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Exploring the Effect of Mood on the Interpretation of Ambiguity,  
With and Without Negative Mood Induction

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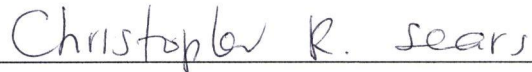
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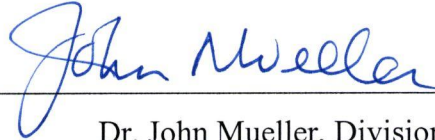
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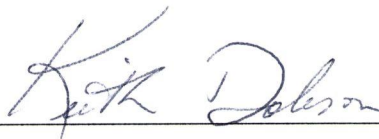
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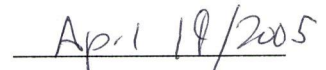
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## Abstract

What is the effect of mood on the interpretation of ambiguous information? Are dysphoric individuals more likely to interpret ambiguous information in a negative manner? We explored these issues using a cross-modal semantic priming task.

Participants listened to ambiguous sentences (e.g., *Joan was stunned by her final exam mark*) and responded to target words presented immediately after the sentence offset, after a delay of 1000 ms, or after a delay of 2000 ms. The target words were semantically related or semantically unrelated to the ambiguous sentences, allowing us to measure semantic priming effects. For the semantically related targets, the target was positively-related (*success*), negatively-related (*distress*), or was neutrally-related (*grades*) to the ambiguous sentence, allowing us to assess the degree of priming for positive, negative, and neutral semantic relations. High negative affect and low negative affect groups were created using scores on the Beck Depression Inventory and the Positive and Negative Affect Scale, and the experiment was conducted with and without negative mood induction. Our results are discussed in terms of the information processing biases associated with dysphoria and depression.

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Exploring the Effect of Mood on the Interpretation of Ambiguity,  
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Mood influences the manner in which individuals perceive themselves, others, and their environment, which in turn influences their experiences and quality of life. Depression is a mood disorder characterized by persistent feelings of sadness, worthlessness, and hopelessness, a diminished ability to think clearly and to concentrate, indecisiveness, disturbances in sleeping and eating patterns, reduced level of energy and motivation, and recurrent thoughts of death (DSM-IV-TR, 2000). While the origins of depression and its maintenance factors remain under investigation (e.g., Haaga, Dyck, & Ernst, 1991; Ingram, 2003), most researchers agree that individuals experiencing depression exhibit a generalized negative bias when compared to non-depressed individuals. Indeed, the notion that depression is associated with a negative information processing bias has played a central theoretical role in the investigation of the cognitive markers of depression.

One of the most productive ways of studying negative processing biases in the laboratory has been to present ambiguous information to participants and to assess their interpretation of that information. The general prediction is that depressed individuals will have an increased tendency to impose negative interpretations on ambiguous information. This prediction has been supported in a number of studies using a variety of methodologies. Butler and Mathews (1983), for example, reported that clinically depressed individuals were more likely to select the more negative interpretations of ambiguous textual scenarios. Similarly, Norman, Miller, and Klee (1983) reported that depressed individuals interpreted the stories on the Cognitive Bias questionnaire (for

which the respondent must choose one of four possible interpretations) by selecting the depressed-distorted option significantly more often than the non-depressed individuals. In studies where participants scored high on measures of depression, researchers have reported that depressed individuals display an exaggerated tendency to assess social performance in a negative manner (Cane & Gotlib, 1985; Forgas, Bower, & Krantz, 1984; Kavanagh & Bower, 1985), a tendency to recall more depression-related words (Bradley, Mogg, & Williams, 1994), and a tendency to entertain an internal dialogue that is asymmetrically negative (Schwartz & Garamoni, 1986).

And yet, as Lawson and MacLeod and others (MacLeod & Mathews, 1991; Mathews & MacLeod, 1994; Mogg, Bradley, Miller, Potts, Glenwright, & Kentish, 1994) have noted, the interpretation of these studies is not as straightforward as it would seem, as most have employed methodologies that are highly susceptible to response bias effects. For instance, when asked to interpret an ambiguous scenario by choosing from several response options that differ in emotional tone, depressed individuals may have a tendency to choose the more negative response option, regardless of their own interpretation of the scenario. The problem then, is that the presence of such an emotionally-linked response bias can produce the appearance of a negative interpretative bias when such a bias does not in fact exist.

To avoid this problem, a number of investigators have turned to semantic priming methodologies to infer which meanings are activated during the processing of ambiguous information. In these experiments, an ambiguous prime word (e.g., *die*) is presented for a short period of time, followed by a target word related to the neutral meaning of the prime (e.g., *dice*), the negative meaning of the prime (e.g., *death*), or a target word

unrelated to the prime (e.g., *cloud*). Depending upon which meaning of the ambiguous prime word is activated, responses to the neutrally-related target or to the negatively-related target will be facilitated, relative to the responses to the unrelated target (a semantic priming effect; Meyer & Schvaneveldt, 1971; Neely, 1976, 1977; see Neely, 1991, for a review). By comparing the magnitude of semantic priming effects for negatively-related targets and for neutrally-related targets as a function of affective state, the presence of a negative bias in interpretation can then be discerned.

An important consideration in semantic priming experiments is the origin of the priming effect—whether it is due to the automatic spreading of activation among related concepts in semantic memory (e.g., Anderson, 1983; Collins & Loftus, 1975; Masson, 1995), where a prime pre-activates the lexical node corresponding to a target, thereby reducing the target's processing time, or whether the priming is due to conscious strategies adopted by participants to anticipate the target, such as the generation of a set of words related to the prime (Neely & Keefe, 1989). The predominate way to distinguish between automatic priming and priming due to expectancy generation is to manipulate the stimulus onset asynchrony (SOA, the time elapsed between the onset of the prime and the onset of the target). Priming at short SOAs (i.e., from 0 ms to 500 ms) is attributed to automatic spreading activation, because there is insufficient time for the slow, expectancy-based strategy to operate. Conversely, a substantial amount of the priming effect at long SOAs (greater than 800 ms) is typically attributed to expectancy-generation (e.g., Balota, Black, & Cheney, 1992; Becker, 1980, 1985; de Groot, 1984; Neely, 1977, 1991), because there is time to generate an expectancy set and because automatic activation is believed to decay over time.

Richards and French (1992) used the semantic priming methodology to study the influence of anxiety on the interpretation of ambiguous word primes. In their study, a group of clinically anxious participants and a control group were presented with a series of ambiguous homograph primes (e.g., *arms*). Each prime could be interpreted in a negative or in a neutral manner, and each prime was followed by a target that was neutrally-related (e.g., *legs*), negatively-related (e.g., *weapons*), or unrelated (e.g., *wind*) to the prime. The participants' task was to make a lexical decision to the target (i.e., to indicate as quickly and accurately as possible whether the target was a word or not, some of the targets being nonwords). To distinguish between semantic priming effects due to automatic processing and semantic priming effects due to conscious strategies, Richards and French manipulated the prime-target SOA by conducting three separate experiments, the first using an SOA of 500 ms, the second an SOA of 750 ms, and the third using an SOA of 1250 ms. Richards and French reported that when the SOA was 500 ms, both groups of participants exhibited priming effects for both the negatively-related targets and the neutrally-related targets. Because the priming at the 500 ms SOA would be mostly due to automatic spreading activation, this result suggests that for both groups of participants both meanings of the ambiguous prime words were automatically activated, and to an equivalent extent. When the SOA was 750 ms or 1250 ms, however, only the clinically anxious participants exhibited a priming effect, and only for the negatively-related targets. Because priming effects at these longer SOAs would be due mostly to controlled processes, such as expectancy strategies, this result is consistent with the notion of a negative bias in the interpretation of ambiguity. Similarly, Calvo, Eysenck, and Estevez (1994), and MacLeod (1990), using ambiguous sentences as primes, found

that at longer SOAs, highly anxious participants showed larger semantic priming effects for targets related to the negative meanings of ambiguous sentences. This would suggest that, like the clinically anxious participants in Richards and French's (1992) study, individuals experiencing high levels of anxiety are disproportionately inclined to choose the negative interpretation of these sentences.

Despite the many advantages of using the semantic priming paradigm to study the influence of mood on the interpretation of ambiguity, to our knowledge only one study has used this methodology to explore the negative interpretative bias associated with depression (Lawson & MacLeod, 1999). In Lawson and MacLeod's (1999) study, participants were presented with prime sentences which they read aloud. After each sentence was read, a target word was presented and the task was to read this word aloud as quickly and as accurately as possible. The dependent variable was the pronunciation latency to read the target. Some of the target words were semantically related to the prime sentences and some were unrelated to the prime sentences, allowing semantic priming effects to be measured. For a subset of the prime sentences (the test stimulus set), the sentences were ambiguous (e.g., *The doctor examined little Emily's growth*), permitting a negative interpretation and a neutral interpretation, and these sentences were paired with two possible target words, one related to the negative interpretation (*tumour*) and the other related to the neutral interpretation (*height*). In this way, semantic priming effects for negatively-related targets and neutrally-related targets could be assessed.

Lawson and MacLeod (1999) created two groups of participants based on their scores on the Beck Depression Inventory. (Lawson & MacLeod further subdivided these groups into a dysphoric mood induction group and a positive mood induction group, but

neither mood induction had any discernable effect in their semantic priming task.) The expectation was that participants in the high BDI group would be more likely to interpret the ambiguous prime sentences in a negative manner, and as a consequence would show larger priming effects for targets related to the negative meanings of the prime sentences. Contrary to this expectation, their results suggested that it was the participants in the low BDI group who showed a disproportionate tendency to impose a negative interpretation on the ambiguous prime sentences. More specifically, Lawson and MacLeod reported that only participants in the low BDI group showed priming for targets related to the negative meaning of the prime sentences; for the participants in the high BDI group there was no hint of priming for the negatively-related targets. Lawson and MacLeod interpreted their findings to indicate that participants with high BDI scores may have an attenuated tendency to impose a negative interpretation on the ambiguous prime sentences. This is, of course, just the opposite of what would be expected from a depression-linked interpretation bias, and therefore challenges the notion that depression is associated with a bias to interpret ambiguous information in a negative manner.

Although Lawson and MacLeod's (1999) conclusions are straightforward, the interpretation of their results is complicated by several aspects of their semantic priming task. First, as noted, Lawson and MacLeod used pronunciation latencies to the target words as their dependent variable. Numerous studies have shown that semantic priming effects are smaller with the pronunciation task than with other latency-based tasks, such as semantic categorization tasks and the lexical decision task (e.g., Balota & Lorch, 1986; Neely, 1991; Seidenberg, Waters, Sanders, & Langer, 1984; West & Stanovich, 1982). Indeed, there are several notable failures to obtain semantic priming effects with the

pronunciation task (e.g., Lupker, 1984). Second, Lawson and MacLeod used a relatively long delay between the offset of the ambiguous prime sentence and the onset of the target word (the interstimulus interval, or ISI). The ISI was 1000 ms, which would have compounded the difficulty of obtaining semantic priming effects with the pronunciation task, as numerous studies have shown that, with the pronunciation task, semantic priming effects are quite small and even statistically elusive when ISIs are longer than 500 ms (Neely, 1991).

The combination of a long ISI and the use of the pronunciation task would have made it difficult for Lawson and MacLeod's (1999) experiment to detect any semantic priming effects. Two observations are consistent with this interpretation. First, an examination of their data (in their Table 1) reveals that the overall semantic priming effect for neutral targets, which would be expected to produce a semantic priming effect regardless of affect group, was only 7 ms (571 ms for the neutrally-related targets and 578 ms for the unrelated targets). Second, the overall semantic priming effect (mean response latencies to the related targets vs. mean response latencies to the unrelated targets) was not statistically significant—overall, there was no semantic priming in their experiment. Consequently, it is difficult to interpret the absence of a statistically significant semantic priming effect in any of the conditions of their experiment. The lack of a priming effect for negatively-related targets for their high BDI group could reflect a reduced tendency to activate the more negative meanings of the ambiguous prime sentences, or it could reflect the elusiveness of the priming effect under the particular methodological circumstances of their study.



### *The Present Research*

Given the theoretical importance of Lawson and MacLeod's (1999) results, the purpose of this study was to re-examine the processing of ambiguous information as a function of mood state. The present experiments also used the semantic priming task to study the interpretation of ambiguity, but our experiments differed from Lawson and MacLeod's (1999) experiment in several important ways.

First, whereas Lawson and MacLeod (1999) used a pronunciation task, we used a lexical decision task because, as noted, semantic priming effects tend to be larger with the lexical decision task. Second, we manipulated the ISI between the offset of the prime sentence and the onset of the target, in order to distinguish between automatic priming effects and priming effects due to expectancy generation. Like Lawson and MacLeod (1999), in Experiment 1A we used an ISI of 1000 ms, which would predominately measure expectancy-induced priming. Unlike Lawson and MacLeod (1999), we also assessed automatic priming effects, by incorporating a 0 ms ISI into the experiment. In Experiment 1B, ISIs of 0 ms and 2000 ms were used, the longer 2000 ms ISI intended to increase the confidence that any priming observed was predominately due to expectancies generated upon listening to the ambiguous prime sentence.

The source of the priming effect is an important theoretical issue, as most cognitive theories of depression assume that depressed individuals have an automatic processing bias for negative information (e.g., Beck, 1976; Bower, 1981; Ingram, 1984; Teasdale, 1988). According to these theories, differences between depressed and non-depressed groups should be most pronounced when the primes and targets are negatively-related and the prime-target SOA or ISI is very brief—conditions favouring an automatic

processing bias for negative information. Other theories take a different view, proposing that the negative bias is a conscious and controlled process, not an automatic one (e.g., Williams, Watts, MacLeod, & Mathews, 1988, 1997). According to this view, depressed participants should show larger priming effects for negatively-related prime-target pairs only when the SOA or ISI is sufficiently long such that expectancy-based priming predominates. Whether or not the bias operates in an automatic fashion is perhaps the most important distinction between these theories (Moretti & Shaw, 1989), and by assessing both automatic and expectancy-induced priming our experiments will provide a clear test of these predictions.

Another issue addressed in our study is the specificity of the priming effects—whether an enhanced or an attenuated priming effect is specific to targets negatively-related to the prime sentences, or whether there is priming for any affective semantic relations, positive or negative in nature. This is an issue discussed by Deldin, Keller, Gergen, and Miller (2001), Ingram, Bernet, and McLaughlin (1994), and Siegle, Granholm, Ingram, and Matt (2001), among others, and in the present study it was addressed by also using targets that were positively-related to the ambiguous prime sentences. For example, the prime sentence *Jason's classmates laughed as he made his presentation* was paired with positively-related target *funny*, in addition to the negatively-related target *foolish*.

Finally, whereas Lawson and MacLeod (1999) had their participants read ambiguous prime sentences, we digitally recorded our sentences and had participants listen to them, thereafter making a lexical decision to a visually-presented target (referred to as a cross-modal semantic priming task; e.g., Seidenberg, Tanenhaus, Leiman, &

Bienkowski, 1982; Simpson, 1984; Swinney, 1979). We chose to present the sentences auditorally so that participants could devote their full attention to the meaning of each sentence, unencumbered by the need to read the sentence aloud.

Our main research questions were as follows: (a) will participants high in negative affect exhibit more semantic priming for negatively-related targets than participants low in negative affect?, (b) will there be group differences in the degree of semantic priming for positively-related targets?, and (c) will the priming effects for the groups vary as a function of ISI (0 ms vs. 1000 ms vs. 2000 ms), which will distinguish between automatic priming effects and priming effects due to expectancy generation?

### Experiment 1

In Experiments 1A and 1B, participants listened to ambiguous sentences and responded to target words presented at different ISIs following the sentence offset. The target words were semantically related or semantically unrelated to the ambiguous sentences, and for the semantically related targets, the target was positively-related, negatively-related, or neutrally-related to the ambiguous sentence. In Experiment 1A, the ISIs used were 0 ms and 1000 ms, and in Experiment 1B the ISIs were 0 ms and 2000 ms, the longer ISI being used to increase the time available to generate expectancies based on the sentence prime. In all other respects the two experiments were identical.

### Method

#### *Participants*

Two hundred and sixty undergraduate students from the University of Calgary participated in the study in exchange for partial course credit. One-hundred and twenty participated in Experiment 1A and 140 participated in Experiment 1B. None of these

individuals participated in more than one of these experiments. All of the participants were women, with a mean age of 21.3 years (range of 18 to 45). Most of the participants were native English speakers ( $n = 247$ ), and the remainder rated themselves as “very fluent” ( $n = 10$ ) or as “fluent” ( $n = 3$ ) in English, using a scale from 1 (*not fluent*) to 5 (*very fluent*).

All of the participants completed the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996) and the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988). The BDI-II assesses participants’ depressive symptoms, whereas the PANAS assesses participants’ pleasant and unpleasant mood states. The PANAS consists of 20 words that describe different emotions (e.g., excited, proud, upset, guilty, distressed); participants read each word and indicated “to what extent you have felt this way”, using a scale from 1 (*very slightly or not at all*) to 5 (*extremely*). These same 20 words are rated for three time frames: “during the past few days”, “during the past few weeks”, and “how you feel on average”. The minimum score is 20 and the maximum score is 100 when the scores for all 20 words are added. (The minimum and the maximum score for the 10 positive words or for the 10 negative words is 10 and 50.) PANAS scores were used in addition to BDI-II scores to assign participants to groups (described below). For each participant, a composite PANAS negative affect score was created by averaging the participant’s responses to the negative affect items (*guilty*, *distressed*, etc.) over two time frames: “during the past few days” and “during the past few weeks”. A composite PANAS positive affect score was also created by averaging the participant’s responses to the positive affect items (*excited*, *proud*, etc.) for the “during the past few days” and “during the past few weeks” time frames.

For Experiments 1A and 1B, a low negative affect group and a high negative affect group were created using the BDI-II scores and the composite PANAS negative affect scores. For both experiments, the low negative affect group consisted of participants with BDI-II scores less than 6 and composite negative affect scores less than 18.0 (i.e., a composite negative affect score less than the median composite negative affect score, calculated by using the PANAS composite scores from all 439 participants in Experiment 1A, Experiment 1B, and Experiment 2). The high negative affect group consisted of participants with BDI-II scores greater than 13 and composite negative affect scores greater than 18.0.

In Experiment 1A, there were 27 participants in the low negative affect group, with a mean BDI-II score of 2.6 (range of 0 to 5) and a mean composite negative affect score of 12.8 (range of 10.0 to 17.5). There were 34 participants in the high negative affect group, with a mean BDI-II score of 20.6 (range of 14 to 40), and a mean composite negative affect score of 26.1 (range of 18.5 to 44.5). The two groups differed significantly in terms of their BDI-II scores,  $t(59) = 14.87, p < .001$ , and in terms of their negative affect scores,  $t(59) = 11.77, p < .001$ . Further, participants in the high negative affect group had a lower mean on the composite positive affect score than participants in the low negative affect group (24.1 vs. 35.3),  $t(59) = 6.41, p < .001$ .

In Experiment 1B, there were 35 participants in the low negative affect group, with a mean BDI-II score of 2.97 (range of 0 to 5) and a mean composite negative affect score of 13.6 (range of 10.0 to 17.5). There were 30 participants in the high negative affect group, with a mean BDI-II score of 21.1 (range of 14 to 36), and a mean composite negative affect score of 26.7 (range of 19 to 50). The two groups differed significantly in

terms of their BDI-II scores,  $t(63) = 16.39, p < .001$ , and in terms of their negative affect scores,  $t(63) = 10.33, p < .001$ . Further, participants in the high negative affect group had a lower mean on the composite positive affect score than the participants in the low negative affect group (25.9 vs. 34.7),  $t(63) = 6.79, p < .001$ . Note that the mean BDI scores and the mean PANAS scores for the high and low negative affect groups were similar in the two experiments.

