed children and controls. In this study, in contrast to the clinical studies, high depressed children did not differ in their recall of self-referentially encoded negative and positive adjectives.

One possible explanation for these data is that memory bias effects associated with depression are only seen in clinical groups among the child and adolescent population. This might be because the effects are relatively subtle and a fairly severely depressed sample is required to reveal them, especially if the stimuli are just emotional words. If this is the case, it is possible that more ecologically valid and engaging emotional material may reveal stronger memory bias effects. Consequently, such material may reveal memory bias effects in non-clinically depressed groups to mirror the data with trait adjectives in the clinical samples (Neshat-Doost et al., 1998; Zupan et al., 1987).

These issues were examined in the final published study in this area. Hughes et al. (1990) examined whether high and low non-clinically depressed children differed in their recall of positive versus negative events embedded within a story of a child's day. However, as with the non-clinical study of Hammen and Zupan (1984), the high depressed children did not exhibit any memory bias effects. An obvious explanation of these data (Hammen & Zupan, 1984; Hughes et al., 1990) is therefore that childhood non-clinical depression is not associated with biased recall for emotional material, regardless of how engaging that material might be. However, there are two methodological aspects of the Hughes et al. (1990) study which suggest that such a conclusion may be precipitate. First, the participants were not asked to encode the story in a self-referent manner. As already noted, we know from numerous studies that self-referent encoding is important if memory bias effects associated with depression are to be revealed (e.g., Zupan et al., 1987). Second, there may have been priming across event type with certain of the positive and negative events being very close in semantic category (e.g., getting an answer wrong [negative], getting a good grade [positive]). This may have made it difficult for differential recall of negative versus positive information to be observed. For these reasons, a further study with non-clinically depressed participants that addresses these methodological issues but that still uses engaging emotional material is indicated.

The study reported here sought to meet this challenge. Specifically, the methodology employed by Hughes et al. (1990) was refined in an attempt to (a) avoid priming between positive and negative events; and (b) encourage self-referent encoding of the narrative material. The resultant paradigm was used to re-examine the association between self-reported childhood

depression and biased recall for engaging, child-oriented, emotional material within a non-clinical sample of children of primary school age. A second aim of the study was to investigate whether any observed association between self-reported childhood depression and biased recall for emotional information changes with age. We know that there is a clear developmental progression in children's conceptualisation of emotions (e.g., Harter & Buddin, 1987). Furthermore, between the ages of 5 and 11, children are believed to become more sophisticated in their mental representations of the self and of the world, and to begin to be able to engage in abstract metacognitive reasoning (Piaget & Inhelder, 1996). Such changes might conceivably impact on the extent to which depression in children is associated with negative schematic content regarding the self and world. This, in turn, may influence the extent to which depressed mood is associated with increased recall of negative information/events. Despite this, there has been virtually no attempt to investigate developmental changes in the association between depression and negative memory bias. In the only study to address this, Neshat-Doost et al. (1998) reported that the strength of the relationship between depression level and selective recall of negative information increased with age. However, their sample was small and comprised clinically depressed children and screened controls. It hence remains to be established whether similar developmental changes occur in the relationship between depression level and selective recall of negative information within a relatively large non-clinical sample of schoolchildren.

The main aims of the current study were consequently as follows:

(1) To establish whether high and low non-clinically depressed schoolchildren differ in their recall of emotional story information. Specifically, whether high depressed children recall relatively greater amounts of negative story information and/or relatively lower amounts of positive story information, compared to healthy controls.

(2) To investigate whether the extent of any such bias varies with age. Specifically, whether it increases across the three age groups (5–7 years → 7–9 years → 9–11 years).

METHOD

Participants

A total of 121 children participated in the study; 55 boys, 66 girls. The majority were Caucasian, four were of Afro-Caribbean descent, two of Asian descent. All participants were aged between 5 yrs 5 mths and 11 yrs 10 mths ($M = 8.53$, $SD = 1.74$) and were recruited from two primary schools in Cambridgeshire, UK. Both schools were nonselective state schools. School 1 was a village school while School 2 was located in a city centre. Both schools scored above the norm for performance on nationally administered tests. This possibly reflects the demographic makeup of the schools, there being a bias towards the higher socioeconomic classes. Children in years one to six were invited to participate in the study. Letters, information sheets, and consent forms were sent out to parents, and children were seen if both parent(s) and child gave consent. The only other inclusion criteria were that participants were aged over 5 yrs 5 mths and had English as their first language. A total of 49 children agreed to participate at School 1, representing a response rate of 24.7%. At School 2, 72 children agreed to participate, representing a response rate of 37.9%. A total of 113 children (93.4% of participants) completed the memory task.[1] Of these, 53 were boys, 60 were girls. The mean age of these participants was 8.51 yrs ($SD = 1.73$).

Measures

The Depression Self-Rating Scale (DSRS; Birleson, 1981).   The DSRS is a measure of depression in childhood. It consists of 18 items covering both cognitive and physical symptoms of mood disturbance. Children judge the extent to which each statement was true for them over the previous week. Responses are made on a 3-point scale comprising "most of the time", "sometimes", and "never". The items are scored 0–2 with "most of the time" or "never" scoring 0 depending on the tone of the item. The DSRS has been found to have both satisfactory internal consistency and test–retest reliability (Birleson,

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[1] Three children were unable to complete the task due to learning difficulties. Another child did not meet the inclusion criteria of having English as his first language. The task was aborted with four children due to interruptions of the testing session.

1981; Birleson, Hudson, Buchanan & Wolff, 1987). The DSRS has been used effectively with children as young as 7 (e.g., Stallard, Velleman, Langsford & Baldwin, 2001). In the present study, the items were read out to the younger children (5 yrs 5 mths to 7 years) who reported that they could not read them. None of the children reported that they did not understand the items.

The Spence Children's Anxiety Scale (SCAS; Spence, 1997). This scale assesses the presence or absence of a range of anxiety-related symptoms. It consists of 44 items: 38 items assessing specific anxiety symptoms and 6 positive filler items. The 38 anxiety items constitute six subscales that assess symptoms for generalised anxiety, separation anxiety, social phobia, panic/agoraphobia, obsessive compulsive disorder, and fear of physical injury. Children are asked to rate how frequently they experience each symptom on a 4-point scale comprising "never" (0), "sometimes" (1), "often" (2), and "always" (3). The internal consistencies of the total scale and of the six subscales are good and test–retest reliability is satisfactory (Spence, 1998). The SCAS has been used effectively with children as young as 8 (e.g., Spence, 1998). In the present study, the items were read out to the younger children (5 yrs 5 mths to 8 years) who reported that they could not read them. None of the children reported that they did not understand the items.