### *Stimuli*

Two-hundred and forty ambiguous sentences were presented to each participant (these are listed in Appendix A; 54 of these sentences were used in Lawson & MacLeod's, 1999, experiment). Half of the sentences were paired with a word target and the other half were paired with a nonword target (e.g., *carticle*). All of the nonword targets were orthographically legal and pronounceable and resembled real words (see Appendix A; the descriptive statistics for the nonword stimuli are listed in Table C5). The nonword targets were matched to the word targets on the number of letters and on the number of orthographic neighbors (i.e., the number of different words that can be created by changing one letter of a word while maintaining letter positions; Coltheart, Davelaar, Jonasson, & Besner, 1977). Matching the nonwords to the words on the number of orthographic neighbors ensured that the visual discrimination between the words and the nonwords was quite difficult, and in these situations participants tend to rely on semantic information to make their decisions (Neely, 1991; Stone & Van Orden, 1993), which increases the likelihood that semantic priming effects will be observed.

Of the 120 sentences paired with word targets, 80 were the critical experimental sentences. Each of these sentences permitted a positive interpretation, a negative

interpretation, and a neutral interpretation, and each sentence was paired with a positively-related word, a negatively-related word, a neutrally-related word, or an unrelated word. For example, the sentence *Kathy had been committed for some time* was paired with the target *years* (a neutrally-related target), *hospital* (a negatively-related target), *romantic* (a positively-related target), and *sauce* (an unrelated target). Each participant saw only one of these pairings in the experiment. The 40 remaining ambiguous sentences were paired with an unrelated word and were included to create a relatedness proportion of 50% (i.e., 50% of the target words were semantically related to the sentences and 50% were not). Participants' responses to these unrelated filler pairs were not analyzed. A relatedness proportion of 50% minimizes the relatedness proportion effect (Neely, 1991), the increase in the magnitude of the semantic priming effect that occurs when the proportion of semantically related targets is increased. The relatedness proportion effect is thought to reflect a conscious strategy some participants engage in upon noticing that a high proportion of the primes and targets are semantically related (i.e., "If there is a relationship between the prime and the target then respond "word"; otherwise respond "nonword"). Because nonwords are never related to their primes, this creates a bias toward "word" responses, which can artificially inflate semantic priming effects, especially at long SOAs (Neely & Keefe, 1989).

Because semantic priming effects vary with printed word frequency, with larger priming effects for lower frequency words (e.g., Borowsky & Besner, 1993; Stanovich & West, 1981), the word targets in the positive, negative, neutral, and unrelated conditions were matched closely on printed word frequency (Kucera & Francis, 1967), in addition to the number of letters and orthographic neighborhood size. The mean normative

frequencies per million words for targets in the positively-related, negatively-related, neutrally-related, and unrelated conditions were 38.1, 36.9, 39.9, and 46.6, respectively, and by convention would be considered to be of low-frequency. (The mean normative frequency of Lawson & MacLeod's 1999, target words was 67.3.) The descriptive statistics for the word stimuli are listed in Appendix C.

Four lists of sentence and word pairs were created, each list consisting of the same sentences but different pairings of sentence and target words (see Appendix B). This allowed the same sentences to be used in the positively-related, negatively-related, neutrally-related, and unrelated conditions, which ensured that any differences between these conditions were not due to differences in the sentence primes. Within each list, 20 sentences were paired with a positively-related target, 20 sentences were paired with a negatively-related target, 20 sentences were paired with a neutrally-related target, and 20 sentences were paired with an unrelated target. An additional 40 sentences were paired with an unrelated target (the unrelated filler pairs), and 120 sentences were paired with a nonword target. The 40 unrelated filler pairs and the 120 nonword target pairs were the same in each list; the only difference between the lists was the sentence and target pairs in the positive, negative, neutral, and unrelated conditions. For example, in List 1, the sentence *Kathy had been committed for some time* was paired with the target *years* (a neutrally-related target). In List 2, the same sentence was paired with the target *hospital* (a negatively-related target), in List 3 this sentence was paired with the target *romantic* (a positively-related target), and in List 4 this sentence was paired with the target *sauce* (an unrelated target).



To incorporate the ISI manipulation (0 ms and 1000 ms in Experiment 1A; 0 ms and 2000 ms in Experiment 1B), within each list, half of the targets were presented immediately after the offset of the ambiguous prime sentence (0 ms ISI) and the remainder of the targets were presented 1000 ms (Experiment 1A) or 2000 ms (Experiment 1B) after the offset of the ambiguous sentence. To counterbalance the ISI manipulation, four new lists were created. List 5 consisted of the same prime-target pairs as List 1, the only difference being the ISI manipulation, with the targets that were presented with a 0 ms ISI in List 1 presented with a 1000 ms ISI (or a 2000 ms ISI) in List 5, and the targets that were presented with a 1000 ms ISI (or a 2000 ms ISI) in List 1 presented with a 0 ms ISI in List 5. The same counterbalancing procedure was employed for List 2 and List 6, List 3 and List 7, and List 4 and List 8. Thus, a total of eight lists of prime and target pairs were created (each list is presented in Appendix B). Each participant was presented with only one of the eight lists, and the presentation of the lists was counterbalanced across participants.

To summarize, each participant was presented with 20 positively-related prime-target pairs, 20 negatively-related prime-target pairs, 20 neutrally-related prime-target pairs, 20 unrelated-prime-target pairs, 40 unrelated prime-filler target pairs, and 120 nonword prime-target pairs, half presented with an ISI of 0 ms, and the remainder presented with an ISI of 1000 ms (Experiment 1A) or 2000 ms (Experiment 1B).

*Semantic Relatedness Ratings.* Because the strength of the semantic relation between primes and targets influences the magnitude of priming effects (e.g., Canas, 1990), semantic relatedness ratings were collected prior to the experiments to ensure that the sentence and target pairs (positively-related, negatively-related, neutrally-related, and

unrelated) used in each of the conditions were properly selected. In a separate study, 78 undergraduate students (none of whom participated in the present experiments) were asked to judge the extent to which each sentence-target pair was related in meaning using a seven-point scale from 0 (*unrelated*) to 6 (*very related*). Participants were also asked to judge whether the relationship between each sentence and target was positive, negative, or neutral, using a seven-point scale from  $-3$  (*very negative*) to  $+3$  (*very positive*), with a midpoint of zero. Each sentence was paired with each of its possible word targets and these were randomly ordered and listed in two separate questionnaires (two questionnaires were created due to the large number of sentence-target pairs to be rated). Each questionnaire was completed by a different group of undergraduate students ( $n = 40$  and  $n = 38$ ; all of the participants were women).

The mean semantic relatedness ratings are listed in Appendix C. The mean semantic relatedness ratings for the positively-related pairs, the negatively-related pairs, and the neutrally-related pairs were very similar (4.38, 4.62, and 4.51, respectively), and were not significantly different from one another,  $F(2, 237) = 2.29, p > .10, MSE = 1.13$ . This indicates that the pairs were of equivalent semantic strength. As a result, any differences among these conditions in the magnitude of the semantic priming effect could not be attributed to differences in the strength of the semantic relations between the sentences and targets. Also note that, as intended, the semantic relatedness ratings for the positively-related, negatively-related, and the neutrally-related pairs were significantly greater than the semantic relatedness ratings for the unrelated pairs ( $M = 0.21$ ; all  $ps < .001$ ).

Also listed in Appendix C are the mean affect ratings for the sentence and target pairs in each condition. An analysis of these ratings indicated that, as intended, the sentence and target pairs in the positively-related condition were rated as being significantly more positively related than the sentence and target pairs in the neutrally-related condition (1.91 vs. 0.23),  $t(158) = 14.26$ ,  $p < .001$ , and the sentence and the target pairs in the negatively-related condition were rated as being significantly more negatively related than the pairs in the neutrally-related condition ( $-1.96$  vs. 0.23),  $t(158) = 21.39$ ,  $p < .001$ .

#### *Apparatus and Procedure*

Prior to the experiment the ambiguous prime sentences were digitally recorded at 22,050 Hz (stereo) by a native English female speaker. Each sentence was digitally edited to ensure that the ISI between the offset of the prime sentence and the onset of the target could be precisely controlled.

For the semantic priming task, stimuli were presented on a color video graphics array monitor driven by a Pentium-class microcomputer. The experiment was programmed using the DMDX software package (Forster & Forster, 2003). The presentation of stimuli was synchronized with the vertical retrace rate of the monitor (14 ms), and response latencies were measured to the nearest ms.

The participant sat approximately 50 cm from the computer monitor and wore a set of stereo headphones connected to the computer. Participants indicated the lexicality of stimuli (*word* or *nonword*) by pressing one of two buttons (labeled as *yes* and *no*) on a response box.

At the start of each trial, the participant heard an ambiguous prime sentence through the stereo headphones. When the ISI was 0 ms, the target (a word or a nonword) was presented in the display immediately after the sentence offset; when the ISI was 1000 ms or 2000 ms the target was presented 1000 ms or 2000 ms after the sentence offset. Targets were presented in white lower case letters on a dark background, in the center of the display, and remained on the display until the participant made a response. The participant's task was to indicate, as quickly and accurately as possible, whether the target was a word or a nonword. If the target was a word the participant was instructed to press the *yes* button on the button box placed in front of them; if the target was not a word the participant was instructed to press the *no* button. Participants were informed that 50% of the targets would be words and 50% would be nonwords. Lexical decision latencies were measured (in milliseconds) from the onset of the target to the participant's *yes* or *no* response. The computer software automatically recorded the accuracy and latency of each response and saved this information in an ASCII text file. The order in which the stimuli were presented was randomized separately for each participant.

Each participant completed 10 practice trials prior to the experimental trials. The practice trials consisted of five ambiguous sentences paired with a word target (one negatively-related pair, three neutrally-related pairs, and one unrelated pair), and five ambiguous sentences paired with a nonword target. These practice trials were not in the experiment and the data from these trials was not analyzed.

Following the semantic priming task, the participant was asked to fill out a demographic information questionnaire (age, ethnicity, and English fluency), the BDI-II, and the PANAS, while alone in a private room. Once completed, the participant placed

the questionnaires into a sealable envelope, and left the sealed envelope in the room to be collected by the experimenter.

## Results

Response latencies of correct responses and error rates were analyzed using a 2 (Affect Group: low negative affect, high negative affect) x 2 (ISI: 0 ms, 1000 ms for Experiment 1A; 0 ms, 2000 ms for Experiment 1B) x 4 (Relatedness: positively-related, negatively-related, neutrally-related, unrelated) mixed-model factorial analysis of variance (ANOVA). Affect group was a between-subjects factor and ISI and relatedness were within-subjects factors. Response latencies greater than 1200 ms were considered outliers and were removed from all analyses. For Experiment 1A, 520 response latencies (3.5% of the data) were removed by this procedure, and for Experiment 1B, 727 response latencies (4.5% of the data) were removed.

### *Experiment 1A (0 ms and 1000 ms ISIs)*

*Analysis of Response Latencies and Errors Rates.* The mean response latencies of correct responses and the mean error rates for the high negative affect group and the low negative affect group are shown in Table 1. (The mean response latencies of correct responses and the mean error rates for all 120 individuals who participated in Experiment 1A are shown in Table H1.)

In the analysis of response latencies, the main effect of relatedness was significant,  $F(3, 177) = 38.96, p < .001, MSE = 1791.71$ . Response latencies to unrelated targets (635 ms) were slower than response latencies to positively-related targets (589 ms), to negatively-related targets (590 ms), and to neutrally-related targets (583 ms), which is the basic semantic priming effect. The main effect of ISI was significant,  $F(1,$

59) = 104.37,  $p < .001$ ,  $MSE = 2266.21$ , as response latencies were faster when the ISI was 1000 ms than when it was 0 ms (577 ms vs. 621 ms). Faster responding at longer ISIs is a common finding in semantic priming experiments that use the lexical decision task (e.g., Neely, 1976, 1991). There was also an interaction between affect group and ISI,  $F(1, 59) = 10.11$ ,  $p < .05$ ,  $MSE = 2266.21$ . The high negative affect group was slower than the low negative affect group when the ISI was 0 ms (644 ms vs. 599 ms) and also when the ISI was 1000 ms (585 ms vs. 568 ms), but the latter difference was smaller and not statistically significant ( $p > .10$ ). The main effect of affect group was not statistically significant,  $F(1, 59) = 2.10$ ,  $p > .10$ ,  $MSE = 54,185.68$ , nor were the interactions between ISI and relatedness,  $F(3, 57) = 1.03$ ,  $p > .05$ ,  $MSE = 1499.72$ , or between affect group and relatedness,  $F(3, 177) = 1.27$ ,  $p > .05$ ,  $MSE = 1791.71$ . The three-way interaction was also not significant,  $F < 1$ .

In the analysis of the error rates, there was a main effect of relatedness,  $F(3, 177) = 43.46$ ,  $p < .001$ ,  $MSE = 26.16$ , with fewer errors in the related conditions (1.1% overall) than in the unrelated condition (7.3%), reflecting the basic semantic priming effect. The main effect of affect group was not statistically significant, nor was the main effect of ISI (both  $F$ s  $< 1$ ), nor were any of the interactions (all  $p$ s  $> .10$ ).

The mean response latencies for the nonwords are listed in Table 1. In the analysis of the nonword data, the main effect of ISI was significant,  $F(1, 59) = 91.76$ ,  $p < .001$ ,  $MSE = 406.68$ . As was the case with the word targets, responses to the nonword targets were faster when the ISI was 1000 ms than when it was 0 ms (684 ms vs. 720 ms). The main effect of affect group was marginally significant,  $F(1, 59) = 3.67$ ,  $p = .06$ ,  $MSE = 17,672.12$ , with the high negative affect group being slower to respond to the nonwords

than the low negative affect group (725 ms vs. 679 ms). Unlike the situation for the words, there was no interaction between affect group and ISI,  $F(1, 59) = 2.43, p > .10$ ,  $MSE = 406.68$ , although the trend was in the same direction (a smaller difference between the groups when the ISI was 1000 ms). For the nonword error data (also listed in Table 1), there were no significant main effects or interactions (all  $ps > .10$ ). (The nonword data for all 120 participants is listed in Table H1.)

*Analysis of Semantic Priming Effects.* Semantic priming effects were calculated by subtracting a participant's mean response latency in each of the positively-, negatively-, and neutrally-related conditions from their mean response latency of the corresponding unrelated condition. The mean semantic priming effects for the high negative affect group and the low negative affect group for the 0 ms ISI and the 1000 ms ISI are shown in Table 1. (The mean semantic priming effects for all 120 participants in Experiment 1A are shown in Table H1.)

The first point to note is that there were large semantic priming effects in each of the positively-related, negatively-related, and neutrally-related conditions, for both groups of participants. The overall semantic priming effect was 47 ms ( $p < .01$ ), and multiple comparisons indicated that the priming effect in each condition was significantly greater than zero (all  $ps < .01$ ). Thus, unlike Lawson and MacLeod (1999), we obtained an overall semantic priming effect, as well as priming effects in each experimental condition.

The second point to note is that there were no differences between the two groups in the magnitude of semantic priming effects, either overall (41 ms for the low negative affect group and 54 ms for the high negative affect group), or in any of the positively-

related, negatively-related, or neutrally-related conditions. This was confirmed in an ANOVA of the priming effects, the data being submitted to a 2 (Affect Group: low negative affect, high negative affect) x 2 (ISI: 0 ms, 1000 ms) x 3 (Relatedness: positively-related, negatively-related, neutrally-related) mixed-model ANOVA, with affect group as a between-subjects factor and ISI and relatedness as within-subjects factors. In this analysis, there were no main effects of group, ISI, or relatedness, and no interactions (all  $ps > .10$ ). Thus, there was no evidence that the degree of priming for negative semantic relations (or for positive semantic relations) was modulated by negative affect, at either the 0 ms ISI or the 1000 ms ISI. This suggests that the participants in the high negative affect group were no more likely to activate the negative (or positive) meanings of the ambiguous prime sentences than were the participants in the low negative group.

*Experiment 1B (0 ms and 2000 ms ISIs)*

*Analysis of Response Latencies and Errors Rates.* The mean response latencies of correct responses and the mean error rates for the high negative affect and the low negative affect group are shown in Table 2. (The mean response latencies of correct responses and the mean error rates for all 140 participants in Experiment 1B are shown in Table H2.) In the analysis of response latencies, the main effect of relatedness was significant,  $F(3, 189) = 48.73, p < .001, MSE = 2,307.86$ , as responses to unrelated targets (674 ms) were slower than responses to positively-related targets (618 ms), negatively-related targets (618 ms), and to neutrally-related targets (611 ms), which reflects the basic semantic priming effect.



The main effect of ISI was significant,  $F(1, 63) = 64.23, p < .001, MSE = 4,104.16$ , as response latencies were faster when the ISI was 2000 ms than when it was 0 ms (608 ms vs. 653 ms). As was the case in Experiment 1A, there was an interaction between affect group and ISI,  $F(1, 63) = 12.96, p < .01, MSE = 4,104.16$ . Like the situation in Experiment 1A, the high negative affect group was slower than the low negative affect group when the ISI was 0 ms (659 ms vs. 646 ms). When the ISI was 2000 ms, however, the low negative affect group was slower than the high negative affect group (621 ms vs. 594 ms), although this difference was not statistically significant ( $p > .10$ ). No other main effects or interactions were statistically significant (all  $ps > .10$ ).

In the analysis of error rates, there was a main effect of relatedness,  $F(3, 189) = 28.42, p < .001, MSE = 21.59$ , with fewer errors in the related conditions (1.1% overall) than in the unrelated condition (5.4%). There was also a marginally significant effect of ISI,  $F(1, 63) = 3.77, p = .06, MSE = 18.05$ , with slightly fewer errors when the ISI was 2000 ms than when it was 0 ms (1.7% vs. 2.5%). No other main effects or interactions were statistically significant (all  $ps > .10$ ).

The mean response latencies and error rates for the nonword targets are also listed in Table 2. (Table H2 lists the nonword data for all 140 participants in Experiment 1B.) In the analysis of the nonword data, the only significant effect was the main effect of ISI,  $F(1, 63) = 66.27, p < .001, MSE = 758.94$ . Like the words, the responses to the nonwords were faster when the ISI was 2000 ms than when it was 0 ms (710 ms vs. 749 ms).

*Analysis of Semantic Priming Effects.* The semantic priming effect data were submitted to a 2 (Affect Group: low negative affect, high negative affect) x 2 (ISI: 0 ms, 2000 ms) x 3 (Relatedness: positively-related, negatively-related, neutrally-related)

mixed-model ANOVA, with affect group a between-subjects factor and ISI and relatedness within-subjects factors. The mean priming effects for the high negative affect group and the low negative affect group are shown in Table 2. (The mean semantic priming effects for all 140 participants in Experiment 1B are shown in Table H2.)

As was the case in Experiment 1A, the overall semantic priming effect (58 ms) was statistically significant ( $p < .01$ ), and multiple comparisons revealed significant priming effects in each of the experimental conditions (all  $ps < .01$ ). But the two groups did not differ in their overall priming effects (for the low negative affect group the mean priming effect was 57 ms, for the high negative affect group it was 60 ms), nor in any of the experimental conditions, as there were no significant main effects or interactions in the ANOVA (all  $ps > .10$ ). Like Experiment 1A then, there was no evidence that participants high in negative affect had a disproportionate tendency to impose a negative interpretation on the ambiguous prime sentences, as would be indicated by the magnitude of their semantic priming effects.

### Discussion

Returning to our research questions, recall that our experiments were designed to answer three basic questions, namely, (a) will participants high in negative affect exhibit more semantic priming for negatively-related targets than participants low in negative affect?, (b) will there be group differences in the degree of semantic priming for positively-related targets?, and (c) will the priming effects for the groups vary as a function of ISI (0 ms vs. 1000 ms vs. 2000 ms)? The results of our experiments are very clear—although there were large semantic priming effects in both experiments, there was no evidence of any group differences in priming effects in either experiment, regardless

of whether the target was related to the negative meaning or to the positive meaning of the prime sentence. This was true when the delay between the prime sentence and the target was 0 ms, which would have tapped automatic semantic priming, and also when ISIs of 1000 ms and 2000 ms were used, which would have tapped expectancy-based priming.

Considered together, these results lend no support to cognitive theories of depression which incorporate a negative processing bias, including theories in which the bias affects automatic information processing (e.g., Beck, 1976; Bower, 1981; Ingram, 1984; Teasdale, 1988) and theories in which the bias affects only conscious, interpretive processes (e.g., Williams, et al., 1988, 1997). Despite the many methodological differences between our experiments, like Lawson and MacLeod (1999), based on these results we also conclude that sub-clinically depressed participants exhibit no obvious negative interpretative bias in this task. The lack of any enhanced or attenuated priming for targets related to the positive meaning of the ambiguous sentence primes further reinforces this conclusion. But there remains the possibility that, for this task, a negative schema must be activated before a negative bias can be readily observed. Although Lawson and MacLeod (1999) used a dysphoric mood induction and found that it had no impact on the priming effects in their study, we felt it was prudent to also incorporate a negative mood induction into our procedure before we reach any final conclusions.

## Experiment 2

Some researchers have suggested that the negative schema must be activated for a negative bias to be observed (Ingram, Bernet, & McLaughlin, 1994; Teasdale & Dent, 1987). Because the participants in Experiment 1 were not independently assessed for

clinical depression, it is possible that, at the time of their participation, the negative schema of the individuals in the high negative affect group was not active, in which case a negative interpretative bias may be difficult to observe. To temporarily activate participants' negative schema, we used a mood induction procedure with the intention of evoking a sad mood state within participants.

As noted, Lawson and MacLeod (1999) used a Velten mood induction procedure in their study, which involved the presentation of positive or negative emotive statements prior to the start of each of the four blocks of trials of their semantic priming task. Participants were asked to read the sentences aloud and to induce the corresponding mood within themselves. After each block of trials participants rated their mood before beginning the next block of trials. Although this mood induction procedure had no impact on the semantic priming effects in their study, according to the mood ratings the procedure was effective, with participants in the dysphoric mood induction condition reporting higher levels of dysphoria than participants in the positive mood induction.

The limitations of the Velten mood induction procedure are widely recognized, and studies suggest that between 30% and 50% of participants are not affected by the procedure (Clark, 1983; Kenealy, 1986). Researchers have noted several concerns in the literature. For one, Cash, Rimm, and MacKinnon (1986) reported that individuals who are not prone towards depressogenic ideation or who are not willing to entertain depressive self-statements at the time of the procedure may disregard the emotive statements as 'silly' or 'sick'. After researching which predictors best contributed to the occurrence and the extent of negative mood induction, Scherrer (2004) reported that the success of the Velten mood induction procedure partly depends on individuals' recent

experiences of negative events, with distant negative experiences leading to a decreased likelihood of success. More serious issues were identified by Kenealy (1986), who reviewed 46 studies and concluded that the effectiveness of the Velten was “inconsistent and equivocal”, as participants’ behaviours and self-reports did not fully correspond to the induced mood. Instead, Kenealy (1986) noted that while participants may report a mood shift, their behaviours often do not change. With these concerns in mind, we chose not to use the Velten mood induction procedure, but to instead use a multi-modal negative mood induction, incorporating video, music, story writing, and explicit instructions inviting participants to adopt a dysphoric mood, as the literature suggests that this combination can be quite effective (e.g., Gerrards-Hesse, Spies, & Hesse, 1994; Hernandez, Vander Wal, & Spring, 2003; Westermann, Spies, Stahl, & Hesse, 1996).

In the present experiment, like Experiment 1, participants listened to ambiguous prime sentences and responded to target words semantically related or semantically unrelated to the ambiguous sentences; for the semantically related targets, the target was positively-related, negatively-related, or was neutrally-related to the ambiguous sentence. The target words were presented after an ISI of 0 ms or after an ISI of 1000 ms. Thus, the only difference between Experiment 1A and the present experiment was the addition of the negative mood induction procedure, the details of which are described below.

### *Method*

*Participants.* One hundred and seventy-nine undergraduate students from the University of Calgary participated in the study in exchange for partial course credit. None of these individuals participated in Experiment 1. Each participant was asked to confirm that she did not have a current diagnosis of depression and that she was not currently in

treatment for depression (i.e., drug therapy or psychotherapy; see Appendix D). Those who were receiving treatment for depression did not participate in the study. All of the participants were women, with a mean age of 20.5 years (range of 17 to 47). Most of the participants were native English speakers ( $n = 164$ ) and the remainder rated themselves as “very fluent” ( $n = 12$ ) or “fluent” ( $n = 3$ ) in English on a scale from 1 (*not fluent*) to 5 (*very fluent*).

All of the participants completed a demographic information sheet (age, ethnicity, English fluency), the Beck Depression Inventory, and the Positive and Negative Affect Scale. A composite PANAS negative affect score was created by averaging the participant’s responses to the negative affect items over the “during the past few days” and “during the past few weeks” time frames; a composite PANAS positive affect score was created in the same manner.

For 24 participants (13.4% of the sample), the negative mood induction procedure (described below) was not effective, and so these participants were excluded from all data analyses. (The mean response latencies and error rates for these 24 participants are shown in Table H4.) Like Experiment 1, a low negative affect group and a high negative affect group were created using the BDI-II scores and the composite PANAS negative affect scores. The low negative affect group consisted of participants with BDI-II scores less than 6 and composite negative affect scores less than 18.0 (i.e., a score less than the median composite negative affect score), and the high negative affect group consisted of participants with BDI-II scores greater than 13 and composite PANAS negative affect scores greater than 18.0.

There were 50 participants in the low negative affect group, with a mean BDI-II score of 2.1 (range of 0 to 5) and a mean composite negative affect score of 13.3 (range 10 to 17.5). There were 19 participants in the high negative affect group, with a mean BDI-II score of 17.8 (range 14 to 34) and a mean composite negative affect score of 25.6 (range 19.5 to 32.5). The two groups differed significantly in terms of their BDI-II scores,  $t(67) = 17.13, p < .001$ , and in terms of their composite negative affect scores  $t(67) = 16.49, p < .001$ . Participants in the high negative affect group had a lower mean on the composite positive affect score than participants in the low negative affect group (25.5 vs. 35.6),  $t(67) = 7.09, p < .001$ .

*Stimuli and Apparatus.* The apparatus and the stimuli for the cross-modal semantic priming task were identical to those used in Experiments 1A and 1B (see Appendix A). The ISI manipulation was the same as in Experiment 1A (ISIs of 0 ms and 1000 ms).

*Procedure.* Participants were first asked to rate their mood using a 21-point scale (see Appendix E), ranging from -10 (labeled *very sad*) to +10 (labeled *very happy*), with a midpoint of 0 (labeled *neutral*). Participants then completed several practice trials for the cross-model semantic priming task (these were the same practice trials given to participants in Experiment 1A). They then completed the demographic information questionnaire (age, ethnicity, and English fluency), the BDI-II, and the PANAS in a private room. Once completed, the questionnaires were sealed into an envelope and handed to the researcher.

Participants were then asked to participate in the negative mood induction procedure. This began with the viewing of the video clip *A Life Cut Short by Tobacco* (a

production of Alberta Alcohol Drug and Abuse Commission), a total of 3 minutes and 30 seconds in length. The video features Barb Tarbox, a 42-year old mother, speaking to young students about the cancer-related ailments she has endured as a result of her cigarette smoking, and her impending death. This video was chosen because of the feelings of sadness that it elicits in viewers, and because it encourages viewers to think about their own mortality and the mortality of loved ones. During the viewing, participants imagined either themselves or someone very close to them (a friend, a partner, or a family member) being affected by cancer like Barb Tarbox. After the video, participants wrote a brief paragraph describing the funeral of the person whom they had imagined (see Appendix F). While doing this, they listened to 8 minutes and 14 seconds of gloomy music (*Adagio in G minor* by Albinoni; also used in a study by McCabe, Gotlib, & Martin, 2000, and by Thompson, Schellenberg, & Husain, 2001). Participants then rated their mood using the same 21-point scale.

The negative mood induction was deemed to have not been successful for those participants who did not rate their mood as less than 0 (*neutral*) on the 21-point scale. As noted, this was the case for 24 participants (13.4% of the sample), and the data from these participants was not subject to any further analysis. For the other 155 participants, the mean mood rating prior to the negative mood induction was 5.40 ( $SD = 2.9$ ) and the mean mood rating after the mood induction was  $-4.63$  ( $SD = 2.2$ ),  $t(154) = 32.92$ ,  $p < .001$ . For the 50 participants in the low negative affect group, the mean mood ratings prior to and after the negative mood induction were 6.21 ( $SD = 2.7$ ) and  $-4.67$  ( $SD = 2.1$ ),  $t(49) = 21.62$ ,  $p < .001$ , and for the 19 participants in the high negative affect group the ratings



were 4.56 ( $SD = 3.1$ ) and  $-4.95$  ( $SD = 2.6$ ), respectively,  $t(18) = 9.15$ ,  $p < .001$ . For all groups of participants then, the negative mood induction was effective.

Following the post negative mood induction mood rating participants began the 240 experimental trials of the cross-modal semantic priming task. When these were completed, participants again rated their mood, using the same 21-point scale. This post-task mood rating was used to determine whether a negative mood persisted throughout the cross-modal semantic priming task. For the 155 women who participated in the study, the mean post-task mood rating was 0.98 ( $SD = 2.6$ ), which was significantly different than pre-induction mood rating (5.40),  $t(154) = 17.39$ ,  $p < .001$ . For the 50 participants in the low negative affect group, the post-task mood rating was 1.44 ( $SD = 2.9$ ), which was significantly different than the pre-mood induction rating of 6.21,  $t(49) = 10.51$ ,  $p < .001$ , and for the 19 participants in the high negative affect group the ratings were 0.42 ( $SD = 2.3$ ) and 4.56, respectively,  $t(18) = 5.75$ ,  $p < .001$ . Thus, the negative mood induced appeared to have persisted throughout the cross-modal semantic priming task, although the intensity of the negative mood was reduced relative to the immediate post-induction rating.

Following the completion of the semantic priming task individuals participated in a positive mood induction. This began with a 3 minute and 30 second viewing of a selection of single-frame cartoons by Gary Larson (Larson, 1989, 1995). Participants then wrote a short paragraph about how their life would change if they won 10 million dollars (see Appendix G) while listening to an 8 minute and 24 seconds piece of uplifting music (*Allegro Con Spirito*, Mozart Sonata for Two Pianos in D Major, K.448, also used by

Thompson, Schellenberg, & Husain, 2001). Following this positive mood induction a final mood rating was obtained.

The positive mood induction had a significant effect on participants' mood ratings, such that for all groups of participants the final mood rating was not significantly different from the first, pre-induction mood rating. Specifically, for all 155 participants, the mean mood rating prior to the negative mood induction was 5.40 ( $SD = 2.9$ ) and the mean mood rating after the positive mood induction was 5.73 ( $SD = 2.3$ ),  $t(154) = 1.80$ ,  $p > .05$ . For the 50 participants in the low negative affect group, the mean mood ratings prior to the negative mood induction and after the positive mood induction were 6.21 ( $SD = 2.7$ ) and 6.12 ( $SD = 2.4$ ), respectively,  $t(49) = 0.27$ ,  $p > .10$ , and for the 19 participants in the high negative affect group the mood ratings were 4.56 ( $SD = 3.1$ ) and 5.02 ( $SD = 2.8$ ), respectively,  $t(18) = 0.65$ ,  $p > .10$ .

### *Results*

Response latencies of correct responses and error rates were analyzed using a 2 (Affect Group: low negative affect, high negative affect)  $\times$  2 (ISI: 0 ms, 1000 ms)  $\times$  4 (Relatedness: positively-related, negatively-related, neutrally-related, unrelated) mixed-model factorial ANOVA, with affect group a between-subject factor and ISI and relatedness within-subject factors. As in Experiments 1A and 1B, response latencies greater than 1200 ms were considered outliers and were removed from all analyses (1241 response latencies, 3.3% of the data).

*Analysis of Response Latencies and Error Rates.* The mean response latencies of correct responses and the mean error rates are shown in Table 3. (The mean response latencies and error rates for all 155 participants are shown in Table H3.) As expected,

there was a main effect of relatedness,  $F(3, 201) = 28.02$ ,  $p < .001$ ,  $MSE = 2627.76$ , with responses to related targets being faster than responses to unrelated targets (with mean response latencies of 592 ms, 601 ms, and 600 ms to positively-related, negatively-related, and neutrally-related targets, respectively, versus a mean response latency of 649 ms to unrelated targets). As in the previous experiments, there was also a main effect of ISI,  $F(1, 67) = 123.10$ ,  $p < .001$ ,  $MSE = 2548.53$ , with slower response latencies when the ISI was 0 ms than when it was 1000 ms (637 ms vs. 584 ms).

The main effect of affect group was not statistically significant, ( $F < 1$ ), nor were there any significant interactions between affect group and ISI ( $F < 1$ ), affect group and relatedness ( $F < 1$ ), ISI and relatedness,  $F(3, 201) = 2.23$ ,  $p = .08$ ,  $MSE = 1948.04$ , nor a three-way interaction,  $F(3, 201) = 2.12$ ,  $p = .09$ . Note that, unlike the situation in Experiment 1A (which also used ISIs of 0 ms and 1000 ms) there was no interaction between affect group and ISI. Recall that in Experiment 1A this interaction occurred because the high negative affect group responded significantly more slowly than the low negative affect group when the ISI was 0 ms (644 ms vs. 599 ms), but not when the ISI was 1000 ms. In the present experiment, however, the high negative affect group did not respond more slowly than the low negative affect group when the ISI was 0 ms (636 ms for the high negative affect group and 638 ms for the low negative affect group), and like Experiment 1A, the response latencies of the two group were very similar when the ISI was 1000 ms (586 ms for the high negative affect group and 581 ms for the low negative affect group), hence the lack of an interaction. Comparing the mean response latencies in Experiments 1A and 2 (Tables 1 and 3) suggests that it is the responding of the low negative affect group that differs between the two experiments—the responses of the low

negative affect participants are slower in Experiment 2 than in Experiment 1A, especially for the 0 ms ISI. Evidently, the negative mood induction slowed the responding of the low negative affect group to such an extent that they were no longer faster than the high negative affect group when the ISI was 0 ms (as they were in Experiment 1A), thereby eliminating the Affect Group x ISI interaction created in Experiment 1A. Note that the negative mood induction seems not to have had the same effect for the participants in the high negative affect group, as their responses in Experiment 2 were no slower than in Experiment 1A.

In the analysis of error rates, consistent with the response latencies, there was a main effect of relatedness,  $F(3, 201) = 16.56, p < .001, MSE = 25.64$ , with fewer errors in the related conditions (1.6% overall) than in the unrelated condition (5.5%). There was also an interaction between affect group and ISI,  $F(1, 67) = 4.86, p < .05, MSE = 20.22$ , consistent with the same interaction observed in the response latencies. Specifically, the low negative affect group made slightly more errors than the high negative affect group when the ISI was 0 ms (3.1% vs. 2.2%) but not when the ISI was 1000 ms (2.0% vs. 3.0%), a pattern that was not observed in Experiment 1A.

The mean response latencies for the nonword targets are listed in Table 3. (The nonword data for all 155 participants are listed in Table H3.) In the analysis of the nonword data, the main effect of ISI was significant,  $F(1, 67) = 105.62, p < .001, MSE = 453.19$ , as responses to the nonword targets were faster when the ISI was 1000 ms than when it was 0 ms (698 ms vs. 739 ms). The main effect of affect group was significant,  $F(1, 67) = 4.30, p < .05, MSE = 13750.74$ , as the participants in the high negative affect group were slower to respond to the nonwords than the participants in the low negative

affect group (742 ms vs. 695 ms), which was also true in Experiment 1A. There was no interaction between affect group and ISI,  $F(1, 67) = 1.05, p > .10, MSE = 453.19$ . In the analysis of the nonword error rates, there was a main affect of affect group,  $F(1, 67) = 18.10, p < .001, MSE = 39.18$ , but no main effect of ISI or an interaction. Consistent with the response latency data, participants in the high negative affect group made more errors when responding to nonwords than participants in the low negative affect group (8.7% vs. 3.6%).

*Analysis of Semantic Priming Effects.* As before, semantic priming effects were analyzed with a 2 (Affect Group: low negative affect, high negative affect) x 2 (ISI: 0 ms, 1000 ms) x 3 (Relatedness: positively-related, negatively-related, neutrally-related) mixed-model ANOVA, with affect group a between-subjects factor and ISI and relatedness within-subjects factors. The mean semantic priming effects for the high negative affect group and the low negative affect group are shown in Table 3. (The mean semantic priming effects for all participants in Experiment 2 are shown in Table H3.) The overall semantic priming effect (50 ms) was statistically significant ( $p < .01$ ). As with the previous experiments, the ANOVA produced no significant main effects or interactions, and there was no evidence of any differences between the groups in the priming effects.

An examination of Table 3 suggests that there may have been one difference between the two groups, and multiple comparisons lent some support to this interpretation. Specifically, for the participants in the low negative affect group, there were significant priming effects in each of the positively-related, negatively-related, and neutrally-related conditions, when the ISI was 0 ms and when it was 1000 ms (all  $ps < .01$ ). For the participants in the high negative affect group, there was also significant

priming in each condition when the ISI was 0 ms (all  $ps < .01$ ), but when the ISI was 1000 ms there was priming in the positively-related condition,  $t(18) = 3.03, p < .01$ , and in the negatively-related condition,  $t(18) = 2.00, p = .06$ , but not in the neutrally-related condition,  $t(18) = .94, p > .10$ . The larger priming effects for positively-related and negatively-related targets relative to neutrally-related targets could be interpreted to reflect an elevated tendency to select an emotionally-linked interpretation of the ambiguous sentences (as opposed to a more specific depression-congruent interpretation). However, the fact that participants in the low negative affect group showed virtually identical priming effects in the positively-related and negatively-related conditions casts doubt in this interpretation. That is, if the participants high in negative affect were more inclined to interpret the prime sentences in a positive or in a negative manner, then they should have exhibited larger priming effects for targets related to the negative and positive interpretations of the sentences. The fact that they did not makes it unlikely that these results reflect a general bias in the processing of emotionally-linked stimuli.

### *Discussion*

The purpose of this experiment was to determine if any evidence of a negative interpretative bias would be observed when participants experienced a negative mood induction, under the assumption that the bias will be more readily observed when a negative schema is activated. Although there were very good reasons to believe that the negative mood induction was effective (including the slower responding of participants low in negative affect relative to Experiment 1A), the results of this experiment were quite similar to those of Experiments 1A and 1B, in that there was little or no evidence for any group differences in the semantic priming effects, and certainly none consistent

with the idea that participants high in negative affect have a negative interpretive bias. (Recall that this was also the case in Lawson and MacLeod's, 1999, study.) As a result, we can rule out the possibility that a lack of a dysphoric mood at the time of testing prevented us from detecting a negative information processing bias in Experiments 1A and 1B.

### General Discussion

The notion that depression is associated with an information processing bias has received a great deal of empirical attention in the past two decades, but researchers have yet to reach a consensus on many of the important dimensions of this phenomenon. While cognitive models implicating schemas (e.g., Beck, 1976) and associative networks (e.g., Bower, 1981; Ingram, 1984) maintain that the negative processing bias affects virtually all aspects of information processing, and from the earliest stages of processing, in other models the bias is limited to conscious and strategic processes most evident in retrieval and production tasks (Williams, et al., 1988, 1997). While this debate has yet to be resolved, there has been significant refinement in the conceptualization of the negative processing bias and in the empirical testing of its predictions. The present study made use of paradigm widely used in cognitive psychology to study the access of meaning, in an effort to test the general prediction that depressed individuals will have an increased tendency to impose negative interpretations on ambiguous information, and the specific predictions as to when this negative interpretative bias takes place. The cross-modal semantic priming task allowed us to determine whether depressed individuals have an increased tendency to activate the more negative meanings of ambiguous prime

sentences, and whether the heightened activation of negative meanings occurs automatically or only after conscious expectations are generated.

Taken together, our results indicate that sub-clinically depressed individuals were no more likely to activate the negative meanings of ambiguous sentences than non-depressed individuals, either automatically or via conscious expectancies. This was also true when a negative mood induction, intended to activate participants' negative schema, was used (Experiment 2). Thus, like Lawson and MacLeod (1999), we conclude that there is no evidence of a negative bias in the interpretation of ambiguous information by depressed individuals, at least when using the semantic priming methods employed in this study.