British Picture Vocabulary Scale (BPVS, Short form; Dunn, Whetton, & Pintilie, 1982). The BPVS measures children's receptive vocabulary for standard English. The short form provides an easily obtainable estimate of the extent of English vocabulary acquisition. As such, it gives an estimate of verbal ability for children who have grown up with English as their first language. Scores on the BPVS can be converted into standardised scores, allowing for comparisons across age groups. The BVPS short form shows high internal reliability for children aged from 3 yrs to 16 yrs (Dunn et al., 1982).

The Emotional Stories Recall task. This comprised three core stories (a "park" story, a "beach" story, and a "going home" story), each of which came in three differently valenced versions (positive, negative, and neutral). The pictures and text for the complete set of nine stories are given in the appendix. The stories were presented as "narrated" picture stories on a Mac IIci computer using Psyscope 1.1b7. Each story comprised a series of short sentences that aurally accompanied seven pictures. The differently valenced versions were created by alteration of a number of key words or phrases within the last two-thirds of each story. Hence, the first third of each core story (section 1) was constant across versions, the last two-thirds (section 2) differed by version. The changes were made in such a way as to maintain the basic causal structure of the story as much as possible across versions, while altering the emotional tone. The pictures presented did not vary by story valence.

Eight adult raters rated each of the nine stories (3 stems × 3 valence versions) for how happy/unhappy they were using two 9-point scales anchored on the left by "not at all" and on the right by "extremely". A repeated measures ANOVA with three within-subject factors: rating (happy, unhappy), story (park, beach, going home), and valence (positive, negative, neutral) was performed on these ratings. There was a significant interaction of rating by valence, $F(2, 14) = 189.19$, $p < .001$. Post-hoc tests based on the Studentised range statistic using a pooled error term revealed that the positive versions were rated as significantly happier than the neutral versions, $q = 6.80$, $p < .001$, which in turn were rated as significantly happier than the negative versions, $q = 10.40$, $p < .001$. The negative versions were rated as significantly unhappier than the neutral versions, $q = 14.89$, $p < .001$, which were rated as significantly unhappier than the positive versions, $q = 6.10$, $p < .001$. None of the interactions involving story was significant, $p > .1$. An additional ANOVA revealed that the extent to which the positive versions were rated as happy did not differ significantly from the extent to which the negative versions were rated as unhappy, $F(1, 7) = 1.87$, $p > .1$, and this did not vary significantly by story, $F(2, 14) = 1.46$, $p > .1$. These findings provide some initial suggestion that the attempt to manipulate the valence of the core stories by alteration of a number of key phrases was successful and that the effect of this manipulation was fairly consistent across stories.

The stories were all between 390 and 460 words in length, with versions of the same story not differing in length by more than 5 words. The presentation time for each story was roughly 2 minutes 30 seconds. The stories were analysed for readability using Microsoft Word 6.0 readability statistics. All the stories had a Flesch–Kincaid Grade level of under 2, suggesting that the lan-

guage used was roughly appropriate for children of the age seen here. The stories were piloted, with children from 5 years of age successfully answering questions testing their comprehension of the stories.

Each set of nine stories came in both a male and a female version, the sex of the protagonist differing between the two sets in order that this could be matched to the sex of the participant. Each participant was presented with the three core stories in different valences: one positive, one negative, and one neutral. Prior to this, a practice story was presented. This was neutral/slightly positive in content and shorter than the experimental stories, comprising three pictures with accompanying narration. Again, this came in both a male and a female version, these differing in terms of the sex of the main protagonist.

Procedure

Children were seen individually during school time for two hour-long sessions as part of a larger study investigating developmental and individual differences in the cognitive processing of emotional information. These two sessions were completed within the same day where possible or, alternatively, on two consecutive days. Participants completed the British Picture Vocabulary Scale and a number of self-report measures including the Depression Self-Rating Scale and the Spence Children's Anxiety Scale at the beginning of the first session. The Emotional Stories Recall task was administered at the start of the second session. Each child received the practice story (with a protagonist of their sex) followed by the three core stories ("going home", "beach", and "park"), each in a differently valenced version (positive, neutral, or negative). The valence in which each core story was presented (e.g., positive "going home", negative "beach", neutral "park"), and the order of presentation by valence (e.g., positive, neutral, negative) were counterbalanced across participants within each age group.

Prior to presentation of each story, participants were instructed that a story was going to be presented on the computer and that they should try to remember as much of it as possible as they would be asked to recall it "word for word as well as you can". Participants were also asked to pretend that they were the protagonist and that the things happening were happening to them. Additionally,

they were informed that they would be asked to do some counting before being asked to repeat the story back to the experimenter. Throughout the task, participants were seated approximately 40 cm in front of the computer. The story pictures were presented against a black background and subtended a visual angle of 23.0°. Story presentation was followed by a 30-second interval during which participants were asked to count forwards or backwards (depending on age) from a given number before recalling the story. Participants were instructed to say "the end" when they had finished and were not prompted unless they appeared to stop halfway in which case they were asked once "can you remember any more?". Following recall, participants were asked some questions about the story prior to presentation of the next story. These questions are not reported here, but included a comprehension check, which all participants passed, and questions regarding the protagonist's feelings, which character was responsible for the story outcome, and how things could have turned out differently. The whole task took approximately 30 to 40 minutes.

Coding of recall protocols

The text of each of the nine stories was split into idea units, where each idea unit represented a separate event or state (following Omanson, 1982, and Van den Broek, Lorch, & Thurlow, 1996). Each story had between 72 and 79 idea units, with the number of idea units not differing by story valence ("park" story = 79 units, "beach" story = 72 units, "going home" story = 73 units). The first section of each story contained approximately 25 units, the second section approximately 50 units.