#### *Limitations and Directions for Future Research*

One potential limitation of the present study was the lack of a neutral prime condition, the use of which could have contributed to our ability to discern differences between the high and low negative affect groups. In studies using single words as primes (e.g., *bread*—*butter*, where *bread* is the prime and *butter* is the target), a neutral prime is an item that is unrelated to the target and provides no semantic cues to the target's identity (e.g., the word *blank*, or a row of letters such as XXXXX). Neutral primes (XXXX—*butter*) differ from unrelated primes (*doctor*—*butter*) in that the prime cannot be used to generate expectancies about potential candidate targets. If the neutral prime condition is used as a baseline, then facilitation and inhibition from expectancy-based priming can be assessed.

More specifically, according to expectancy theories (Becker, 1980, 1985), participants generate expectancies about potential targets when reading the prime,



assuming there is enough time to generate an expectancy set before the target appears.

When the target is included in the expectancy set, responses are faster relative to the neutral prime condition (a measure of facilitation), and when the target is not included in the expectancy set, responses are delayed relative to the neutral prime condition (a measure of inhibition). The advantage of using a neutral prime is the ability to measure inhibition, which is not possible when an unrelated condition is used as the baseline (whereas facilitation can be measured using an unrelated condition or a neutral condition). The inhibition effect can be used to assess the conscious, strategic component of the semantic priming effect, as opposed to priming due to automatic spreading activation. Priming effects at relatively long intervals between primes and targets are more dependent on expectancy generation than on automatic spreading activation (Neely, 1991), and when the interval between the prime and the target is short (e.g., 250 ms or less), inhibition in the unrelated priming condition is greatly reduced or eliminated, as there is no time to generate an expectancy set (in contrast, as SOA increases, inhibition increases, although this appears to be the case with the lexical decision task but not with the pronunciation task; Neely, 1991).

Neutral priming conditions were common in much of the early work on semantic priming (e.g., Neely, 1976, 1977), but eventually fell out of favour because of controversies regarding their adequacy and interpretation (e.g., Balota & Duchek, 1989; de Groot, Thomassen, & Hudson, 1986; Jonides & Mack, 1984; Neely, 1991), particularly when examining the time course of facilitation and inhibition. If the neutral prime is not a proper baseline, for example, then the measurement of facilitation and inhibition will be under or overestimated, and this problem will be exacerbated if the

adequacy of the neutral prime varies with the SOA. These concerns are less of an issue when comparing the relative magnitude of inhibition between different groups—even if a particular neutral prime is not an optimal baseline measure it would, at the very least, provide a way of comparing the degree of inhibition experienced by different groups of participants when responding to targets unrelated to the sentence prime.

The advantage of using a neutral prime in the present study is that it may have revealed differences between the high and low negative affect groups in the degree of inhibition experienced when responding to unexpected targets. If participants with a negative interpretative bias are more likely to interpret the ambiguous sentences in a negative manner, then with ISIs of 1000 ms and 2000 ms their expectancy set would be predicted to include potential target words related to the negative interpretation of the prime. For example, if the prime sentence “The jury has reached a verdict” is interpreted in a negative manner, then the expectancy set might include words such as “guilty”, and “punish”, in addition to neutrally-related words such as “court” and “lawyer”. As noted, if one of these words is then presented as a target, responses will be facilitated relative to a neutral prime condition, but if the target is not included in the expectancy set, responses will be delayed relative to the neutral prime condition.

This inhibition reflects the cost of the expectancy violation, and would be also experienced by participants in low negative affect, because a target in the unrelated condition will never be a member of the expectancy set. However, if participants high in negative affect have a larger expectancy set than participants low in negative affect, because their expectancy set includes words such “guilty” and “punish”, whereas the expectancy set of participants low in negative affect does not, then they will experience

more inhibition in the unrelated condition. This is a consequence of the search mechanism embodied in models of expectancy-induced priming—larger expectancy sets lead to more inhibition because the set is searched in a serial exhaustive fashion before a response is made. Employing a neutral priming condition would thus provide another way of testing for the presence of a negative interpretative bias in depressed individuals, with higher degrees of inhibition predicted in the unrelated condition. (A possible neutral sentence prime would be “Please respond to the following word or nonword”.) But note that a neutral prime condition would be useful only for testing differences between groups on expectancy-based priming, not on automatic priming, because, as noted, inhibition is greatly reduced or eliminated at short SOAs because there is no time to generate an expectancy set. Consequently, using a neutral prime would have changed none of our conclusions based on the priming effects observed at the 0 ms ISIs.

Another limitation of our study is that our participants, all of whom are women, were not independently assessed for clinical depression, and thus the generalizability of our results is open to question. Researchers have raised serious concerns about the generalizability of results from sub-clinical samples to theories of clinical depression (e.g., Haaga and Solomon, 1993; Kendall, Hollon, Beck, Hammen, & Ingram, 1987), even though analogous findings have been reported in clinical and sub-clinical samples. It remains a possibility that our methods would have detected a negative interpretative bias with a clinically depressed sample, and this will be an important issue for future research.

*Conclusions*

The results of the present study contribute to a growing body of evidence suggesting that there are important differences between the cognitive biases associated with anxiety and depression (Williams et al., 1988, 1997). While high levels of anxiety seem to be associated with an elevated tendency to activate the more negative meanings of ambiguous prime stimuli (e.g., Calvo, Eysenck, & Estevez, 1994; Richard & French, 1992; MacLeod, 1990), the same association does not appear to be true for individuals experiencing high levels of dysphoria. If this distinction withstands further empirical scrutiny then it may ultimately provide important insights into the cognitive mechanisms underlying mood disorders.

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Table 1

*Experiment 1A: Mean Response Latencies, Error Rates, and Semantic Priming Effects for the Positively-related, Negatively-related, Neutrally-related, and Unrelated Conditions at the 0 ms and 1000 ms Interstimulus Interval (ISI).*

Relatedness	Response latency (ms)		Semantic priming effect (ms)	
	0 ms ISI	1000 ms ISI	0 ms ISI	1000 ms ISI
Low negative affect group ( $n = 27$ )				
Positive	593 (118; 0.3)	566 (108; 1.8)	42	29
Negative	584 (99; 0.7)	564 (97; 1.8)	51	31
Neutral	586 (104; 2.9)	550 (97; 0.7)	49	45
Unrelated	635 (110; 7.7)	595 (105; 5.5)		
High negative affect group ( $n = 34$ )				
Positive	623 (87; 1.1)	575 (77; 0.5)	65	48
Negative	636 (81; 1.1)	577 (68; 0.2)	52	46
Neutral	630 (65; 1.1)	568 (74; 1.1)	58	55
Unrelated	688 (88; 7.6)	623 (75; 8.2)		

*Note.* Standard deviations and percentage errors in parenthesis ( $SD$ ; %). For the Low negative affect group, the mean response latency for the nonwords was 693 ms ( $SD = 106$ ) when the ISI was 0 ms and 664 ms ( $SD = 104$ ) when the ISI was 1000 ms; the mean error rates were 3.6% and 3.9%, respectively. For the High negative affect group, the mean response latency for the nonwords was 746 ms ( $SD = 90$ ) when the ISI was 0 ms and 705 ms ( $SD = 81$ ) when the ISI was 1000 ms; the mean error rates were 5.3% and 5.2%, respectively.

Table 2

*Experiment 1B: Mean Response Latencies, Error Rates, and Semantic Priming Effects for the Positively-related, Negatively-related, Neutrally-related, and Unrelated Conditions at the 0 ms and 2000 ms Interstimulus Interval (ISI).*

Relatedness	Response latency (ms)		Semantic priming effect (ms)	
	0 ms ISI	2000 ms ISI	0 ms ISI	2000 ms ISI
Low negative affect group ( $n = 35$ )				
Positive	641 (104; 0.2)	605 (91; 1.7)	45	63
Negative	631 (90; 1.1)	608 (90; 1.1)	55	60
Neutral	629 (107; 1.4)	606 (103; 0.5)	57	62
Unrelated	686 (99; 6.5)	668 (104; 4.8)		
High negative affect group ( $n = 30$ )				
Positive	643 (127; 1.0)	584 (87; 0.3)	68	49
Negative	651 (112; 1.6)	584 (109; 1.6)	60	49
Neutral	634 (112; 2.0)	576 (94; 0.3)	77	57
Unrelated	711 (131; 6.3)	633 (120; 4.0)		

*Note.* Standard deviations and percentage errors in parenthesis ( $SD$ ; %). For the Low negative affect group, the mean response latency for the nonwords was 751 ms ( $SD = 97$ ) when the ISI was 0 ms and 718 ms ( $SD = 91$ ) when the ISI was 2000 ms; the mean error rates were 4.8% and 5.0%, respectively. For the High negative affect group, the mean response latency for the nonwords was 748 ms ( $SD = 115$ ) when the ISI was 0 ms and 702 ms ( $SD = 100$ ) when the ISI was 2000 ms; the mean error rates were 4.3% and 4.7%, respectively.

Table 3

*Experiment 2: Mean Response Latencies, Error Rates, and Semantic Priming Effects for the Positively-related, Negatively-related, Neutrally-related, and Unrelated Conditions at the 0 ms and 1000 ms Interstimulus Interval (ISI).*

Relatedness	Response latency (ms)		Semantic priming effect (ms)	
	0 ms ISI	1000 ms ISI	0 ms ISI	1000 ms ISI
Low negative affect group ( $n = 50$ )				
Positive	622 (81; 3.0)	573 (75; 1.0)	52	51
Negative	626 (91; 1.2)	573 (78; 0.4)	48	51
Neutral	622 (83; 1.8)	573 (82; 1.4)	52	51
Unrelated	674 (90; 6.4)	624 (73; 5.2)		
High negative affect group ( $n = 19$ )				
Positive	616 (81; 1.0)	559 (67; 1.5)	76	46
Negative	632 (79; 2.6)	574 (71; 1.5)	60	31
Neutral	615 (77; 1.5)	589 (85; 2.1)	77	16
Unrelated	692 (93; 3.6)	605 (80; 6.8)		

*Note.* Standard deviations and percentage errors in parenthesis ( $SD$ ; %). For the low negative affect group, the mean response latency for the nonwords was 718 ms ( $SD = 82$ ) when the ISI was 0 ms and 672 ms ( $SD = 77$ ) when the ISI was 1000 ms; the mean error rates were 3.9% and 3.5%, respectively. For the High negative affect group, the mean response latency for the nonwords was 760 ms ( $SD = 99$ ) when the ISI was 0 ms and 723 ms ( $SD = 91$ ) when the ISI was 1000 ms; the mean error rates were 8.3% and 9.2%, respectively.



## Appendix A

### Positively-related, Negatively-related, Neutrally-related, and

#### Unrelated Sentence-Target Pairs

1. Everyone was surprised at Mark's fourth placing in the state finals.  
Positively-related target: improvement  
Negatively-related target: upset  
Neutrally-related target: race  
Unrelated target: camel
2. Seeing Linda again filled John with emotion.  
Positively-related target: love  
Negatively-related target: angry  
Neutrally-related target: feelings  
Unrelated target: chair
3. Doug slid down the slope.  
Positively-related target: ski  
Negatively-related target: accident  
Neutrally-related target: snow  
Unrelated target: olive
4. Ian had his first stroke on the golf course in 1994.  
Positively-related target: accomplishment  
Negatively-related target: heart  
Neutrally-related target: beginner  
Unrelated target: pumpkin
5. The man put the box outside the door and quickly left.  
Positively-related target: gift  
Negatively-related target: bomb  
Neutrally-related target: package  
Unrelated target: soul
6. The outcome of Jane's job interview surprised her.  
Positively-related target: hired  
Negatively-related target: rejected  
Neutrally-related target: meeting  
Unrelated target: violin
7. Her father shared his thoughts regarding her boyfriend.  
Positively-related target: approve  
Negatively-related target: disapprove  
Neutrally-related target: daughter

Unrelated target: marble

8. The bank clerk handed the money to the man.  
Positively-related target: rebate  
Negatively-related target: robbery  
Neutrally-related target: currency  
Unrelated target: zoology
9. Brian showed no emotion when he received his exam results.  
Positively-related target: succeed  
Negatively-related target: fail  
Neutrally-related target: marks  
Unrelated target: lemon
10. The Miner inspected the large cut.  
Positively-related target: gold  
Negatively-related target: wound  
Neutrally-related target: earth  
Unrelated target: religion
11. The man stopped Chris in the street.  
Positively-related target: greet  
Negatively-related target: beg  
Neutrally-related target: ask  
Unrelated target: venom
12. Joan was stunned by her final exam result.  
Positively-related target: success  
Negatively-related target: distress  
Neutrally-related target: grades  
Unrelated target: vegetable
13. When the report on John's department was released, it drew a lot of attention.  
Positively-related target: congratulate  
Negatively-related target: investigation  
Neutrally-related target: financial  
Unrelated target: otter
14. Betty felt faint when the roulette wheel finally stopped spinning.  
Positively-related target: win  
Negatively-related target: lose  
Neutrally-related target: gamble  
Unrelated target: square
15. While waiting for the train Linda was approached by a stranger.  
Positively-related target: friendly

Negatively-related target: danger  
Neutrally-related target: request  
Unrelated target: muffler

16. The young art student's sculpture attracted a lot of attention.

Positively-related target: beauty  
Negatively-related target: obscene  
Neutrally-related target: clay  
Unrelated target: fertilizer

17. Jason's classmates laughed as he made his presentation.

Positively-related target: funny  
Negatively-related target: foolish  
Neutrally-related target: classroom  
Unrelated target: maple

18. The two women ran into each other in the car park.

Positively-related target: friends  
Negatively-related target: collide  
Neutrally-related target: parking  
Unrelated target: moon

19. Some runners were crying upon crossing the finish line.

Positively-related target: victory  
Negatively-related target: pain  
Neutrally-related target: sweat  
Unrelated target: oyster

20. The music stirred strong feelings in Alex.

Positively-related target: happiness  
Negatively-related target: sadness  
Neutrally-related target: jazz  
Unrelated target: boat

21. Pat slid quickly along the icy pond.

Positively-related target: skate  
Negatively-related target: fall  
Neutrally-related target: frozen  
Unrelated target: plywood

22. A few policemen showed up at the party.

Positively-related target: celebrate  
Negatively-related target: noise  
Neutrally-related target: dance  
Unrelated target: monk

23. It was half past the hour when Sue arrived for her 1 o'clock job interview.  
Positively-related target: early  
Negatively-related target: late  
Neutrally-related target: appointment  
Unrelated target: lamp
24. Her supervisor was aware of her work habits.  
Positively-related target: diligent  
Negatively-related target: lazy  
Neutrally-related target: salary  
Unrelated target: hat
25. Sharon squealed when she was grabbed.  
Positively-related target: hug  
Negatively-related target: attack  
Neutrally-related target: hands  
Unrelated target: industry
26. The couple called the chef to the table  
Positively-related target: compliment  
Negatively-related target: complain  
Neutrally-related target: enquire  
Unrelated target: umbrella
27. His mood reflected the weather.  
Positively-related target: sunny  
Negatively-related target: stormy  
Neutrally-related target: climate  
Unrelated target: magazine
28. The child's dreams were vivid.  
Positively-related target: joyful  
Negatively-related target: nightmare  
Neutrally-related target: sleep  
Unrelated target: capital
29. Jill felt little emotion about her driving test results.  
Positively-related target: excel  
Negatively-related target: failed  
Neutrally-related target: license  
Unrelated target: onion
30. Mary decided to shave her head.  
Positively-related target: charity  
Negatively-related target: cancer  
Neutrally-related target: hair

Unrelated target: aircraft

31. Her belly was aching so much she had to leave the room.

Positively-related target: laugh

Negatively-related target: poison

Neutrally-related target: exit

Unrelated target: species

32. The storekeeper was shocked when he counted the day's takings.

Positively-related target: profit

Negatively-related target: loss

Neutrally-related target: cash

Unrelated target: wand

33. The boy's Halloween costume matched his personality.

Positively-related target: hero

Negatively-related target: devil

Neutrally-related target: mask

Unrelated target: petition

34. Sue watched from the window as the man coming to get her approached the house.

Positively-related target: boyfriend

Negatively-related target: kidnap

Neutrally-related target: taxi

Unrelated target: opera

35. The diver sank to the bottom of the ocean.

Positively-related target: treasure

Negatively-related target: drowning

Neutrally-related target: scuba

Unrelated target: town

36. His memory capacity is unusual.

Positively-related target: amazing

Negatively-related target: poor

Neutrally-related target: recall

Unrelated target: blanket

37. Working behind bars had given Sam a different view on life.

Positively-related target: wisdom

Negatively-related target: jail

Neutrally-related target: tavern

Unrelated target: drain

38. Lisa asked her father not to put her down.

Positively-related target: piggy-back

Negatively-related target: insult  
Neutrally-related target: carry  
Unrelated target: army

39. The father was aware of his son's activities.

Positively-related target: hockey  
Negatively-related target: crime  
Neutrally-related target: schedule  
Unrelated target: zebra

40. Roberta wept after hearing the jury's verdict.

Positively-related target: freedom  
Negatively-related target: prison  
Neutrally-related target: tears  
Unrelated target: banana

41. Adam's life is not what he thought it would be.

Positively-related target: amazed  
Negatively-related target: unhappy  
Neutrally-related target: plans  
Unrelated target: pigeon

42. She told him what she thought about him.

Positively-related target: admire  
Negatively-related target: dislike  
Neutrally-related target: opinion  
Unrelated target: calendar

43. Monica was stopped as she left the store.

Positively-related target: winner  
Negatively-related target: shoplift  
Neutrally-related target: purchase  
Unrelated target: dental

44. The crowd gasped as the plane spiraled toward the ground.

Positively-related target: feat  
Negatively-related target: crash  
Neutrally-related target: stunt  
Unrelated target: philosopher

45. The students all agreed on the difficulty level of the exam.

Positively-related target: simple  
Negatively-related target: hard  
Neutrally-related target: final  
Unrelated target: street

46. Bill's essay was returned covered with comments.  
Positively-related target: praise  
Negatively-related target: criticism  
Neutrally-related target: writing  
Unrelated target: diamond
47. He needed more money to support his addiction.  
Positively-related target: athlete  
Negatively-related target: drugs  
Neutrally-related target: habit  
Unrelated target: pink
48. Kathy had been committed for some time.  
Positively-related target: relationship  
Negatively-related target: hospital  
Neutrally-related target: years  
Unrelated target: sauce
49. Mandy felt a change in Paul's attitude toward their relationship.  
Positively-related target: romantic  
Negatively-related target: unloving  
Neutrally-related target: dating  
Unrelated target: hangar
50. She uses her body as a tool to make a living.  
Positively-related target: model  
Negatively-related target: prostitute  
Neutrally-related target: legs  
Unrelated target: pool
51. His intelligence test results were considered abnormal.  
Positively-related target: genius  
Negatively-related target: dumb  
Neutrally-related target: knowledge  
Unrelated target: transportation
52. The children were removed from the smoky room.  
Positively-related target: rescued  
Negatively-related target: fire  
Neutrally-related target: restaurant  
Unrelated target: turtle
53. There is something different about this child.  
Positively-related target: clever  
Negatively-related target: slow  
Neutrally-related target: kid

Unrelated target: honeycomb

54. As they walked out the door, people threw things at them.

Positively-related target: rice

Negatively-related target: stones

Neutrally-related target: tradition

Unrelated target: deer

55. The two men discussed how to blow up the dinghy.

Positively-related target: toy

Negatively-related target: explode

Neutrally-related target: pump

Unrelated target: pottery

56. The dog made the discovery.

Positively-related target: child

Negatively-related target: corpse

Neutrally-related target: hound

Unrelated target: wish

57. Kevin did not see his wife waving in the sea.

Positively-related target: holiday

Negatively-related target: drown

Neutrally-related target: swim

Unrelated target: stamp

58. The businessman felt overwhelmed by the day's events.

Positively-related target: promotion

Negatively-related target: tragedy

Neutrally-related target: corporation

Unrelated target: oatmeal

59. The driver gestured at the other driver.

Positively-related target: thanked

Negatively-related target: offend

Neutrally-related target: auto

Unrelated target: running

60. Eve is unlike the other girls in her grade.

Positively-related target: creative

Negatively-related target: withdrawn

Neutrally-related target: student

Unrelated target: whistle

61. Paul's cost cutting actions were unexpected.

Positively-related target: efficient



Negatively-related target: unemployed  
Neutrally-related target: budget  
Unrelated target: ballet