Participants' attempts at recalling the stories were recorded and transcribed. Participants' recall protocols were scored for the presence of idea units. For each unit, a score of 1, $\frac{1}{2}$, or 0 was given depending on whether the unit had been fully recalled, partially recalled, or totally omitted. This was conducted using a coding manual (devised by the first author) which specified key elements for each idea unit. Correct recall of all of these elements or the exact equivalent meaning resulted in a score of 1. Correct recall of any of these elements or their exact equivalent meaning, or recall of the gist of the unit as a whole resulted in a score of $\frac{1}{2}$. Otherwise a score of 0 was given. For

example, for the idea unit "Two women were sitting by the beach wall", three key elements were specified: "Two women", "sitting", and "beach wall". A protocol with "two ladies were sat by the beach wall" would score 1, while a protocol with "two women were chatting by a wall" would score $\frac{1}{2}$. Two raters practised using the coding system. Following this, Rater 1 coded the recall protocols for all participants while Rater 2 coded the protocols from a randomly selected subset of participants (12 children, 4 from each year group—approximately 10% of the total sample). The coding was carried out blind to participants' depression and anxiety levels. In total, the presence/partial presence or absence of 2700 ideas units was double-coded. The two raters showed high correspondence in their coding (Kappa = 0.81). Rater 1's coding was used to compute the proportion of idea units recalled for sections 1 and 2 of each story. This meant that, for each participant, there were six summary recall scores: two for the positive story (POSs1, POSs2), two for the negative story (NEGs1, NEGs2), and two for the neutral story (NEUs1, NEUs2), these reflecting the proportion of units recalled for the first and second sections of each story. It was not possible to constrain the content of the summary recall variables to just the emotional parts of the story. The valence of the story emerged out of the second sector narrative as a whole, as opposed to primarily being a function of the use of explicitly valenced words or phrases. Indeed, the proportion of such "stand-alone" valenced story units was small.

RESULTS

Participant characteristics by age group and depression level

Participants were divided into three age groups (age group 1: 5 yrs 5 mths to 7 yrs 6 mths; age group 2: 7 yrs 7 mths to 9 yrs 6 mths; age group 3: 9 yrs 8 mths to 11 yrs 10 mths). These age groups were based on year groupings at the time children were seen at School 1. At this point, years 1 and 2 equated to age group 1, years 3 and 4 to age group 2, years 5 and 6 to age group 3. Since the children in School 2 were tested at a different point in the school year, participants at this school could no longer be allocated to the three age groups on the basis of year groupings and instead were matched to the groups by age.

Participants in each age group were further subdivided into "low depressed" and "high depressed" subgroups on the basis of their scores on the DSRS. This was achieved using a median split on DSRS scores within each age group. In practice, the median DSRS score for each group was the same, children scoring 8 or less being allocated to the "low depressed" group, children scoring 9 or higher being allocated to the "high depressed" group. Participant details are given by age group and depression level in Table 1. The mean depression levels in the high depressed groups are indicative of significant depression (Birleson, 1981; Birleson et al., 1987).

TABLE 1
Participant details by age group and depression level

	Age group 1 (5 yrs 5–7 yrs 6)		Age group 2 (7 yrs 7–9 yrs 6)		Age group 3 (9 yrs 8–11 yrs 10)	
	Low depressed	High depressed	Low depressed	High depressed	Low depressed	High depressed
Ns	18	22	17	17	19	20
Gender ratio (boys:girls)	8:10	12:10	8:9	8:9	7:12	10:10
Verbal IQ	113.67	103.14	115.59	111.76	115.21	112.35
(BPVS stand. scores)	(14.63)	(16.63)	(10.47)	(13.60)	(16.26)	(17.74)
Anxiety	27.50	39.45	28.24	35.06	17.95	31.15
(SCAS)	(19.02)	(17.85)	(12.21)	(13.67)	(8.20)	(8.51)
Depression	4.78	12.64	5.24	12.00	5.58	11.20
(DSRS)	(2.67)	(3.58)	(2.25)	(2.09)	(2.29)	(3.55)

"BPVS" = the British Picture Vocabulary Scale, short form; Dunn et al., 1982. "DSRS" = the Depression Self-Rating Scale; Birleson, 1981. "SCAS" = the Spence Children's Anxiety Scale; Spence, 1997.

There was no significant difference in partici-pation according to gender. Additionally, the gender ratio did not vary significantly by depres-sion level for the sample as a whole or for any of the three age groups.

Due to violations of assumptions of normality and homogeneity of variance, nonparametric analyses were used to investigate anxiety (SCAS) scores by depression level and age group. In age groups 1 and 3, participants in the high depressed subgroups scored significantly higher on the SCAS than participants in the low depressed subgroups, Mann Whitney U: $U = 117.00$, $p < .05$, $U = 42.50$, $p < .001$, respectively. Additionally, participants in age group 3 scored lower on the SCAS than participants in age groups 1 and 2, Mann Whitney U: $U = 564.00$, $p < .05$, $U = 470.50$, $p < .05$, respectively. DSRS (depression) scores did not vary significantly by age group.

A two-way ANOVA with age group and depression level as between-subjects factors was conducted on participants' standardised BPVS scores. This revealed a main effect of depression level, $F(1, 107) = 3.96$, $p < .05$, with participants in the low depressed subgroups having higher standardised BPVS scores than participants in the high depressed subgroups. It should also be noted that the mean standardised BPVS score for the entire sample was nearly one standard deviation above the norm. This is perhaps not unexpected given the demographics of the schools and the higher than average perfor-mance of pupils on national tests.

Recall performance

Means for the summary recall scores are given by age group and depression level in Table 2. The valence in which each core story was presented and the order of presentation by valence were not fully counterbalanced within each of the age group by depression level subgroups. In order to establish whether this was likely to be an issue, one way ANOVAS were conducted on each of the six summary recall scores with either (i) the core story/valence combination or (ii) order of pre-sentation as a between-subjects factor. There was no significant effect of core story/valence combi-nation or order of presentation on any of the summary scores (ps > .1). These factors were therefore excluded from subsequent analyses.

Factors influencing participants' recall scores were examined by conducting a repeated measures ANCOVA with two within-subject fac-tors: valence (positive, negative, neutral) and section (1, 2) and two between-subjects factors: age group (1–3) and depression level (low, high). "Verbal IQ" (as indicated by standardised BPVS scores) was entered as a covariate since the high and low depressed groups differed significantly on this measure. The ANCOVA results revealed a main effect of age group, $F(2, 106) = 31.82$, $p <$

TABLE 2
Proportions of units recalled

| | Age group 1 (5 yrs 5–7 yrs 6) | | Age group 2 (7 yrs 7–9 yrs 6) | | Age group 3 (9 yrs 8–11 yrs 10) | |
	Low depressed (N = 18)	High depressed (N = 22)	Low depressed (N = 17)	High depressed (N = 17)	Low depressed (N = 19)	High depressed (N = 20)
POSs1	.28 (.12)	.19 (.12)	.37 (.19)	.33 (.14)	.45 (.12)	.39 (.17)
POSs2	.15 (.08)	.16 (.07)	.24 (.13)	.23 (.10)	.34 (.11)	.29 (.13)
NEGs1	.23 (.12)	.22 (.13)	.28 (.17)	.33 (.11)	.43 (.12)	.42 (.18)
NEGs2	.19 (.11)	.18 (.09)	.26 (.13)	.29 (.12)	.40 (.12)	.36 (.13)
NEUs1	.21 (.13)	.22 (.12)	.32 (.14)	.31 (.11)	.43 (.13)	.38 (.15)
NEUs2	.17 (.08)	.14 (.06)	.22 (.12)	.23 (.10)	.31 (.10)	.28 (.11)

Means and standard deviations (in parentheses) for proportions of units recalled for sections 1 and 2 of the positive story (POSs1, POSs2), the negative story (NEGs1, NEGs2), and the neutral story (NEUs1, NEUs2) by age group and depression level.

.001. Post-hoc tests based on the Studentised Range Statistic[2] indicated that participants in age group 3 (9–11 yrs) showed significantly greater overall recall than participants in age group 1 (5–7 yrs), $q = 4.67, p < .01$. Participants in age group 2 (7–9 yrs) showed an intermediate level of recall, not differing significantly from age group 3 or age group 1, $q = 2.37, p = .10, q = 2.11, p > .1$, respectively. Age was also included as a continuous variable in a partial correlation analysis (controlling again for BPVS scores). There was a significant positive relationship between age and amount recalled, $r(110) = .60, p < .001$, corroborating the results of the ANCOVA.

There was also a significant effect of verbal IQ, $F(1, 106) = 16.74, p < .001$, with higher standardised BPVS scores being associated with greater overall recall. In addition, there was a main effect of section, $F(1, 106) = 113.68, p < .001$, with a greater proportion of units being recalled from section 1 than from section 2, and a main effect of valence, $F(2, 212) = 8.98, p < .001$. The proportion of units recalled for the negative story was significantly greater than for the positive story, $q = 2.85, p < .05$. The proportion of units recalled was also significantly greater for both the negative and positive stories than for the neutral story, $q = 5.88, p < .001; q = 3.04, p < .05$, respectively.

The main effect of valence was qualified by a significant two-way interaction of valence by section, $F(2, 212) = 7.29, p < .001$, as shown in Figure 1. Post-hoc tests based on the Studentised Range Statistic using a pooled error term indicated that for section 1 there were no significant differences in the proportion of units recalled between the three valence conditions, $ps > .05$. There was, however, a nonsignificant trend towards the number of units recalled being higher for the positive than for the neutral story, $q = 2.93, p = .096$. For section 2, the proportion of units recalled was significantly greater for the negative story than for either the positive or neutral story, $q = 5.85, p < .001; q = 7.13, p < .001$, respectively. There was no significant difference in recall of the positive and neutral stories, $q = 1.27, p > .1$.

The main effect of valence was also qualified by a significant two-way interaction of valence by depression level, $F(2, 212) = 3.86, p < .05$, as shown in Figure 2. This ANCOVA was repeated with anxiety scores included as a covariate. This had little impact on the two-way interaction of valence
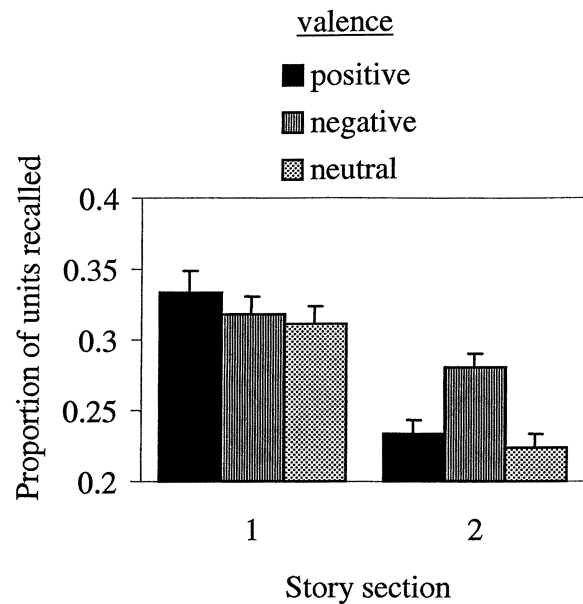
[2] These were used for all post-hoc analyses unless otherwise specified.

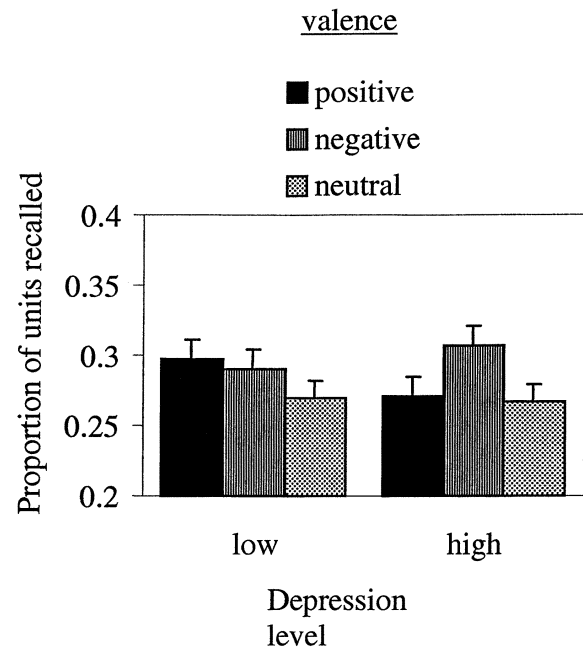**Figure 1.** Proportion of units recalled by story valence and section.

Figure 2. Proportion of units recalled by story valence and depression level.

by depression level, which remained significant, $F(2, 210) = 3.26, p < .05$. Breaking down this interaction, the low depressed group recalled more of the positive than of the neutral story, $q = 3.67, p < .05$, and showed a near-significant trend towards recalling more of the negative than of the neutral story, $q = 2.76, p = .051$. They did not differ

significantly in the proportion of units recalled for the positive versus the negative story, $q = .92$, $p > .1$. The high depressed group, meanwhile, recalled more of the negative story than of either the positive or neutral story, $q = 4.94$, $p < .001$, $q = 5.62$, $p < .001$, respectively, and did not differ in the amount they recalled for the positive versus the neutral story, $q = .69$, $p > .1$. There were no other significant main effects or interactions.