62. Carol cried throughout the service.  
Positively-related target: marriage  
Negatively-related target: funeral  
Neutrally-related target: ceremony  
Unrelated target: agile

63. My sister sings like no other.  
Positively-related target: talent  
Negatively-related target: badly  
Neutrally-related target: voice  
Unrelated target: addition

64. The fruit they ate had an unusual flavour.  
Positively-related target: tasty  
Negatively-related target: rotten  
Neutrally-related target: apple  
Unrelated target: geography

65. The statistics assignment was nothing like Tara had imagined.  
Positively-related target: clear  
Negatively-related target: difficult  
Neutrally-related target: mathematic  
Unrelated target: firewood

66. The poem evoked some unexpected emotions in Jane.  
Positively-related target: merry  
Negatively-related target: gloomy  
Neutrally-related target: poetry  
Unrelated target: stick

67. The boy came home from school with a note for his parents.  
Positively-related target: proud  
Negatively-related target: trouble  
Neutrally-related target: message  
Unrelated target: planet

68. The principal phoned the girl's parents.  
Positively-related target: award  
Negatively-related target: suspension  
Neutrally-related target: telephone  
Unrelated target: velocity

69. The boss called Jason into his office.  
Positively-related target: raise  
Negatively-related target: fired  
Neutrally-related target: chat  
Unrelated target: spoon
70. Her stubbornness got her what she deserved.  
Positively-related target: medal  
Negatively-related target: enemy  
Neutrally-related target: personality  
Unrelated target: garage
71. The teenage boy was sent to the farm.  
Positively-related target: vacation  
Negatively-related target: punishment  
Neutrally-related target: cow  
Unrelated target: harp
72. The jury has reached a verdict.  
Positively-related target: innocent  
Negatively-related target: guilty  
Neutrally-related target: lawyer  
Unrelated target: boots
73. The veterinarian gave the cat a final needle.  
Positively-related target: cure  
Negatively-related target: kill  
Neutrally-related target: drug  
Unrelated target: Latin
74. No one could have predicted the athlete's performance.  
Positively-related target: exceed  
Negatively-related target: defeat  
Neutrally-related target: badminton  
Unrelated target: red
75. Jill was amazed when the doctor gave her the results.  
Positively-related target: healthy  
Negatively-related target: sick  
Neutrally-related target: medicine  
Unrelated target: cricket
76. Sarah took her neighbour's favourite toy.  
Positively-related target: repair  
Negatively-related target: steal  
Neutrally-related target: doll

Unrelated target: axis

77. Candie's belly is getting bigger.

Positively-related target: baby

Negatively-related target: fat

Neutrally-related target: abdomen

Unrelated target: pollen

78. At the hearing, the lawyer argued that Mark was responsible.

Positively-related target: reliable

Negatively-related target: blame

Neutrally-related target: judge

Unrelated target: dictionary

79. She quickly held out her hands in front of her.

Positively-related target: embrace

Negatively-related target: falling

Neutrally-related target: arms

Unrelated target: tea

80. Craig left the exam an hour early.

Positively-related target: easy

Negatively-related target: failure

Neutrally-related target: test

Unrelated target: lawn

#### Unrelated Prime-Target Pairs (fillers)

1. He believed his success to reflect his luck.

Unrelated target: frog

2. She told her friend that Joe was looking for her.

Unrelated target: melon

3. She could not bring herself to look at him.

Unrelated target: adverb

4. His curves are not proportional.

Unrelated target: glue

5. The doctor was stunned by the patient's progress.

Unrelated target: snow

6. Her abilities were not average.

Unrelated target: potato

7. She believed him when he made his promise.  
Unrelated target: eclipse
8. His wife's personality is very interesting.  
Unrelated target: cabin
9. The doctor explained the patient's condition.  
Unrelated target: lemonade
10. In the end, he had learned a valuable lesson.  
Unrelated target: pear
11. He was surprised when he learned of her feelings.  
Unrelated target: basement
12. She anxiously opened the telegram.  
Unrelated target: concept
13. Shane encountered the animal while hiking.  
Unrelated target: glass
14. David started the fire at the camp.  
Unrelated target: diabetic
15. She ran as fast as she could.  
Unrelated target: federation
16. The event was not what Kevin had expected.  
Unrelated target: erosion
17. The exam grades were not what the students expected.  
Unrelated target: metropolitan
18. The situation made him more aware of his capabilities.  
Unrelated target: electricity
19. Carly's opinion of him is quite clear.  
Unrelated target: craft
20. He was not of average intelligence.  
Unrelated target: hamburger
21. He noticed her figure was certainly not average.  
Unrelated target: law
22. Lisa noticed he was not average in height.

Unrelated target: bruise

23. No one considered her to be average in appearance.

Unrelated target: lice

24. I never thought that our friendship would take this path.

Unrelated target: raisin

25. When he heard the news, he drove to his home as quickly as he could.

Unrelated target: random

26. The pilot had an announcement for the passengers.

Unrelated target: knuckle

27. She was admitted right away.

Unrelated target: sun

28. They could not stop talking about her.

Unrelated target: formula

29. It was snowing when the wreath arrived.

Unrelated target: job

30. The strength of the punch took Peter by surprise.

Unrelated target: wizard

31. Tears were rolling down her cheeks.

Unrelated target: diameter

32. The dad could not see his children in the park.

Unrelated target: globe

33. He had a good reason to hide.

Unrelated target: currency

34. The teacher wrote a few names on the board.

Unrelated target: autopsy

35. He is a student with special needs.

Unrelated target: window

36. Her energy level is atypical.

Unrelated target: customer

37. She argued her point to her husband.

Unrelated target: snake

38. She was the perfect host.  
Unrelated target: herb
39. A car pulled over beside the child.  
Unrelated target: glacier
40. The party was just as Ben expected.  
Unrelated target: income

Nonword Prime-Target Pair Condition

1. He had tears in his eyes.  
Nonword target: dap
2. His friend's judgment of his abilities was different than his own.  
Nonword target: crof
3. The principal suggested that she attend another school.  
Nonword target: stibes
4. The man offered the child a candy.  
Nonword target: glounced
5. Her methods are different than those of other professors.  
Nonword target: swarched
6. Her level of understanding was not what her husband had anticipated.  
Nonword target: splants
7. The weather suddenly changed.  
Nonword target: cloams
8. They believed he played a role.  
Nonword target: stroul
9. Their dance moves were the talk of the town.  
Nonword target: shamped
10. Their vacation did not proceed as planned.  
Nonword target: jinched
11. Her friend told her a secret.  
Nonword target: strupe
12. The priest visited the patient.  
Nonword target: vauge

13. Joe calculated the odds of achieving his goal.  
Nonword target: keized
14. She gave him an answer to his wedding proposal.  
Nonword target: cleaked
15. She picked up something that was not hers.  
Nonword target: loy
16. He talked to her about his childhood memories.  
Nonword target: wark
17. His nickname is not an accurate description of his personality.  
Nonword target: blorm
18. She had a talk with her daughter.  
Nonword target: chond
19. He brought up the issue with his wife.  
Nonword target: clett
20. His change of heart was a surprise to everyone involved.  
Nonword target: spaig
21. She knew exactly what she had to do.  
Nonword target: carticle
22. His boss wanted to have a word with him.  
Nonword target: blothing
23. His luck is changing.  
Nonword target: porps
24. His performance was not what he had anticipated.  
Nonword target: skirks
25. They saw him talking to the priest.  
Nonword target: prouched
26. Her friends hid it without telling her the location.  
Nonword target: pligue
27. During Thanksgiving Mary learned the family's secret.  
Nonword target: bruned
28. She told him that she needed more space.

Nonword target: brooched

29. Paula's arrival was unexpected.

Nonword target: strulled

30. Margaret had decided to break her engagement.

Nonword target: teef

31. Henry had devised a plan to break into the market.

Nonword target: huck

32. Louise's heartbeat quickened at the sound of the man's footsteps.

Nonword target: flarm

33. The teacher asked them to stay after class.

Nonword target: spurse

34. He received his evaluation from management.

Nonword target: slont

35. His record was sent away.

Nonword target: tods

36. Her eyes widened as she looked at her bank statement.

Nonword target: cruft

37. Her perception of the situation was uncommon.

Nonword target: wrencked

38. This religion advocated a different form of worship.

Nonword target: gleaved

39. She was anxious to learn the content of the letter.

Nonword target: cleading

40. The new law was the cause of vivid discussions among some citizens.

Nonword target: steeked

41. The evaluation she received was well deserved.

Nonword target: cressing

42. Chris phoned the insurance company.

Nonword target: shends

43. His pants were not fitting as well as before.

Nonword target: phirk



44. Everyone was shocked by her New Year's resolution.  
Nonword target: lod
45. The family received a box filled with food items  
Nonword target: carmlless
46. The child shared her secret with her counselor.  
Nonword target: joap
47. The child was hiding under the bed.  
Nonword target: swulled
48. He took the money out of her purse.  
Nonword target: wault
49. She received an important message in the mail.  
Nonword target: loode
50. The reality of the situation came as a surprise.  
Nonword target: contrant
51. The quality of his work is an indication of his efforts.  
Nonword target: spram
52. His feelings prevented him from assessing the situation accurately.  
Nonword target: crog
53. The chemistry between Candie and Adam is inexplicable.  
Nonword target: bloothing
54. He still remembers the first time he met her parents.  
Nonword target: bame
55. Her reaction was not what he expected.  
Nonword target: brabes
56. Josie's opinion on marriage is quite clear.  
Nonword target: swalged
57. The content of the file has not yet been revealed.  
Nonword target: mauged
58. She is heading toward the bottom.  
Nonword target: speem
59. He could not contain his emotions any longer.

Nonword target: slenged

60. The physician provided her diagnosis.

Nonword target: screets

61. A panel of judges made the final decision.

Nonword target: rooth

62. The news in the telegram was completely unexpected.

Nonword target: wouged

63. His friends are aware of his attitude.

Nonword target: mephed

64. Her concluding remarks astonished the audience.

Nonword target: screbbled

65. Sarah's interpretation of the book surprised everyone.

Nonword target: crawped

66. Allan left after Paul had beaten him.

Nonword target: blinched

67. Several people in the studio looked on as Michael drew the sword.

Nonword target: distless

68. The doctor examined little Emily's growth.

Nonword target: blashing

69. Children rushed from the buildings at the sound of the bell.

Nonword target: froned

70. The professor provided her with feedback on her paper.

Nonword target: drapping

71. The experience considerably altered his self-esteem.

Nonword target: sloons

72. Ann and John decided to inform their friends.

Nonword target: douthful

73. Her expectations were different than his.

Nonword target: stulp

74. Christmas time is always filled with emotions.

Nonword target: cose

75. The committee made its decision about the applicants.  
Nonword target: hend
76. The professor wanted to see him about his essay.  
Nonword target: grashed
77. She meant every word she said.  
Nonword target: wesk
78. Her life story is well known.  
Nonword target: snilled
79. He could not believe that he heard her correctly.  
Nonword target: munched
80. It was an offer she could not refuse.  
Nonword target: stused
81. The note was from a man she did not know.  
Nonword target: creened
82. I believe that she feels the same way about me.  
Nonword target: besigned
83. He checked his lottery ticket a second time.  
Nonword target: knatch
84. He could not possibly mean what he had said.  
Nonword target: wheemed
85. Her date was not at all what she expected.  
Nonword target: flerce
86. David could never remember a time he felt like this.  
Nonword target: flonds
87. She wondered if the other students felt the same way about the exam.  
Nonword target: banes
88. He decided to phone his lawyer.  
Nonword target: straised
89. The child's drawing skills are unusual.  
Nonword target: crey
90. They talked about it over coffee.

Nonword target: casteful

91. He taught her a lesson.

Nonword target: tirt

92. She decided it was important to make a decision.

Nonword target: jerf

93. He handed the baby over to her and left.

Nonword target: blorn

94. Her boss phoned her at home.

Nonword target: teene

95. She did not go to work today.

Nonword target: kitched

96. His girlfriend wrote him a letter.

Nonword target: maffed

97. She decided to move out on her own.

Nonword target: blirt

98. He certainly did not expect it.

Nonword target: chooce

99. Their conversation was filled with emotions.

Nonword target: trand

100. Everyone agreed that he had met his match.

Nonword target: plood

101. He followed her home.

Nonword target: splots

102. Upon his arrival, many people surrounded him.

Nonword target: tisc

103. Everyone stopped talking when she walked in.

Nonword target: trowned

104. She was in for a big surprise.

Nonword target: firt

105. They interviewed her on the street.

Nonword target: metched

106. She drank until the bottle was empty.  
Nonword target: jood
107. They discussed his eating habits.  
Nonword target: strinds
108. The couple discussed their future together.  
Nonword target: rimp
109. The child ran away.  
Nonword target: sauk
110. They photographed the man boarding the plane.  
Nonword target: clasked
111. The painting depicted a famous historical scene.  
Nonword target: dricked
112. There was so much going on he could not fall asleep.  
Nonword target: scripes
113. She felt that it was her destiny.  
Nonword target: gised
114. He is a unique person.  
Nonword target: steef
115. They used his story as an example to the others.  
Nonword target: dess
116. Julian tied the knot.  
Nonword target: antitude
117. She knew how it would end.  
Nonword target: strassed
118. No one else knew except her mother.  
Nonword target: spooved
119. They searched until sunset.  
Nonword target: crouched
120. The father wondered about his daughter's contribution.  
Nonword target: screnned

Practice Trials

1. Lydia was shocked by her mark on the psychology exam.  
Neutrally-related target: score
2. The teenager's character was not well defined.  
Nonword target: binister
3. The housekeeper saw a shadow moving toward the side door.  
Neutrally-related target: house
4. The security guard heard a scream coming from the mansion.  
Nonword target: aerogate
5. The ambience in the theater was such that Mark could feel his heart pounding.  
Negatively-related target: scared
6. Nikki and Like are constantly measuring up.  
Nonword target: blanting
7. The Prime Minister demanded a press conference be scheduled.  
Unrelated target: surplus
8. She could see a shadow following her.  
Nonword target: myt
9. He refused to share his impression.  
Neutrally-related target: ideas
10. Some people passed their judgment on the race.  
Nonword target: crix

## Appendix B

Table B1

*Sentence Prime-Word Target Pairs List 1.*

Sentence prime	Target
Positively-related prime target pairs presented at 0 ms ISI	
Everyone was surprised at Mark's fourth placing in the state finals.	improvement
Doug slid down the slope.	ski
The man put the box outside the door and quickly left.	gift
Her father shared his thoughts regarding her boyfriend.	approve
The outcome of Jane's job interview surprised her.	hired
Ian had his first stroke on the golf course in 1994.	accomplishment
Seeing Linda again filled John with emotion.	love
The bank clerk handed the money to the man.	rebate
The Miner inspected the large cut.	gold
Brian showed no emotion when he received his exam results.	succeed
Positively-related prime target pairs presented at 1000 ms ISI or 2000 ms ISI	
The man stopped Chris in the street.	greet
Joan was stunned by her final exam result.	success
When the report on John's department was released, it drew a lot of attention.	congratulate
Betty felt faint when the roulette wheel finally stopped spinning.	win
While waiting for the train Linda was approached by a stranger.	friendly
The young art student's sculpture attracted a lot of attention.	beauty
Jason's classmates laughed as he made his presentation.	funny
The two women ran into each other in the car park.	friends

Some runners were crying upon crossing the finish line.	victory
The music stirred strong feelings in Alex.	happiness

Negatively-related prime target pairs presented at 0 ms ISI

Pat slid quickly along the icy pond.	fall
A few policemen showed up at the party.	noise
It was half past the hour when Sue arrived for her 1 o'clock job interview.	late
Her supervisor was aware of her work habits. (lazy	lazy
Working behind bars had given Sam a different view on life.	jail
The couple called the chef to the table.	complain
His mood reflected the weather.	stormy
The child's dreams were vivid.	nightmare
Jill felt little emotion about her driving test results.	failed
Mary decided to shave her head.	cancer

Negatively-related prime target pairs presented at 1000 ms ISI or 2000 ms ISI

Her belly was aching so much she had to leave the room.	poison
The storekeeper was shocked when he counted the day's takings.	loss
The boy's Halloween costume matched his personality.	devil
Sue watched from the window as the man coming to get her approached the house.	kidnap
The diver sank to the bottom of the ocean.	drowning
His memory capacity is unusual.	poor
Sharon squealed when she was grabbed.	attack
Lisa asked her father not to put her down.	insult
The father was aware of his son's activities.	crime
Roberta wept after hearing the jury's verdict.	prison



Neutrally-related prime target pairs presented at 0 ms ISI

Adam's life is not what he thought it would be.	plans
She told him what she thought about him.	opinion
Monica was stopped as she left the store.	purchase
The crowd gasped as the plane spiraled toward the ground.	stunt
There is something different about this child.	kid
Bill's essay was returned covered with comments.	writing
He needed more money to support his addiction.	habit
Kathy had been committed for some time.	years
Mandy felt a change in Paul's attitude toward their relationship.	dating
She uses her body as a tool to make a living.	legs

Neutrally-related prime target pairs presented at 1000 ms ISI or 2000 ms ISI

His intelligence test results were considered abnormal.	knowledge
The children were removed from the smoky room.	restaurant
The students all agreed on the difficulty level of the exam.	final
As they walked out the door, people threw things at them.	tradition
The two men discussed how to blow up the dinghy.	pump
The dog made the discovery.	hound
Kevin did not see his wife waving in the sea.	swim
The businessman felt overwhelmed by the day's events.	corporation
The driver gestured at the other driver.	auto
Eve is unlike the other girls in her grade.	student

Unrelated prime target pairs presented at 0 ms ISI

Paul's cost cutting actions were unexpected.	ballet
Carol cried throughout the service.	agile

My sister sings like no other.	addition
The fruit they ate had an unusual flavour.	geography
The statistics assignment was nothing like Tara had imagined.	firework
The poem evoked some unexpected emotions in Jane.	stick
The boy came home from school with a note for his parents.	planet
The principal phoned the girl's parents.	velocity
The boss called Jason into his office.	spoon
Her stubbornness got her what she deserved.	garage
Unrelated prime target pairs presented at 1000 ms ISI or 2000 ms ISI	
The teenage boy was sent to the farm.	harp
The jury has reached a verdict.	boots
The veterinarian gave the cat a final needle.	Latin
No one could have predicted the athlete's performance.	red
Jill was amazed when the doctor gave her the results.	cricket
Sarah took her neighbour's favourite toy.	axis
Candie's belly is getting bigger.	pollen
At the hearing, the lawyer argued that Mark was responsible.	dictionary
She quickly held out her hands in front of her.	tea
Craig left the exam an hour early.	lawn

Table B2

*Sentence Prime-Word Target Pairs List 2.*

Sentence prime	Target
Positively-related prime target pairs presented at 0 ms ISI	
Pat slid quickly along the icy pond.	skate
A few policemen showed up at the party.	celebrate
It was half past the hour when Sue arrived for her 1 o'clock job interview.	early
Her supervisor was aware of her work habits.	diligent
Sharon squealed when she was grabbed.	hug
The couple called the chef to the table.	compliment
His mood reflected the weather.	sunny
The child's dreams were vivid.	joyful
Jill felt little emotion about her driving test results.	excel
Mary decided to shave her head.	charity
Positively-related prime target pairs presented at 1000 ms or 2000 ms ISI	
Her belly was aching so much she had to leave the room.	laugh
The storekeeper was shocked when he counted the day's takings.	profit
The boy's Halloween costume matched his personality.	hero
Sue watched from the window as the man coming to get her approached the house.	boyfriend
The diver sank to the bottom of the ocean.	treasure
His memory capacity is unusual.	amazing
Working behind bars had given Sam a different view on life.	wisdom
Lisa asked her father not to put her down.	piggy-back
The father was aware of his son's activities.	hockey