In order to further examine this differential recall of positive and negative material in the high depression group relative to the low depression group, three additional 2×2 ANCOVAs were performed. The first compared the high and low depressed groups on recall of positive versus negative story units. Here, there was a significant valence by depression level interaction, $F(1,110) = 6.90$, $p < .01$. Two further ANCOVAs comparing, respectively, recall for negative versus neutral story units and recall for positive versus neutral story units revealed no significant interactions with depression level: $F(1,110) = 1.69$, $p > .1$; $F(1,110) = 2.59$, $p > .1$.

DISCUSSION

The primary aim of the current experiment was to investigate whether high and low non-clinically depressed children differed in their recall of emotional story information. It was hypothesised that, in child populations, memory biases for emotional information might be more easily observed with such material than with the single word stimuli typically used in adult studies. The findings reported here do indeed suggest that high and low depressed children show differential recall of negative versus positive stories. High depressed participants showed a selective recall bias in favour of the negative story, relative to the positive story, while low depressed participants showed even-handed recall of the positive and negative stories. These findings differ from earlier reports that only *clinically* depressed samples of children and adolescents show a negative bias in their recall for self-referent emotional adjectives relative to controls/low-depressed groups (Hammen & Zupan, 1984; Neshat-Doost et al., 1998; Zupan et al., 1987). The present data suggest that whether or not depression-related memory biases for emotional material are observed in children may depend both on the nature of the population (clinical versus non-clinical) and on the nature of the stimuli used (e.g., stories versus single words).

The use of emotional stories may possibly show up weaker depression-related memory biases present in non-clinical child samples that are missed by studies using materials primarily devised for use with adults.

In relation to this, the failure by Hughes et al. (1990) to find a difference between high and low non-clinically depressed children in their recall of emotional events set within a single story may have been due to issues concerning their methodology rather than to their use of a non-clinical population. The materials used in the current study were designed to reduce the likelihood of recall of negative events priming recall of positive events (negative and positive information being presented separately in unrelated stories). Problems arising from priming across event types may possibly have accounted for Hughes et al.'s (1990) failure to find an association between childhood depression and selective recall of negative versus positive story events. The current study also used instructions designed to encourage self-referential encoding (participants being asked to pretend that they were the central story character and that the things happening were happening to them). It is probable that this will also have contributed to the difference in results between this study and Hughes et al. (1990) where self-referential encoding was not specifically encouraged. Subsequent studies will be able to elucidate which of these factors has the greatest impact. The primary concern here was to demonstrate that, with child-oriented materials, depression-related memory biases are observable within samples of young non-clinically depressed children. This may have implications for both our understanding and handling of depression in children.

Following on from this, a second explicit aim of this experiment was to examine whether the extent to which high depressed participants differed from low depressed participants in their recall of emotional information varied with age. Overall levels of recall increased with age from the youngest to the oldest age group (5–7 years → 7–9 years → 9–11 years), as expected (Van den Broek et al., 1996). However, the extent to which high depressed participants showed enhanced recall of the negative story and reduced recall of the positive story relative to low depressed participants did not, in fact, differ significantly by age group. This may arguably indicate that the representational apparatus necessary for depression-related memory biases to emerge is in place from as early as 5 years of age. Here it

should be noted that this finding contrasts with that of Neshat-Doost et al. (1998) who reported that the relationship between depression and negatively biased recall increased with age. However, the participants in the Neshat Doost et al. (1998) study were older than those in the current study (aged 10 to 17 years versus 5 to 11 years). Hence, one possibility is that the relationship between depression and biased recall towards negative information strengthens particularly within late childhood/adolescence. This could possibly reflect changes in the ability to reflect upon one's own representations of the self and the world. Alternatively, the difference in results between the two studies could reflect differences in participants' clinical status and/or in the stimuli used. It is conceivable that the impact of age-related changes in the ability to mentally represent the self and the world may be more notable when contrasting clinically depressed youngsters with controls. Additionally, the stimuli used by Neshat Doost et al. (1998) were single word stimuli, as used in the adult studies. Hence, the apparent strengthening with age of the relationship between depression and biased recall towards negative information may again reflect that these materials are less optimal for revealing depression-related biases in younger samples. Finally, it is also worth considering that age effects may vary across different emotions and so future studies might benefit from looking at stories with differing categorical emotional content, as opposed to just differing valence.

Further studies varying participant clinical status, age range, and stimuli, will allow us to clarify some of these remaining issues and should take us towards a fuller understanding of the relationship between childhood depression and biased recall of emotional information. The current study, meanwhile, demonstrates that, with child-orientated materials, depression-related biases in recall towards negative information are observable in a non-clinical sample of school-children as young as 5 to 7 years of age.

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# APPENDIX
MATERIALS FOR THE EMOTIONAL STORIES RECALL TASK

The text given was presented aurally.

The practice story (male)
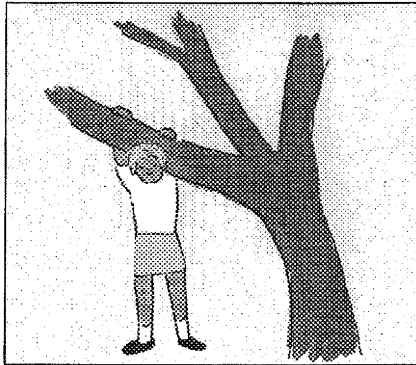
One day in the summer holidays, Bob and his sister, Emily, were feeling bored. They decided to go outside and play in the garden. They lived in a big house with a huge garden. In the garden there were a lot of trees. Bob and Emily liked to play in the trees. Emily climbed up into one tree. She held onto a branch and started to swing forwards and backwards. She was pretending that she was Tarzan.

Bob sat in the tree and watched Emily. He didn't want to play at being Tarzan. Instead he sat and looked to see who was going past. Bob saw their Dad. He was walking down the garden to the bit where the apple trees were. He was going to pick some apples. Bob called out and asked if they could help. Their Dad said Yes.
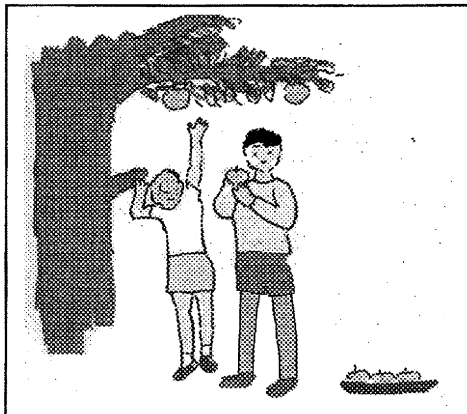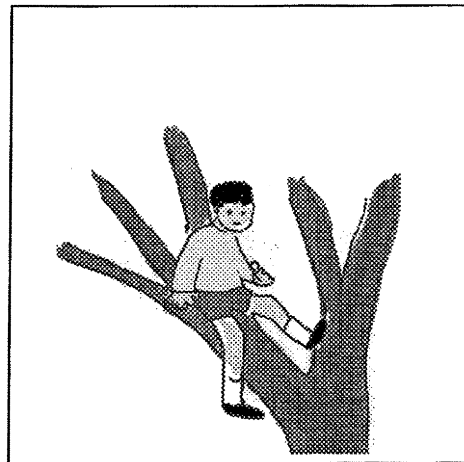
So, Bob and Emily went to help their Dad pick apples. They picked lots and lots. Then they went back inside.
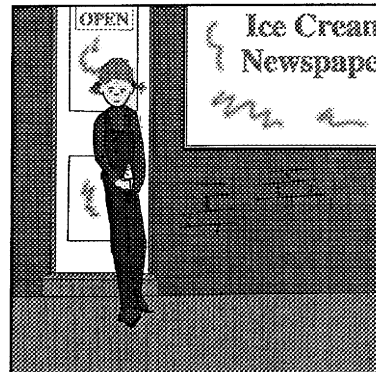
The park story (female)

Section 1. Pictures
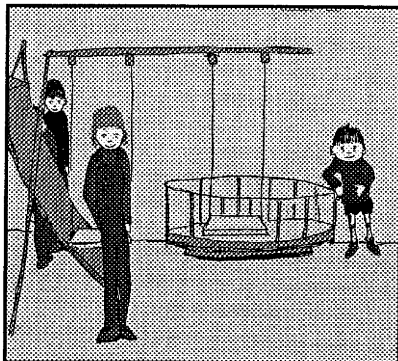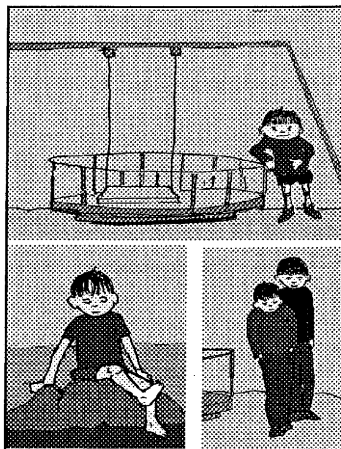
Picture 1

Picture 2

Picture 3

Section 1. Text
One Saturday, the sun was shining and the day was warm. There were a lot of children in the playground. A few parents were there as well. Some of the children were waiting to use the slide. Others were playing on the roundabout. Jane had just come off the swings. She wanted to find something else to do. She decided to get an ice cream. Some of Jane's friends stayed to play in the playground. Others went to the river where they could paddle. Some left on their own. The rest left with older brothers or sisters. Jane thought that there was a shop that sold ice cream nearby. She walked to the shop. When she got there, she asked the shopkeeper if he sold ice cream. The shopkeeper said "yes" and Jane bought one. It was the sort that she liked best. She left the shop, and ate her ice cream on a bench outside. It was nice and she sang to herself as she set off back to the playground.

Section 2. Pictures

Picture 4

Picture 5

Picture 6

Picture 7

Section 2. Text: negative version
There were two ways that Jane could walk back. There was the way that she had got to the shop. But there was also a quicker way. Jane decided to take the quicker way. Her parents had walked this way with her before. It was quiet and quite dark. Jane felt scared. She started to sing more loudly and walked quickly up the path. She walked past a house with a fence round its back garden. She heard a noise and turned around. A boy stepped out through a door in the fence. He wasn't someone she knew. He had something in his hand. It was a knife. Jane looked at it, feeling scared. "Give me your watch," said the boy. He moved forward, holding the knife. Jane

refused and put her arm up. The boy waved the knife at her. Jane cried out loud and felt frightened. "Come with me," said the boy, grabbing Jane's hand. "Walk with me to the park." The park was close by. Jane walked beside the boy, feeling very upset. Just as they reached the park, Jane saw her Uncle. He lived on the other side of the park, and must have been for a walk. Jane called out to him. The boy looked worried. "Who's that?" he said. Jane's Uncle joined them. He watched while the boy put the knife down. Then he seized the boy's arm, and yelled at him. "You must come back with us," he said. "Let's find Jane's parents and tell them what you've been doing. Attacking her with a knife!" The boy looked guilty. Jane's Uncle put a hand on his shoulder and the three of them left the park.

Section 2. Text: positive version
There were two ways that Jane could walk back. There was the way that she had got to the shop. But there was also a quicker way. Jane decided to take the quicker way. Her parents had walked this way with her before. It was quiet and quite sunny. Jane felt happy. She started to sing more loudly and skipped along up the path. She walked past a house with a fence round its back garden. She heard a noise and turned around. A boy stepped out through a door in the fence. He was a friend from school. He had something in his hand. It was a baby squirrel. Jane looked at it, feeling amazed. "Put out your arms," said the boy. He moved forward, holding the baby squirrel. Jane agreed and put her arms out. The boy gave the baby squirrel to her. Jane laughed out loud and felt excited. "Come with me," said the boy, touching Jane's hand. "Walk with me to the park." The park was close by. Jane walked beside the boy, feeling very happy. Just as they reached the park, Jane saw her Uncle. He lived on the other side of the park, and must have been for a walk. Jane called out to him. The boy looked surprised. "Who's that?" he said. Jane's Uncle joined them. He watched while Jane put the baby squirrel down. Then he shook the boy's hand, and smiled at him. "You must come back with us," he said. "Let's find Jane's parents and tell them what you've been doing. Rescuing a baby squirrel!" The boy looked proud. Jane's Uncle put a hand on his shoulder and the three of them left the park.