Roberta wept after hearing the jury's verdict.	freedom
--	---------

Negatively-related prime target pairs presented at 0 ms ISI

Adam's life is not what he thought it would be.	unhappy
---	---------

She told him what she thought about him.	dislike
--	---------

Monica was stopped as she left the store.	shoplift
---	----------

The crowd gasped as the plane spiraled toward the ground.	crash
---	-------

The students all agreed on the difficulty level of the exam.	hard
--	------

Bill's essay was returned covered with comments.	criticism
--	-----------

He needed more money to support his addiction.	drugs
--	-------

Kathy had been committed for some time.	hospital
---	----------

Mandy felt a change in Paul's attitude toward their relationship.	unloving
---	----------

She uses her body as a tool to make a living.	prostitute
---	------------

Negatively-related prime target pairs presented at 1000 ms or 2000 ms ISI

His intelligence test results were considered abnormal.	dumb
---	------

The children were removed from the smoky room.	fire
--	------

There is something different about this child.	slow
--	------

As they walked out the door, people threw things at them.	stones
---	--------

The two men discussed how to blow up the dinghy.	explode
--	---------

The dog made the discovery.	corpse
-----------------------------	--------

Kevin did not see his wife waving in the sea.	drown
---	-------

The businessman felt overwhelmed by the day's events.	tragedy
---	---------

The driver gestured at the other driver.	offend
--	--------

Eve is unlike the other girls in her grade.	withdrawn
---	-----------

Paul's cost cutting actions were unexpected.	budget
--	--------

Neutrally-related prime target pairs presented at 0 ms ISI

Carol cried throughout the service.	ceremony
My sister sings like no other.	voice
The fruit they ate had an unusual flavour.	apple
The statistics assignment was nothing like Tara had imagined.	mathematic
The poem evoked some unexpected emotions in Jane.	poetry
The boy came home from school with a note for his parents.	message
The principal phoned the girl's parents.	telephone
The boss called Jason into his office.	chat
Her stubbornness got her what she deserved.	personality

Neutrally-related prime target pairs presented at 1000 ms or 2000 ms ISI

The teenage boy was sent to the farm.	cow
The jury has reached a verdict.	lawyer
The veterinarian gave the cat a final needle.	drug
No one could have predicted the athlete's performance.	badminton
Jill was amazed when the doctor gave her the results.	medicine
Sarah took her neighbour's favourite toy.	doll
Candie's belly is getting bigger.	abdomen
At the hearing, the lawyer argued that Mark was responsible.	judge
She quickly held out her hands in front of her.	arms
Craig left the exam an hour early.	test

Unrelated prime target pairs presented at 0 ms ISI

Everyone was surprised at Mark's fourth placing in the state finals.	camel
Seeing Linda again filled John with emotion.	chair
Doug slid down the slope.	olive
Ian had his first stroke on the golf course in 1994.	pumpkin

Jason's classmates laughed as he made his presentation.	maple
The outcome of Jane's job interview surprised her.	violin
Her father shared his thoughts regarding her boyfriend.	marble
The bank clerk handed the money to the man.	zoology
The music stirred strong feelings in Alex.	boat
The Miner inspected the large cut.	religion

Unrelated prime target pairs presented at 1000 ms or 2000 ms ISI

The man stopped Chris in the street.	venom
The man put the box outside the door and quickly left.	soul
When the report on John's department was released, it drew a lot of attention.	otter
Betty felt faint when the roulette wheel finally stopped spinning.	square
While waiting for the train Linda was approached by a stranger.	muffler
The young art student's sculpture attracted a lot of attention.	fertilizer
Joan was stunned by her final exam result.	vegetable
The two women ran into each other in the car park.	moon
Some runners were crying upon crossing the finish line.	oyster
Brian showed no emotion when he received his exam results.	lemon

Table B3

*Sentence Prime-Word Target Pairs List 3.*

Sentence prime	Target
Positively-related prime target pairs presented at 0 ms ISI	
Adam's life is not what he thought it would be.	amazed
She told him what she thought about him.	admire
Monica was stopped as she left the store.	winner
The crowd gasped as the plane spiraled toward the ground.	feat
The students all agreed on the difficulty level of the exam.	simple
Bill's essay was returned covered with comments.	praise
He needed more money to support his addiction.	athlete
Kathy had been committed for some time.	relationship
Mandy felt a change in Paul's attitude toward their relationship.	romantic
She uses her body as a tool to make a living.	model
Positively-related prime target pairs presented at 1000 ms or 2000 ms ISI	
His intelligence test results were considered abnormal.	genius
The children were removed from the smoky room.	rescued
There is something different about this child.	clever
As they walked out the door, people threw things at them.	rice
The two men discussed how to blow up the dinghy.	toy
The dog made the discovery.	child
Kevin did not see his wife waving in the sea.	holiday
The businessman felt overwhelmed by the day's events.	promotion
The driver gestured at the other driver.	thanked
Eve is unlike the other girls in her grade.	creative

Negatively-related prime target pairs presented at 0 ms ISI

Paul's cost cutting actions were unexpected.	unemployed
Carol cried throughout the service.	funeral
My sister sings like no other.	badly
The fruit they ate had an unusual flavour.	rotten
The statistics assignment was nothing like Tara had imagined.	difficult
The poem evoked some unexpected emotions in Jane.	gloomy
The boy came home from school with a note for his parents.	trouble
The principal phoned the girl's parents.	suspension
The boss called Jason into his office.	fired
Her stubbornness got her what she deserved.	enemy

Negatively-related prime target pairs presented at 1000 ms or 2000 ms ISI

The teenage boy was sent to the farm.	punishment
The jury has reached a verdict.	guilty
The veterinarian gave the cat a final needle.	kill
No one could have predicted the athlete's performance.	defeat
Jill was amazed when the doctor gave her the results.	sick
Sarah took her neighbour's favourite toy.	steal
Candie's belly is getting bigger.	fat
At the hearing, the lawyer argued that Mark was responsible.	blame
She quickly held out her hands in front of her.	falling
Craig left the exam an hour early.	failure

Neutrally-related prime target pairs presented at 0 ms ISI

Everyone was surprised at Mark's fourth placing in the state finals.	race
Seeing Linda again filled John with emotion.	feelings



Doug slid down the slope.	snow
Ian had his first stroke on the golf course in 1994.	beginner
Joan was stunned by her final exam result.	grades
The outcome of Jane's job interview surprised her.	meeting
While waiting for the train Linda was approached by a stranger.	request
The bank clerk handed the money to the man.	currency
Brian showed no emotion when he received his exam results.	marks
The Miner inspected the large cut.	earth

Neutrally-related prime target pairs presented at 1000 ms or 2000 ms ISI

The man stopped Chris in the street.	ask
The man put the box outside the door and quickly left.	package
When the report on John's department was released, it drew a lot of attention.	financial
Betty felt faint when the roulette wheel finally stopped spinning.	gamble
Her father shared his thoughts regarding her boyfriend.	daughter
The young art student's sculpture attracted a lot of attention.	clay
Jason's classmates laughed as he made his presentation.	classroom
The two women ran into each other in the car park.	parking
Some runners were crying upon crossing the finish line.	sweat
The music stirred strong feelings in Alex.	jazz

Unrelated prime target pairs presented at 0 ms ISI

Pat slid quickly along the icy pond.	plywood
A few policemen showed up at the party.	monk
It was half past the hour when Sue arrived for her 1 o'clock job interview.	lamp
Her supervisor was aware of her work habits.	hat
Sharon squealed when she was grabbed.	industry

The couple called the chef to the table.	umbrella
His mood reflected the weather.	magazine
The child's dreams were vivid.	capital
Jill felt little emotion about her driving test results.	onion
Mary decided to shave her head.	aircraft

Unrelated prime target pairs presented at 1000 ms or 2000 ms ISI

Her belly was aching so much she had to leave the room.	species
The storekeeper was shocked when he counted the day's takings.	wand
The boy's Halloween costume matched his personality.	petition
Sue watched from the window as the man coming to get her approached the house.	opera
The diver sank to the bottom of the ocean.	town
His memory capacity is unusual.	blanket
Working behind bars had given Sam a different view on life.	drain
Lisa asked her father not to put her down.	army
The father was aware of his son's activities.	zebra
Roberta wept after hearing the jury's verdict.	banana

Table B4

*Sentence Prime-Word Target Pairs List 4.*

Sentence prime	Target
Positively-related prime target pairs presented at 0 ms ISI	
Paul's cost cutting actions were unexpected.	efficient
Carol cried throughout the service.	marriage
My sister sings like no other.	talent
The fruit they ate had an unusual flavour.	tasty
The statistics assignment was nothing like Tara had imagined.	clear
The poem evoked some unexpected emotions in Jane.	merry
The boy came home from school with a note for his parents.	proud
The principal phoned the girl's parents.	award
The boss called Jason into his office.	raise
Her stubbornness got her what she deserved.	medal
Positively-Related Prime Target Pairs Presented at 1000 or 2000 ms ISI	
The teenage boy was sent to the farm.	vacation
The jury has reached a verdict.	innocent
The veterinarian gave the cat a final needle.	cure
No one could have predicted the athlete's performance.	exceed
Jill was amazed when the doctor gave her the results.	healthy
Sarah took her neighbour's favourite toy.	repair
Candie's belly is getting bigger.	baby
At the hearing, the lawyer argued that Mark was responsible.	reliable
She quickly held out her hands in front of her.	embrace
Craig left the exam an hour early.	easy

Negatively-related prime target pairs presented at 0 ms ISI

Everyone was surprised at Mark's fourth placing in the state finals.	upset
The music stirred strong feelings in Alex.	sadness
Doug slid down the slope.	accident
Ian had his first stroke on the golf course in 1994.	heart
Joan was stunned by her final exam result.	distress
The outcome of Jane's job interview surprised her.	rejected
Her father shared his thoughts regarding her boyfriend.	disapprove
The bank clerk handed the money to the man.	robbery
Brian showed no emotion when he received his exam results.	fail
The Miner inspected the large cut.	wound

Negatively-related prime target pairs presented at 1000 ms or 2000 ms ISI

The man stopped Chris in the street.	beg
The man put the box outside the door and quickly left.	bomb
When the report on John's department was released, it drew a lot of attention.	investigation
Betty felt faint when the roulette wheel finally stopped spinning.	lose
While waiting for the train Linda was approached by a stranger.	danger
The young art student's sculpture attracted a lot of attention.	obscene
Jason's classmates laughed as he made his presentation.	foolish
The two women ran into each other in the car park.	collide
Some runners were crying upon crossing the finish line.	pain
Seeing Linda again filled John with emotion.	angry

Neutrally-related prime target pairs presented at 0 ms ISI

Pat slid quickly along the icy pond.	frozen
A few policemen showed up at the party.	dance

It was half past the hour when Sue arrived for her 1 o'clock job interview.	appointment
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Her supervisor was aware of her work habits.	salary
--	--------

Sharon squealed when she was grabbed.	hands
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The couple called the chef to the table.	enquire
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His mood reflected the weather.	climate
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The boy's Halloween costume matched his personality.	mask
--	------

Working behind bars had given Sam a different view on life.	tavern
---	--------

Mary decided to shave her head.	hair
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Neutrally-related prime target pairs presented at 1000 ms or 2000 ms ISI

Her belly was aching so much she had to leave the room.	exit
---	------

The storekeeper was shocked when he counted the day's takings.	cash
--	------

The child's dreams were vivid.	sleep
--------------------------------	-------

Sue watched from the window as the man coming to get her approached the house.	taxi
--	------

The diver sank to the bottom of the ocean.	scuba
--	-------

His memory capacity is unusual.	recall
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Jill felt little emotion about her driving test results.	license
--	---------

Lisa asked her father not to put her down.	carry
--	-------

The father was aware of his son's activities.	schedule
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Roberta wept after hearing the jury's verdict.	tears
--	-------

Unrelated prime target pairs presented at 0 ms ISI

Adam's life is not what he thought it would be.	pigeon
---	--------

She told him what she thought about him.	calendar
--	----------

Monica was stopped as she left the store.	dental
---	--------

The crowd gasped as the plane spiraled toward the ground.	philosopher
---	-------------

The students all agreed on the difficulty level of the exam.	street
Bill's essay was returned covered with comments.	diamond
He needed more money to support his addiction.	pink
Kathy had been committed for some time.	sauce
Mandy felt a change in Paul's attitude toward their relationship.	hangar
There is something different about this child.	honeycomb

Unrelated prime target pairs presented at 1000 ms or 2000 ms ISI

His intelligence test results were considered abnormal.	transportation
The children were removed from the smoky room.	turtle
She uses her body as a tool to make a living.	pool
As they walked out the door, people threw things at them.	deer
The two men discussed how to blow up the dinghy.	pottery
The dog made the discovery.	wish
Kevin did not see his wife waving in the sea.	stamp
The businessman felt overwhelmed by the day's events.	oatmeal
The driver gestured at the other driver.	running
Eve is unlike the other girls in her grade.	whistle

Table B5

*Sentence Prime-Word Target Pairs List 5.*

Sentence prime	Target
Positively-related prime target pairs presented at 0 ms ISI	
The man stopped Chris in the street.	greet
Joan was stunned by her final exam result.	success
When the report on John's department was released, it drew a lot of attention.	congratulate
Betty felt faint when the roulette wheel finally stopped spinning.	win
While waiting for the train Linda was approached by a stranger.	friendly
The young art student's sculpture attracted a lot of attention.	beauty
Jason's classmates laughed as he made his presentation.	funny
The two women ran into each other in the car park.	friends
Some runners were crying upon crossing the finish line.	victory
The music stirred strong feelings in Alex.	happiness
Positively-related prime target pairs presented at 1000 ms or 2000 ms ISI	
Everyone was surprised at Mark's fourth placing in the state finals.	improvement
Seeing Linda again filled John with emotion.	love
Ian had his first stroke on the golf course in 1994.	accomplishment
The outcome of Jane's job interview surprised her.	hired
The bank clerk handed the money to the man.	rebate
The Miner inspected the large cut.	gold
Doug slid down the slope.	ski
The man put the box outside the door and quickly left.	gift
Her father shared his thoughts regarding her boyfriend.	approve

Brian showed no emotion when he received his exam results. succeed

Negatively-related prime target pairs presented at 0 ms ISI

Her belly was aching so much she had to leave the room. poison

The storekeeper was shocked when he counted the day's takings. loss

The boy's Halloween costume matched his personality. devil

Sue watched from the window as the man coming to get her approached the house. kidnap

The diver sank to the bottom of the ocean. drowning

His memory capacity is unusual. poor

Sharon squealed when she was grabbed. attack

Lisa asked her father not to put her down. insult

The father was aware of his son's activities. crime

Roberta wept after hearing the jury's verdict. prison

Negatively-related prime target pairs presented at 1000 ms or 2000 ms ISI

Pat slid quickly along the icy pond. fall

A few policemen showed up at the party. noise

It was half past the hour when Sue arrived for her 1 o'clock job interview. late

Her supervisor was aware of her work habits. lazy

Working behind bars had given Sam a different view on life. jail

The couple called the chef to the table. complain

His mood reflected the weather. stormy

The child's dreams were vivid. nightmare

Jill felt little emotion about her driving test results. failed

Mary decided to shave her head. cancer

Neutrally-related prime target pairs presented at 0 ms ISI



His intelligence test results were considered abnormal.	knowledge
The children were removed from the smoky room.	restaurant
The students all agreed on the difficulty level of the exam.	final
As they walked out the door, people threw things at them.	tradition
The two men discussed how to blow up the dinghy.	pump
The dog made the discovery.	hound
Kevin did not see his wife waving in the sea.	swim
The businessman felt overwhelmed by the day's events.	corporation
The driver gestured at the other driver.	auto
Eve is unlike the other girls in her grade.	student

Neutrally-related prime target pairs presented at 1000 ms or 2000 ms ISI

Adam's life is not what he thought it would be.	plans
She told him what she thought about him.	opinion
Monica was stopped as she left the store.	purchase
The crowd gasped as the plane spiraled toward the ground.	stunt
There is something different about this child.	kid
Bill's essay was returned covered with comments.	writing
He needed more money to support his addiction.	habit
Kathy had been committed for some time.	years
Mandy felt a change in Paul's attitude toward their relationship.	dating
She uses her body as a tool to make a living.	legs

Unrelated prime target pairs presented at 0 ms ISI

The teenage boy was sent to the farm.	harp
The jury has reached a verdict.	boots
The veterinarian gave the cat a final needle.	Latin

No one could have predicted the athlete's performance.	red
Jill was amazed when the doctor gave her the results.	cricket
Sarah took her neighbour's favourite toy.	axis
Candie's belly is getting bigger.	pollen
At the hearing, the lawyer argued that Mark was responsible.	dictionary
She quickly held out her hands in front of her.	tea
Craig left the exam an hour early.	lawn

Unrelated prime target pairs presented at 1000 ms or 2000 ISI

Paul's cost cutting actions were unexpected.	ballet
Carol cried throughout the service.	agile
My sister sings like no other.	addition
The fruit they ate had an unusual flavour.	geography
The statistics assignment was nothing like Tara had imagined.	firework
The poem evoked some unexpected emotions in Jane.	stick
The boy came home from school with a note for his parents.	planet
The principal phoned the girl's parents.	velocity
The boss called Jason into his office.	spoon
Her stubbornness got her what she deserved.	garage

Table B6

*Sentence Prime-Word Target Pairs List 6.*

Sentence prime	Target
Positively-related prime target pairs presented at 0 ms ISI	
Her belly was aching so much she had to leave the room.	laugh
The storekeeper was shocked when he counted the day's takings.	profit
The boy's Halloween costume matched his personality.	hero
Sue watched from the window as the man coming to get her approached the house.	boyfriend
The diver sank to the bottom of the ocean.	treasure
His memory capacity is unusual.	amazing
Working behind bars had given Sam a different view on life.	wisdom
Lisa asked her father not to put her down.	piggy-back
The father was aware of his son's activities.	hockey
Roberta wept after hearing the jury's verdict.	freedom
Positively-related prime target pairs presented at 1000 ms or 2000 ms ISI	
Pat slid quickly along the icy pond.	skate
A few policemen showed up at the party.	celebrate
It was half past the hour when Sue arrived for her 1 o'clock job interview.	early
Her supervisor was aware of her work habits.	diligent
Sharon squealed when she was grabbed.	hug
The couple called the chef to the table.	compliment
His mood reflected the weather.	sunny
The child's dreams were vivid.	joyful
Jill felt little emotion about her driving test results.	excel

Mary decided to shave her head. charity

Negatively-related prime target pairs presented at 0 ms ISI

His intelligence test results were considered abnormal. dumb

The children were removed from the smoky room. fire

There is something different about this child. slow

As they walked out the door, people threw things at them. stones

The two men discussed how to blow up the dinghy. explode

The dog made the discovery. corpse

Kevin did not see his wife waving in the sea. drown

The businessman felt overwhelmed by the day's events. tragedy

The driver gestured at the other driver. offend

Eve is unlike the other girls in her grade. withdrawn

Paul's cost cutting actions were unexpected. budget

Negatively-related prime target pairs presented at 1000 ms or 2000 ms ISI

Adam's life is not what he thought it would be. unhappy

She told him what she thought about him. dislike

Monica was stopped as she left the store. shoplift

The crowd gasped as the plane spiraled toward the ground. crash

The students all agreed on the difficulty level of the exam. hard

Bill's essay was returned covered with comments. criticism

He needed more money to support his addiction. drugs

Kathy had been committed for some time. hospital

Mandy felt a change in Paul's attitude toward their relationship. unloving

She uses her body as a tool to make a living. prostitute

Neutrally-related prime target pairs presented at 0 ms ISI

The teenage boy was sent to the farm.	cow
The jury has reached a verdict.	lawyer
The veterinarian gave the cat a final needle.	drug
No one could have predicted the athlete's performance.	badminton
Jill was amazed when the doctor gave her the results.	medicine
Sarah took her neighbour's favourite toy.	doll
Candie's belly is getting bigger.	abdomen
At the hearing, the lawyer argued that Mark was responsible.	judge
She quickly held out her hands in front of her.	arms
Craig left the exam an hour early.	test