Section 2. Text: neutral version
There were two ways that Jane could walk back. There was the way that she had got to the shop. But there was also a quicker way. Jane decided to take the quicker way. Her parents had walked this way with her before. It was quiet and quite cloudy. Jane felt tired. She started to sing more loudly and walked on up the path. She walked past a house with a fence round its back garden. She heard a noise and turned around. A boy stepped out through a door in the fence. He was someone from school. He had something in his hand. It was a small conker. Jane looked at it, feeling puzzled. "Put out your hand," said the boy. He moved forward, holding the small conker. Jane shrugged and put her hand out. The boy gave the small conker to her. Jane took it and felt surprised. "Come with me," said the boy, tapping Jane's arm. "Walk with me to the park." The park was close by. Jane walked beside the boy, feeling very tired. Just as they reached the park, Jane saw her Uncle. He lived on the other side of the park, and must have been for a walk. Jane called out to him. The boy looked interested. "Who's that?" he said. Jane's Uncle joined them. He watched while Jane put the small conker down. Then he shook the boy's hand, and nodded at him. "You must come back with us," he said. "Let's find Jane's parents and tell them what you've been doing. Finding conkers!" The boy looked tired. Jane's Uncle put a hand on his shoulder and the three of them left the park.
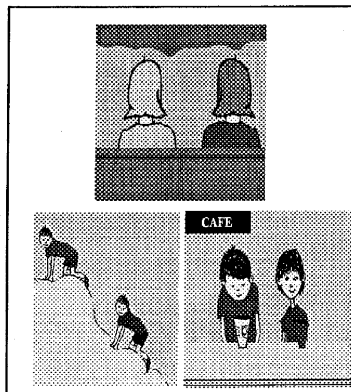
The beach story (male)

Section 1. Pictures
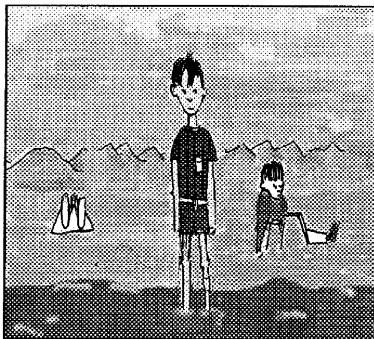
Picture 1   Picture 2   Picture 3

Section 1. Text
One day in July, Ben was at the beach. His parents and some of his friends were there too. The weather was good. There were a lot of people sunbathing. Some children were building sandcastles. Ben was paddling in the sea. He came out of the water, dried his feet and put on his shoes. Then he decided to explore the beach a bit. He looked around. Two women were sitting by the beach wall. Some children were climbing rocks. And a group of teenagers were drinking coke in front of the beach café. Ben thought that there might be some rock pools on the other side of the rocks. So he walked over to the rocks and started to climb up. He found one small pool in a hole. Some seawater had been left there when the tide was in. He looked for shells in the pool and found several that he liked. Then he began to climb further up. He still wanted to get to the top and down the other side.
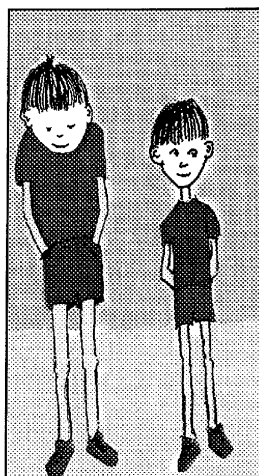
Section 2. Pictures
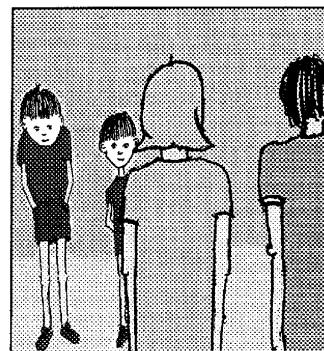

Picture 4   Picture 5   Picture 6   Picture 7

Section 2. Text: negative version
The rocks were quite high. Ben found some cracks that he could put his feet in and went higher and higher. After a few minutes, he stopped for a rest. He had climbed rocks with his parents before, but it had got darker and he felt scared. Just then, he heard a shout. It was a boy slightly older than him. "Come on," the boy said. "I'll help you climb." They climbed on together and reached the top. Ben looked down the other side. Suddenly he slipped forward. He felt frightened. He fell down the rocks, and hit the ground. He cried and was scared. There were cuts all over his legs. They were quite big. He felt very upset. He wished his parents were there but didn't want to climb back to find them. He looked at the cuts, picked himself up and thought about what he should do. Just then the boy appeared. He had been climbing down slowly. He looked worried when he saw the cuts and told Ben there was a quicker way back to the main beach. He offered to show it to him. Ben got up and they walked back together. Ben's parents had been waiting for him. They waved when they saw him and came over. Ben told his mum about the cuts. His mum cried and said, "You could be dead!" Then she turned to the boy and told him off for letting Ben climb. The boy looked guilty but asked if he could stay with them for a bit.

Section 2. Text: positive version
The rocks were quite high. Ben found some cracks that he could put his feet in and went higher and higher. After a few minutes, he stopped for a rest. He had climbed rocks with his parents before and it was still sunny, so he felt happy. Just then, he heard a shout. It was a boy slightly older than him. "Come on," the boy said. "I'll help you climb." They climbed on together and reached the top. Ben looked down the other side. Suddenly he peered forward. He felt excited. He hurried down the rocks, and reached the ground. He laughed, and was amazed. There were coins all over the ground. They were quite big. He felt very happy. He wished his parents were there but didn't want to climb back to find them. He looked at the coins, picked some up and thought about what he should do. Just then the boy appeared. He had been climbing down slowly. He looked surprised when he saw the coins and told Ben there was a quicker way back to the main beach. He offered to show it to him. Ben got up and they walked back together. Ben's parents had been waiting for him. They waved when they saw him and came over. Ben told his mum about the coins. His mum smiled and said, "You could be rich!" Then she turned to the boy and thanked him for helping Ben climb. The boy looked proud and asked if he could stay with them for a bit.

Section 2. Text: neutral version
The rocks were quite high. Ben found some cracks that he could put his feet in and went higher and higher. After a few minutes, he stopped for a rest. He had climbed rocks with his parents before but it had got cloudy and he felt unsure. Just then, he heard a shout. It was a boy slightly older than him. "Come on," the boy said. "I'll help you climb." They climbed on together and reached the top. Ben

looked down the other side. He felt tired. Suddenly he stepped forward. He jumped down the rocks, and landed on the ground. He looked around, and was surprised. There were shells all over the ground. They were quite big. He felt very tired. He wished his parents were there but didn't want to climb back to find them. He looked at the shells, picked some up and thought about what he should do. Just then the boy appeared. He had been climbing down slowly. He looked interested when he saw the shells and told Ben there was a quicker way back to the main beach. He offered to show it to him. Ben got up and they walked back together. Ben's parents had been waiting for him. They waved when they saw him and came over.. Ben told his mum about the shells. His mum looked and said, ''You could keep them!'' Then she turned to the boy and thanked him for watching Ben climb. The boy looked tired and asked if he could stay with them for a bit.
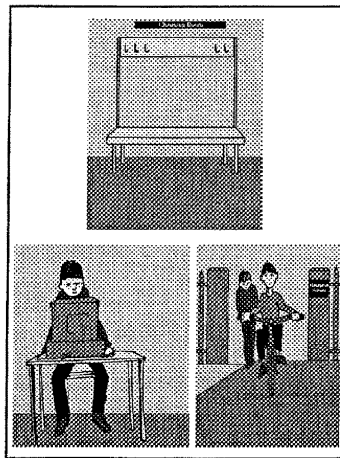
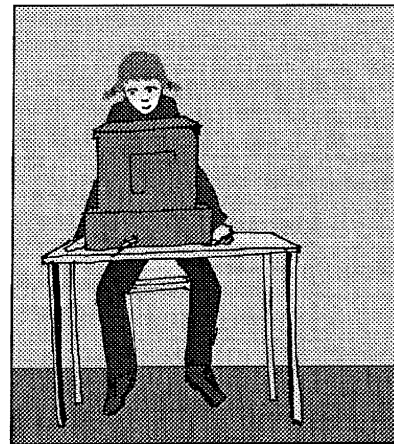## The going home story (female)

Section 1. Pictures
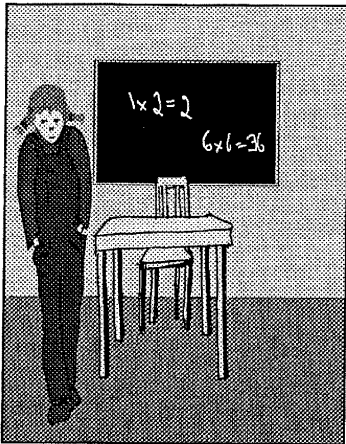
Picture 1   Picture 2   Picture 3

*Section 1. Text*
One day in autumn, the time was half past three. At Hampton School the bell went. The last lesson ended and the children left their desks. Sally had just had a Maths lesson. She had been given some homework to do. She wanted to get a good mark for it. Some of the children stayed on after school to play football. They went to the changing rooms. Others went to the computer room to do their homework. The rest left to go home. Some left by bike, others walked. A few were picked up by their parents. Sally thought that her homework would get a good mark if it were neat. So she went to the computer room. She did her homework on one of the computers. It looked very neat and she felt pleased. She got up and said goodbye to the children who were still there. Then she left to walk home.

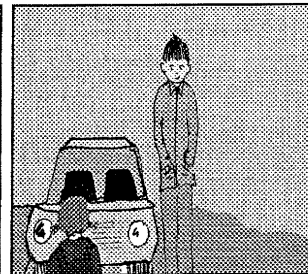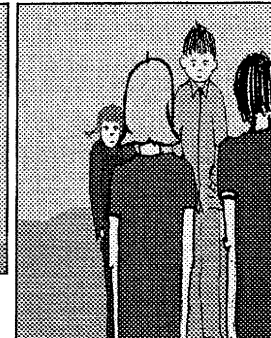*Section 2. Pictures*
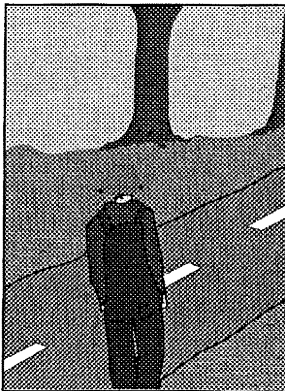
Picture 4   Picture 5   Picture 6   Picture 7

Section 2. Text: negative version
Sally's parents let her walk home. She did this each day. She had to go up one road, around a bend, and along another road to get to her house. As she set off, Sally looked ahead. The trees were waving in the wind, and it was quite dark. She felt scared, and started to walk quickly. A bit later, she thought about what mark she'd get for her homework. This took her mind off the walk home. Suddenly Sally saw a car. It was being driven by Clive Zachs. Clive Zachs was a teacher. He lived nearby and knew Sally's parents. He was on his way home. He had had a busy day, and was thinking about how it had gone. He got closer to where Sally was standing. Sally was scared. She waved at the car and tried to get Clive Zach's attention. Clive Zachs put on his brakes. Sally screamed. The car knocked Sally over. She lay in front of it, feeling frightened. Clive Zachs got out. He came over to Sally, to see how she was. He was worried that Sally was hurt and offered to take her home. Sally felt very upset but she said, "Yes" and got into the car. Clive Zachs drove Sally home. Sally's parents came out to meet them. Sally's mum yelled at Clive Zachs. She told him off for knocking Sally over. Clive Zachs looked guilty. "I'd better go now," he said and left.

Section 2. Text: positive version
Sally's parents let her walk home. She did this each day. She had to go up one road, around a bend, and along another road to get to her house. As she set off, Sally looked ahead. The trees were waving in the wind, and it was quite sunny. She felt happy, and started to skip. A bit later, she thought about what mark she'd get for her homework. This took her mind off the walk home. Suddenly Sally saw a car. It was being driven by Clive Zachs. Clive Zachs was a TV star. He lived nearby and knew Sally's parents. He was on his way home. He had had a busy day, and was thinking about how it had gone. He got closer to where Sally was standing. Sally was amazed. She waved at the car and tried to get Clive Zachs' attention. Clive Zachs put on his brakes. Sally smiled. The car stopped by Sally. She waited in front of it, feeling excited. Clive Zachs got out. He came over to Sally, to see how she was. He was surprised to see Sally and offered to take her home. Sally felt very happy. She said, "Yes" and got into the car. Clive Zachs drove Sally home. Sally's parents came out to meet them. Sally's mum hugged Clive Zachs. She thanked him for bringing Sally home. Clive Zachs looked proud. "I'd better go now," he said and left.

Section 2. Text: neutral version
Sally's parents let her walk home. She did this each day. She had to go up one road, around a bend, and along another road to get to her house. As she set off, Sally looked ahead. The trees were waving in the wind, and it was quite cloudy. She felt tired, and kept on walking. A bit later, she thought about what mark she'd get for her homework. This took her mind off the walk home. Suddenly Sally saw a car. It was being driven by Clive Zachs. Clive Zachs was Sally's brother's teacher. He lived nearby and knew Sally's parents. He was on his way home. He had had a busy day, and was thinking about how it had gone. He got closer to where Sally was standing. Sally was surprised. She waved at the car and tried to get Clive Zachs' attention. Clive Zachs put on his brakes. Sally watched. The car stopped by Sally. She waited in front of it, feeling bored with walking. Clive Zachs got out. He came over to Sally, to see how she was. He was interested in how things were going and offered to take Sally home. Sally felt very tired. She said, "Yes" and got into the car. Clive Zacks drove Sally home. Sally's parents came out to meet them. Sally's mum greeted Clive Zachs. She thanked him for bringing Sally home. Clive Zachs looked tired. "I'd better go now," he said and left.