Neutrally-related prime target pairs presented at 1000 ms or 2000 ms ISI

Carol cried throughout the service.	ceremony
My sister sings like no other.	voice
The fruit they ate had an unusual flavour.	apple
The statistics assignment was nothing like Tara had imagined.	mathematic
The poem evoked some unexpected emotions in Jane.	poetry
The boy came home from school with a note for his parents.	message
The principal phoned the girl's parents.	telephone
The boss called Jason into his office.	chat
Her stubbornness got her what she deserved.	personality

Unrelated prime target pairs presented at 0 ms ISI

The man stopped Chris in the street.	venom
The man put the box outside the door and quickly left.	soul
When the report on John's department was released, it drew a lot of attention.	otter
Betty felt faint when the roulette wheel finally stopped spinning.	square

While waiting for the train Linda was approached by a stranger.	muffler
The young art student's sculpture attracted a lot of attention.	fertilizer
Joan was stunned by her final exam result.	vegetable
The two women ran into each other in the car park.	moon
Some runners were crying upon crossing the finish line.	oyster
Brian showed no emotion when he received his exam results.	lemon

Unrelated prime target pairs presented at 1000 ms or 2000 ms ISI

Everyone was surprised at Mark's fourth placing in the state finals.	camel
Seeing Linda again filled John with emotion.	chair
Doug slid down the slope.	olive
Ian had his first stroke on the golf course in 1994.	pumpkin
Jason's classmates laughed as he made his presentation.	maple
The outcome of Jane's job interview surprised her.	violin
Her father shared his thoughts regarding her boyfriend.	marble
The bank clerk handed the money to the man.	zoology
The music stirred strong feelings in Alex.	boat
The Miner inspected the large cut.	religion

Table B7

*Sentence Prime-Word Target Pairs List 7.*

Sentence prime	Target
Positively-related prime target pairs presented at 0 ms ISI	
His intelligence test results were considered abnormal.	genius
The children were removed from the smoky room.	rescued
There is something different about this child.	clever
As they walked out the door, people threw things at them.	rice
The two men discussed how to blow up the dinghy.	toy
The dog made the discovery.	child
Kevin did not see his wife waving in the sea.	holiday
The businessman felt overwhelmed by the day's events.	promotion
The driver gestured at the other driver.	thanked
Eve is unlike the other girls in her grade.	creative
Positively-related prime target pairs presented at 1000 ms or 2000 ms ISI	
Adam's life is not what he thought it would be.	amazed
She told him what she thought about him.	admire
Monica was stopped as she left the store.	winner
The crowd gasped as the plane spiraled toward the ground.	feat
The students all agreed on the difficulty level of the exam.	simple
Bill's essay was returned covered with comments.	praise
He needed more money to support his addiction.	athlete
Kathy had been committed for some time.	relationship
Mandy felt a change in Paul's attitude toward their relationship.	romantic
She uses her body as a tool to make a living.	model

Negatively-related prime target pairs presented at 0 ms ISI

The teenage boy was sent to the farm.	punishment
The jury has reached a verdict.	guilty
The veterinarian gave the cat a final needle.	kill
No one could have predicted the athlete's performance.	defeat
Jill was amazed when the doctor gave her the results.	sick
Sarah took her neighbour's favourite toy.	steal
Candie's belly is getting bigger.	fat
At the hearing, the lawyer argued that Mark was responsible.	blame
She quickly held out her hands in front of her.	falling
Craig left the exam an hour early.	failure

Negatively-related prime target pairs presented at 1000 ms or 2000 ms ISI

Paul's cost cutting actions were unexpected.	unemployed
Carol cried throughout the service.	funeral
My sister sings like no other.	badly
The fruit they ate had an unusual flavour.	rotten
The statistics assignment was nothing like Tara had imagined.	difficult
The poem evoked some unexpected emotions in Jane.	gloomy
The boy came home from school with a note for his parents.	trouble
The principal phoned the girl's parents.	suspension
The boss called Jason into his office.	fired
Her stubbornness got her what she deserved.	enemy

Neutrally-related prime target pairs presented at 0 ms ISI

The man stopped Chris in the street.	ask
The man put the box outside the door and quickly left.	package



When the report on John's department was released, it drew a lot of attention.	financial
Betty felt faint when the roulette wheel finally stopped spinning.	gamble
Her father shared his thoughts regarding her boyfriend.	daughter
The young art student's sculpture attracted a lot of attention.	clay
Jason's classmates laughed as he made his presentation.	classroom
The two women ran into each other in the car park.	parking
Some runners were crying upon crossing the finish line.	sweat
The music stirred strong feelings in Alex.	jazz

Neutrally-related prime target pairs presented at 1000 ms or 2000 ms ISI

Everyone was surprised at Mark's fourth placing in the state finals.	race
Seeing Linda again filled John with emotion.	feelings
Doug slid down the slope.	snow
Ian had his first stroke on the golf course in 1994.	beginner
Joan was stunned by her final exam result.	grades
The outcome of Jane's job interview surprised her.	meeting
While waiting for the train Linda was approached by a stranger.	request
The bank clerk handed the money to the man.	currency
Brian showed no emotion when he received his exam results.	marks
The Miner inspected the large cut.	earth

Unrelated prime target pairs presented at 0 ms ISI

Her belly was aching so much she had to leave the room.	species
The storekeeper was shocked when he counted the day's takings.	wand
The boy's Halloween costume matched his personality.	petition
Sue watched from the window as the man coming to get her approached the house.	opera

The diver sank to the bottom of the ocean.	town
His memory capacity is unusual.	blanket
Working behind bars had given Sam a different view on life.	drain
Lisa asked her father not to put her down.	army
The father was aware of his son's activities.	zebra
Roberta wept after hearing the jury's verdict.	banana

Unrelated prime target pairs presented at 1000 ms or 2000 ms ISI

Pat slid quickly along the icy pond.	plywood
A few policemen showed up at the party.	monk
It was half past the hour when Sue arrived for her 1 o'clock job interview.	lamp
Her supervisor was aware of her work habits.	hat
Sharon squealed when she was grabbed.	industry
The couple called the chef to the table.	umbrella
His mood reflected the weather.	magazine
The child's dreams were vivid.	capital
Jill felt little emotion about her driving test results.	onion
Mary decided to shave her head.	aircraft

Table B8

*Sentence Prime-Word Target Pairs List 8.*

Sentence prime	Target
Positively-related prime target pairs presented at 0 ms ISI	
The teenage boy was sent to the farm.	vacation
The jury has reached a verdict.	innocent
The veterinarian gave the cat a final needle.	cure
No one could have predicted the athlete's performance.	exceed
Jill was amazed when the doctor gave her the results.	healthy
Sarah took her neighbour's favourite toy.	repair
Candie's belly is getting bigger.	baby
At the hearing, the lawyer argued that Mark was responsible.	reliable
She quickly held out her hands in front of her.	embrace
Craig left the exam an hour early.	easy
Positively-related prime target pairs presented at 1000 ms or 2000 ms ISI	
Paul's cost cutting actions were unexpected.	efficient
Carol cried throughout the service.	marriage
My sister sings like no other.	talent
The fruit they ate had an unusual flavour.	tasty
The statistics assignment was nothing like Tara had imagined.	clear
The poem evoked some unexpected emotions in Jane.	merry
The boy came home from school with a note for his parents.	proud
The principal phoned the girl's parents.	award
The boss called Jason into his office.	raise
Her stubbornness got her what she deserved.	medal

## Negatively-related prime target pairs presented at 0 ms ISI

The man stopped Chris in the street.	beg
The man put the box outside the door and quickly left.	bomb
When the report on John's department was released, it drew a lot of attention.	investigation
Betty felt faint when the roulette wheel finally stopped spinning.	lose
While waiting for the train Linda was approached by a stranger.	danger
The young art student's sculpture attracted a lot of attention.	obscene
Jason's classmates laughed as he made his presentation.	foolish
The two women ran into each other in the car park.	collide
Some runners were crying upon crossing the finish line.	pain
Seeing Linda again filled John with emotion.	angry

## Negatively-related prime target pairs presented at 1000 ms or 2000 ms ISI

Everyone was surprised at Mark's fourth placing in the state finals.	upset
The music stirred strong feelings in Alex.	sadness
Doug slid down the slope.	accident
Ian had his first stroke on the golf course in 1994.	heart
Joan was stunned by her final exam result.	distress
The outcome of Jane's job interview surprised her.	rejected
Her father shared his thoughts regarding her boyfriend.	disapprove
The bank clerk handed the money to the man.	robbery
Brian showed no emotion when he received his exam results.	fail
The Miner inspected the large cut.	wound

## Neutrally-related prime target pairs presented at 0 ms ISI

Her belly was aching so much she had to leave the room.	exit
The storekeeper was shocked when he counted the day's takings.	cash

The child's dreams were vivid.	sleep
Sue watched from the window as the man coming to get her approached the house.	taxi
The diver sank to the bottom of the ocean.	scuba
His memory capacity is unusual.	recall
Jill felt little emotion about her driving test results.	license
Lisa asked her father not to put her down.	carry
The father was aware of his son's activities.	schedule
Roberta wept after hearing the jury's verdict.	tears

Neutrally-related prime target pairs presented at 1000 ms or 2000 ms ISI

Pat slid quickly along the icy pond.	frozen
A few policemen showed up at the party.	dance
It was half past the hour when Sue arrived for her 1 o'clock job interview.	appointment
Her supervisor was aware of her work habits.	salary
Sharon squealed when she was grabbed.	hands
The couple called the chef to the table.	enquire
His mood reflected the weather.	climate
The boy's Halloween costume matched his personality.	mask
Working behind bars had given Sam a different view on life.	tavern
Mary decided to shave her head.	hair

Unrelated prime target pairs presented at 0 ms ISI

His intelligence test results were considered abnormal.	transportation
The children were removed from the smoky room.	turtle
She uses her body as a tool to make a living.	pool
As they walked out the door, people threw things at them.	deer

The two men discussed how to blow up the dinghy.	pottery
The dog made the discovery.	wish
Kevin did not see his wife waving in the sea.	stamp
The businessman felt overwhelmed by the day's events.	oatmeal
The driver gestured at the other driver.	running
Eve is unlike the other girls in her grade.	whistle

Unrelated prime target pairs presented at 1000 ms or 2000 ms ISI

Adam's life is not what he thought it would be.	pigeon
She told him what she thought about him.	calendar
Monica was stopped as she left the store.	dental
The crowd gasped as the plane spiraled toward the ground.	philosopher
The students all agreed on the difficulty level of the exam.	street
Bill's essay was returned covered with comments.	diamond
He needed more money to support his addiction.	pink
Kathy had been committed for some time.	sauce
Mandy felt a change in Paul's attitude toward their relationship.	hangar
There is something different about this child.	honeycomb

Table B9

*Sentence Prime-Nonword Target Pairs Lists.*

Sentence prime	Target
Nonword Targets Presented at 0 ms ISI in Lists 1, 2, 3, and 4	
and at 1000 ms or 2000 ms ISI in Lists 5, 6, 7, and 8	
He had tears in his eyes.	dap
His friend's judgment of his abilities was different than his own.	crof
The principal suggested that she attend another school.	stibes
The man offered the child a candy.	glounced
Her methods are different than those of other professors.	swarched
Her level of understanding was not what her husband had anticipated.	splants
The weather suddenly changed.	cloams
They believed he played a role.	stroul
Their dance moves were the talk of the town.	shamped
Their vacation did not proceed as planned.	jinchd
Her friend told her a secret.	strupe
The priest visited the patient.	vauge
Joe calculated the odds of achieving his goal.	keized
She gave him an answer to his wedding proposal.	cleaked
She picked up something that was not hers.	loy
He talked to her about his childhood memories.	wark
His nickname is not an accurate description of his personality.	blorm
She had a talk with her daughter.	chond
He brought up the issue with his wife.	clett
His change of heart was a surprise to everyone involved.	spaig

She knew exactly what she had to do.	carticle
His boss wanted to have a word with him.	blothing
His luck is changing.	porps
His performance was not what he had anticipated.	skirks
They saw him talking to the priest.	prouched
Her friends hid it without telling her the location.	pligue
During Thanksgiving Mary learned the family's secret.	bruned
She told him that she needed more space.	brooched
Paula's arrival was unexpected.	strulled
Margaret had decided to break her engagement.	teef
Henry had devised a plan to break into the market.	huck
Louise's heartbeat quickened at the sound of the man's footsteps.	flarm
The teacher asked them to stay after class.	spurse
He received his evaluation from management.	slont
His record was sent away.	tods
Her eyes widened as she looked at her bank statement.	cruft
Her perception of the situation was uncommon.	wrencked
This religion advocated a different form of worship.	gleaved
She was anxious to learn the content of the letter.	cleading
The new law was the cause of vivid discussions among some citizens.	steeked
The evaluation she received was well deserved.	creasing
Chris phoned the insurance company.	shends
His pants were not fitting as well as before.	phirk
Everyone was shocked by her New Year's resolution.	lod
The family received a box filled with food items.	carmless



The child shared her secret with her counselor.	joap
The child was hiding under the bed.	swulled
He took the money out of her purse.	vault
She received an important message in the mail.	loode
The reality of the situation came as a surprise.	contrant
The quality of his work is an indication of his efforts.	spram
His feelings prevented him from assessing the situation accurately.	crog
The chemistry between Candie and Adam is inexplicable.	bloothing
He still remembers the first time he met her parents.	bame
Her reaction was not what he expected.	brabes
Josie's opinion on marriage is quite clear.	swalged
The content of the file has not yet been revealed.	mauged
She is heading toward the bottom.	speem
He could not contain his emotions any longer.	slenged
The physician provided her diagnosis.	screets

Nonword targets presented at 1000 ms or 2000 ms ISI in Lists 1, 2, 3, and 4  
and at 0 ms ISI in Lists 5, 6, 7, and 8

A panel of judges made the final decision.	rooth
The news in the telegram was completely unexpected.	wouged
His friends are aware of his attitude.	mephed
Her concluding remarks astonished the audience.	screbbed
Sarah's interpretation of the book surprised everyone.	crawped
Allan left after Paul had beaten him.	blinched
Several people in the studio looked on as Michael drew the sword.	distless
The doctor examined little Emily's growth.	blashing

Children rushed from the buildings at the sound of the bell.	froned
The professor provided her with feedback on her paper.	drapping
The experience considerably altered his self-esteem.	sloons
Ann and John decided to inform their friends.	douthful
Her expectations were different than his.	stulp
Christmas time is always filled with emotions.	cose
The committee made its decision about the applicants.	hend
The professor wanted to see him about his essay.	grashed
She meant every word she said.	wesk
Her life story is well known.	snilled
He could not believe that he heard her correctly.	murched
It was an offer she could not refuse.	stused
The note was from a man she did not know.	creened
I believe that she feels the same way about me.	besigned
He checked his lottery ticket a second time.	knatch
He could not possibly mean what he had said.	wheemed
Her date was not at all what she expected.	flerce
David could never remember a time he felt like this.	flonds
She wondered if the other students felt the same way about the exam.	banes
He decided to phone his lawyer.	straised
The child's drawing skills are unusual.	crey
They talked about it over coffee.	casteful
He taught her a lesson.	tirt
She decided it was important to make a decision.	jerf
He handed the baby over to her and left.	blorn

Her boss phoned her at home.	teene
She did not go to work today.	kitched
His girlfriend wrote him a letter.	maffed
She decided to move out on her own.	blirt
He certainly did not expect it.	chooce
Their conversation was filled with emotions.	trand
Everyone agreed that he had met his match.	plood
He followed her home.	splots
Upon his arrival, many people surrounded him.	tisc
Everyone stopped talking when she walked in.	trowned
She was in for a big surprise.	firt
They interviewed her on the street.	metched
She drank until the bottle was empty.	jood
They discussed his eating habits.	strinds
The couple discussed their future together.	rimp
The child ran away.	sauk
They photographed the man boarding the plane.	clasked
The painting depicted a famous historical scene.	dricked
There was so much going on he could not fall asleep.	scripes
She felt that it was her destiny.	gised
He is a unique person.	steef
They used his story as an example to the others.	dess
Julian tied the knot.	antitude
She knew how it would end.	strassed
No one else knew except her mother.	spooved

They searched until sunset.

crooched

The father wondered about his daughter's contribution.

screnned

Table B10

*Sentence Prime-Unrelated Word Target Filler Pairs Lists.*

Sentence prime	Target
Unrelated Prime-Target Pairs fillers Presented at 0 ms ISI in Lists 1, 2, 3, and 4, and at 1000 ms or 2000 ms ISI in Lists 5, 6, 7, and 8	
He believed his success to reflect his luck.	frog
She told her friend that Joe was looking for her.	melon
She could not bring herself to look at him.	adverb
His curves are not proportional.	glue
The doctor was stunned by the patient's progress.	snow
Her abilities were not average.	potato
She believed him when he made his promise.	eclipse
His wife's personality is very interesting.	cabin
The doctor explained the patient's condition.	lemonade
In the end, he had learned a valuable lesson.	pear
He was surprised when he learned of her feelings.	basement
She anxiously opened the telegram.	concept
Shane encountered the animal while hiking.	glass
David started the fire at the camp.	diabetic
She ran as fast as she could.	federation
The event was not what Kevin had expected.	erosion
The exam grades were not what the students expected.	metropolitan
The situation made him more aware of his capabilities.	electricity
Carly's opinion of him is quite clear.	craft
He was not of average intelligence.	hamburger

Unrelated Prime-Target Pairs fillers Presented at 1000 ms or 2000 ms ISI in Lists 1, 2, 3, and 4,

and at 0 ms ISI in Lists 5, 6, 7, and 8

He noticed her figure was certainly not average.	law
Lisa noticed he was not average in height.	bruise
No one considered her to be average in appearance.	lice
I never thought that our friendship would take this path.	raisin
When he heard the news, he drove to his home as quickly as he could.	random
The pilot had an announcement for the passengers.	knuckle
She was admitted right away.	sun
They could not stop talking about her.	formula
It was snowing when the wreath arrived.	job
The strength of the punch took Peter by surprise.	wizard
Tears were rolling down her cheeks.	diameter
The dad could not see his children in the park.	globe
He had a good reason to hide.	currency
The teacher wrote a few names on the board.	autopsy
He is a student with special needs.	window
Her energy level is atypical.	customer
She argued her point to her husband.	snake
She was the perfect host.	herb
A car pulled over beside the child.	glacier
The party was just as Ben expected.	income

## Appendix C

Table C1

*Positive Word Target Frequency Data.*

Word	Letters	Frequency	N	Strength	Affect
Improvement (1)	11	0	0	4.70	2.18
Love (2)	4	232	14	5.39	2.82
Ski (3)	3	3	2	5.25	1.35
Accomplishment (4)	14	0	0	2.35	0.85
Gift (5)	4	33	6	4.50	1.83
Hired (6)	5	25	11	5.30	2.75
Approve (7)	7	7	0	5.05	2.43
Rebate (8)	6	0	2	3.92	1.76
Succeed (9)	7	15	0	4.63	1.95
Gold (10)	4	52	13	3.87	1.89
Greet (11)	5	7	3	4.68	1.88
Success (12)	7	93	0	5.00	2.68
Congratulate (13)	12	0	0	4.29	2.05
Win (14)	3	55	15	5.05	2.60
Friendly (15)	8	61	0	4.03	1.42
Beauty (16)	6	71	0	4.98	2.65
Funny (17)	5	41	8	5.45	2.58
Friends (18)	7	0	0	4.71	2.39
Victory (19)	7	61	1	5.18	2.66
Happiness (20)	9	0	0	5.18	2.60
Skate (21)	5	1	3	5.26	1.76

Celebrate (22)	9	0	1	4.03	0.05
Early (23)	5	366	2	4.43	1.90
Diligent (24)	8	2	0	4.89	2.29
Hug (25)	3	3	16	4.47	2.03
Compliment (26)	10	0	1	5.10	2.63
Sunny (27)	6	0	6	4.89	2.42
Joyful (28)	6	1	0	2.43	2.00
Excel (29)	5	1	1	2.08	0.60
Charity (30)	7	8	2	4.82	2.61
Laugh (31)	5	28	2	4.58	2.18
Profit (32)	6	28	0	5.18	2.53
Hero (33)	4	52	6	4.85	2.28
Boyfriend (34)	9	0	0	5.00	2.50
Treasure (35)	8	4	2	4.15	2.03
Amazing (36)	7	20	0	4.34	2.18
Wisdom (37)	6	44	0	4.18	1.55
Piggy-back (38)	10	0	0	4.47	1.66
Hockey (39)	6	1	3	4.68	1.28
Freedom (40)	7	128	0	4.79	1.74
Amazed (41)	6	11	1	3.61	1.71
Admire (42)	6	10	0	4.53	2.08
Winner (43)	6	8	10	3.03	1.85
Feat (44)	4	6	14	1.93	-0.18
Simple (45)	6	161	6	4.68	1.90
Praise (46)	6	17	2	5.13	2.60



Athlete (47)	7	9	0	2.25	-1.60
Relationship (48)	12	0	0	5.05	2.05
Romantic (49)	8	32	0	4.92	2.32
Model (50)	5	77	6	5.10	1.43
Genius (51)	6	23	0	5.18	2.38
Rescued (52)	7	0	2	5.21	2.55
Clever (53)	6	17	1	4.11	2.24
Rice (54)	4	33	19	4.90	2.25
Toy (55)	3	4	17	3.08	0.32
Child (56)	5	213	2	3.61	1.08
Holiday (57)	7	17	0	3.05	1.13
Promotion (58)	9	0	0	4.71	2.53
Thanked (59)	7	0	1	4.37	1.71
Creative (60)	8	49	1	4.18	1.85
Efficient (61)	9	0	0	4.37	1.92
Marriage (62)	8	95	1	4.65	2.15
Talent (63)	6	40	0	5.08	2.50
Tasty (64)	5	2	8	4.43	1.93
Clear (65)	5	219	3	2.29	0.79
Merry (66)	5	8	7	3.61	1.95
Proud (67)	5	50	0	4.90	2.38
Award (68)	5	46	2	3.92	2.32
Raise (69)	5	52	1	4.50	2.58
Medal (70)	5	7	3	3.26	1.29
Vacation (71)	8	47	1	4.08	0.97

Innocent (72)	8	37	0	5.39	2.08
Cure (73)	4	28	14	5.03	2.71
Exceed (74)	6	19	0	4.70	2.40
Healthy (75)	7	33	1	5.18	2.76
Repair (76)	6	20	1	1.74	0.76
Baby (77)	4	62	3	5.25	2.25
Reliable (78)	8	22	1	3.78	1.30
Embrace (79)	7	13	0	4.53	2.16
Easy (80)	4	125	2	4.79	2.03

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*Note.* The number in parenthesis ( ) indicates the sentence number to which the word corresponds (see Appendix A). The mean number of letters was 6.43 letters and the median 6.00 letters; the mean frequency was 38.1 and the median 17.00; the neighborhood size (N) mean was 3.13 and the median 1.00; the strength rating mean was 4.39 and the median 4.67; and the affect rating was 1.91 and the median 2.05.

Table C2

*Negative Word Frequency Data.*

Word	Letters	Frequency	N	Strength	Affect
Upset (1)	5	14	0	4.55	-2.03
Angry (2)	5	45	0	4.78	-2.35
Accident (3)	8	33	0	4.24	-1.87
Heart (4)	5	173	3	3.45	-1.58
Bomb (5)	4	36	5	4.03	-2.47
Rejected (6)	8	0	2	4.79	-2.45
Disapprove (7)	10	0	0	4.75	-1.78
Robbery (8)	7	0	2	5.21	-2.66
Fail (9)	4	37	16	4.47	-1.95
Wound (10)	5	28	8	4.97	-1.84
Beg (11)	3	11	14	4.18	-0.84
Distress (12)	8	15	1	4.38	-2.03
Investigation (13)	13	0	0	4.60	-1.35
Lose (14)	4	58	16	4.63	-2.20
Danger (15)	6	70	8	4.87	-2.55
Obscene (16)	7	2	0	4.48	-1.48
Foolish (17)	7	0	0	3.95	-1.42
Collide (18)	7	0	0	4.78	-1.85
Pain (19)	4	88	11	4.35	-1.78
Sadness (20)	7	0	2	5.18	-1.58
Fall (21)	4	147	13	3.78	-1.15
Noise (22)	5	37	3	5.08	-1.80

Late (23)	4	179	18	5.43	-2.20
Lazy (24)	4	9	5	4.87	-2.00
Attack (25)	6	105	1	5.05	-2.48
Complain (26)	8	11	0	4.88	-2.03
Stormy (27)	6	8	2	4.70	-1.65
Nightmare (28)	9	0	0	4.61	-1.89
Failed (29)	6	0	12	4.23	-1.95
Cancer (30)	6	25	6	4.68	-0.98
Poison (31)	6	10	1	3.74	-2.34
Loss (32)	4	86	14	5.00	-2.33
Devil (33)	5	25	0	4.80	-1.30
Kidnap (34)	6	0	0	3.87	-2.55
Drowning (35)	8	0	5	4.53	-2.35
Poor (36)	4	113	7	4.29	-1.79
Jail (37)	4	21	11	5.25	-0.93
Insult (38)	6	7	2	5.00	-2.20
Crime (39)	5	34	5	4.29	-2.26
Prison (40)	6	42	2	4.97	-2.26
Unhappy (41)	7	26	0	4.70	-2.25
Dislike (42)	7	14	0	4.89	-1.79
Shoplift (43)	8	0	0	4.82	-2.53
Crash (44)	5	20	5	5.68	-2.84
Hard (45)	4	202	15	5.26	-2.03
Criticism (46)	9	0	1	4.95	-1.82
Drugs (47)	5	0	5	5.58	-2.70

Hospital (48)	8	110	0	4.15	-1.65
Unloving (49)	8	0	1	4.87	-2.53
Prostitute (50)	10	0	0	5.39	-2.53
Dumb (51)	4	13	3	3.98	-2.10
Fire (52)	4	187	15	5.11	1.16
Slow (53)	4	60	16	4.18	-1.85
Stones (54)	6	0	8	4.71	-2.18
Explode (55)	7	0	1	3.93	-1.18
Corpse (56)	6	7	0	3.61	-2.24
Drown (57)	5	3	5	5.03	-2.58
Tragedy (58)	7	49	0	3.75	-2.05
Offend (59)	6	4	0	4.66	-1.76
Withdrawn (60)	9	0	1	4.45	-1.45
Unemployed (61)	10	0	0	3.03	-2.00
Funeral (62)	7	33	0	5.37	-2.66
Badly (63)	5	34	2	3.98	-1.55
Rotten (64)	6	2	3	4.90	-2.25
Difficult (65)	9	0	0	5.18	-2.05
Gloomy (66)	6	3	1	3.74	-1.58
Trouble (67)	7	134	0	5.00	-2.08
Suspension (68)	10	0	0	5.05	-2.45
Fired (69)	5	44	13	5.20	-2.53
Enemy (70)	5	88	1	3.28	-2.10
Punishment (71)	10	0	0	3.30	-1.93
Guilty (72)	6	29	1	5.63	-2.03

Kill (73)	4	63	14	5.18	-2.32
Defeat (74)	6	31	1	4.65	-2.03
Sick (75)	4	51	15	4.98	-2.38
Steal (76)	5	5	4	5.21	-2.53
Fat (77)	3	60	17	5.13	-1.82
Blame (78)	5	34	5	5.03	-2.05
Falling (79)	7	33	10	4.73	-1.38
Failure (80)	7	89	0	4.18	-2.24

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*Note.* The number in parenthesis ( ) indicates the sentence number to which the word corresponds (see Appendix A). The mean number of letters was 6.19 letters and the median 6.00 letters; the mean frequency was 36.1 and the median 17.50; the neighborhood size (N) mean was 4.48 and the median 2.00; the strength rating mean was 4.63 and the median 4.74; and the affect rating was -1.97 and the median -2.03.

Table C3

*Neutral Word Target Frequency Data.*

Word	Letters	Frequency	N	Strength	Affect
Race (1)	4	103	16	4.87	0.76
Feelings (2)	8	0	1	5.74	1.55
Snow (3)	4	59	8	4.93	1.05
Beginner (4)	8	1	0	3.38	0.60
Package (5)	7	20	0	5.13	0.55
Meeting (6)	7	159	1	3.55	0.35
Daughter (7)	8	8	1	4.45	0.40
Currency (8)	8	12	0	5.10	0.93
Marks (9)	5	0	10	5.15	0.00
Earth (10)	5	150	1	3.65	0.38
Ask (11)	3	128	4	4.40	0.80
Grades (12)	6	0	12	5.24	0.13
Financial (13)	9	0	0	3.53	0.16
Gamble (14)	6	3	3	5.21	-1.11
Request (15)	7	49	1	4.15	0.25
Clay (16)	4	100	9	4.58	1.29
Classroom (17)	9	0	0	4.32	-0.16
Parking (18)	7	0	8	4.80	0.10
Sweat (19)	5	23	3	3.61	0.92
Jazz (20)	4	99	1	4.53	1.53
Frozen (21)	6	27	0	5.15	0.18

Dance (22)	5	90	2	3.65	0.48
Appointment (23)	11	0	0	5.00	-0.63
Salary (24)	6	43	0	4.18	1.18
Hands (25)	5	0	9	4.05	-0.63
Enquire (26)	7	0	3	4.21	0.55
Climate (27)	7	26	0	4.08	0.26
Sleep (28)	5	65	6	4.93	0.85
License (29)	7	36	1	4.84	0.47
Hair (30)	4	148	6	5.63	0.23
Exit (31)	4	7	2	4.80	-0.73
Cash (32)	4	36	13	5.05	0.89
Mask (33)	4	9	8	4.13	0.18
Taxi (34)	4	16	1	3.83	0.63
Scuba (35)	5	0	1	4.97	0.74
Recall (36)	6	39	0	4.58	0.93
Tavern (37)	6	2	1	2.90	0.33
Carry (38)	5	88	5	4.55	0.95
Schedule (39)	8	36	0	4.15	0.93
Tears (40)	5	0	17	5.35	-1.33
Plans (41)	5	0	9	4.33	-0.73
Opinion (42)	7	96	0	5.55	0.24
Purchase (43)	8	47	0	3.48	-0.63
Stunt (44)	5	1	5	4.58	1.35
Final (45)	5	156	0	3.78	-0.50



Writing (46)	7	117	2	5.00	-0.23
Habit (47)	5	23	0	5.58	-2.13
Years (48)	5	0	13	4.89	0.05
Dating (49)	6	0	10	4.96	0.28
Legs (50)	4	0	14	4.18	-0.93
Knowledge (51)	9	0	0	4.37	1.16
Restaurant (52)	10	0	0	3.75	-0.68
Kid (53)	3	61	12	4.29	0.24
Tradition (54)	9	0	0	3.48	1.00
Pump (55)	4	11	12	4.18	0.60
Hound (56)	5	7	7	4.95	1.50
Swim (57)	4	15	5	4.25	0.15
Corporation (58)	11	0	0	3.80	-0.18
Auto (59)	4	22	1	3.93	-0.20
Student (60)	7	131	0	3.68	0.37
Budget (61)	6	59	2	5.13	-0.10
Ceremony (62)	8	18	0	4.85	0.05
Voice (63)	5	226	1	5.18	1.42
Apple (64)	5	9	2	4.45	-0.29
Mathematic (65)	10	0	0	4.88	-0.50
Poetry (66)	6	88	0	4.88	0.88
Message (67)	7	64	2	5.05	0.21
Telephone (68)	9	0	1	5.30	-0.60
Chat (69)	4	5	9	4.85	0.50

Personality (70)	11	0	0	4.55	-0.68
Cow (71)	3	29	23	4.15	0.08
Lawyer (72)	6	43	1	4.10	0.15
Drug (73)	4	24	5	5.20	-1.20
Badminton (74)	9	0	0	3.63	0.37
Medicine (75)	8	30	1	3.84	0.03
Doll (76)	4	10	10	5.23	-1.20
Abdomen (77)	7	6	0	4.84	0.53
Judge (78)	5	77	3	4.43	0.18
Arms (79)	4	121	5	4.13	0.58
Test (80)	4	119	12	5.15	0.83

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*Note.* The number in parenthesis ( ) indicates the sentence number to which the word corresponds (see Appendix A). The mean number of letters was 6.08 letters and the median 6.00 letters; the mean frequency was 39.9 and the median 19.00; the neighborhood size (N) mean was 4.01 and the median 1.00; the strength rating mean was 4.51 and the median 4.55; and the affect rating was 0.24 and the median 0.26.

Table C4

*Unrelated Word Target Frequency Data.*

Word	Letters	Frequency	N	Strength	Affect
Camel (1)	5	1	2	0.18	-0.05
Chair (2)	5	66	3	0.13	-0.05
Olive (3)	5	5	2	0.00	-0.08
Pumpkin (4)	7	2	1	0.00	-0.08
Soul (5)	4	47	6	0.34	0.00
Violin (6)	6	11	0	0.05	-0.05
Marble (7)	6	21	3	0.05	-0.13
Zoology (8)	7	1	0	0.15	-0.15
Lemon (9)	5	18	1	0.05	-0.18
Religion (10)	8	119	0	0.13	-0.08
Venom (11)	5	2	0	0.16	-0.08
Vegetable (12)	9	0	0	0.15	0.03
Otter (13)	5	5	3	0.01	-0.05
Square (14)	6	143	1	0.13	-0.11
Muffler (15)	7	2	3	0.20	-0.20
Fertilizer (16)	9	0	2	0.24	0.13
Maple (17)	5	7	1	0.23	-0.03
Moon (18)	4	60	13	0.18	0.00
Oyster (19)	6	6	1	0.10	-0.13
Boat (20)	4	72	13	0.11	-0.03
Plywood (21)	7	9	0	0.11	0.08

Monk (22)	4	16	3	0.05	-0.24
Lamp (23)	4	18	12	0.03	-0.08
Hat (24)	3	56	21	0.13	-0.08
Industry (25)	8	171	0	0.26	-0.37
Umbrella (26)	8	8	0	0.00	-0.08
Magazine (27)	8	39	0	0.20	-0.05
Capital (28)	7	85	1	0.05	-0.03
Onion (29)	5	15	2	0.00	-0.08
Aircraft (30)	8	70	0	0.21	-0.05
Species (31)	7	37	0	0.08	-0.18
Wand (32)	4	1	10	0.16	-0.11
Petition (33)	8	15	0	0.08	-0.05
Opera (34)	5	47	0	1.50	0.65
Town (35)	4	212	8	0.21	-0.11
Blanket (36)	7	30	2	0.15	0.05
Drain (37)	5	18	5	0.84	-0.53
Army (38)	5	132	2	0.80	-0.38
Zebra (39)	5	1	0	0.03	-0.13
Banana (40)	6	4	0	0.10	-0.18
Pigeon (41)	6	3	1	0.03	-0.16
Calendar (42)	8	28	1	0.25	-0.05
Dental (43)	6	12	5	0.34	-0.03
Philosopher (44)	11	0	0	0.11	-0.24
Street (45)	5	244	0	0.00	-0.13

Diamond (46)	7	8	0	0.08	0.03
Pink (47)	4	48	12	0.08	-0.37
Sauce (48)	5	20	2	0.24	-0.08
Hangar (49)	6	1	2	0.38	-0.23
Pool (50)	4	111	8	1.32	0.55
Transportation (51)	14	0	0	0.00	-0.08
Turtle (52)	6	8	1	0.15	0.00
Honeycomb (53)	9	0	0	0.15	-0.03
Deer (54)	4	13	14	0.13	-0.26
Pottery (55)	7	16	3	0.13	-0.08
Wish (56)	4	110	7	0.36	0.00
Stamp (57)	5	8	4	0.03	-0.16
Oatmeal (58)	7	1	1	0.00	-0.08
Running (59)	7	123	7	0.34	-0.03
Whistle (60)	7	4	2	0.45	0.10
Ballet (61)	6	45	9	0.24	-0.16
Agile (62)	5	2	2	0.34	-0.21
Addition (63)	8	142	1	0.20	0.00
Geography (64)	9	0	0	0.97	0.13
Firewood (65)	8	0	0	0.13	-0.03
Stick (66)	5	39	9	0.15	0.00
Planet (67)	6	21	3	0.08	-0.11
Velocity (68)	8	26	0	0.15	-0.05
Spoon (69)	5	6	5	0.03	-0.03

Garage (70)	6	21	0	0.08	-0.18
Harp (71)	4	1	10	0.08	-0.08
Boots (72)	5	20	18	0.15	-0.15
Latin (73)	5	500	3	0.08	-0.05
Red (74)	3	197	13	0.42	0.11
Cricket (75)	7	3	2	0.18	0.03
Axis (76)	4	38	2	0.30	-0.10
Pollen (77)	6	11	1	0.20	-0.10
Dictionary (78)	10	0	0	0.11	-0.13
Tea (79)	3	28	8	1.03	0.11
Lawn (80)	4	15	7	0.15	-0.05

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*Note.* The number in parenthesis ( ) indicates the sentence number to which the word corresponds (see Appendix A). The mean number of letters was 6.06 letters and the median 6.00 letters; the mean frequency was 46.0 and the median 15.50; the neighborhood size (N) mean was 3.55 and the median 2.00; the strength rating mean was 0.22 and the median 0.15; and the affect rating was -0.07 and the median -0.08.

Table C5

*Nonword Target Frequency Data.*

Nonword	Letters	N	Nonword	Letters	N
Dap (1)	3	18	Blothing (22)	8	2
Crof (2)	4	2	Porps (23)	5	5
Stibes (3)	6	2	Skirks (24)	6	5
Glounced (4)	8	1	Prouched (25)	8	2
Swarched (5)	8	2	Pligue (26)	6	1
Splants (6)	7	1	Bruned (27)	6	2
Cloams (7)	6	1	Brooched (28)	8	2
Stroul (8)	6	1	Strulled (29)	8	1
Shamped (9)	7	3	Teef (30)	4	6
Jinched (10)	7	3	Huck (31)	4	13
Strupe (11)	6	1	Flarm (32)	5	2
Vauge (12)	5	1	Spurse (33)	6	2
Keized (13)	6	1	Slont (34)	5	1
Cleaked (14)	7	6	Tods (35)	4	17
Loy (15)	3	16	Cruft (36)	5	4
Wark (16)	4	17	Wrencked (37)	8	1
Blorm (17)	5	1	Gleaved (38)	7	3
Chond (18)	5	1	Cleading (39)	8	4
Clett (19)	5	2	Steeked (40)	7	4
Spaig (20)	5	2	Cressing (41)	8	5
Carticle (21)	8	2	Shends (42)	6	1

Phirk (43)	5	1	Distless (67)	8	4
Lod (44)	3	19	Blashing (68)	8	6
Carmless (45)	8	2	Froned (79)	6	2
Joap (46)	4	1	Draping (70)	8	6
Swulled (47)	7	3	Sloons (71)	6	3
Wault (48)	5	4	Douthful (72)	8	2
Loode (49)	5	1	Stulp (73)	5	2
Contrant (50)	8	2	Cose (74)	4	18
Spram (51)	5	4	Hend (75)	4	16
Crog (52)	4	6	Grashed (76)	7	5
Bloothing (53)	9	0	Wesk (77)	4	4
Bame (54)	4	17	Snilled (78)	7	5
Brabes (55)	6	6	Murched (79)	7	4
Swalged (56)	7	1	Stused (80)	6	1
Mauged (57)	6	3	Creened (81)	7	1
Speem (58)	5	2	Besigned (82)	8	2
Slenged (59)	7	2	Knatch (83)	6	2
Screets (60)	7	3	Wheemed (84)	7	2
Rooth (61)	5	4	Flerce (85)	6	2
Wouged (62)	6	1	Flonds (86)	6	3
Mephed (63)	6	1	Banes (87)	5	17
Screbbed (64)	8	1	Straised (88)	8	1
Crawped (65)	7	3	Crey (89)	4	4
Blinched (66)	8	4	Casteful (90)	8	2



Tirt (91)	4	7	Jood (106)	4	6
Jerf (92)	4	3	Strinds (107)	7	2
Blorn (93)	5	1	Rimp (108)	4	11
Teene (94)	5	4	Sauk (109)	4	4
Kitched (95)	7	5	Clasked (110)	7	4
Maffed (96)	6	3	Dricked (111)	7	5
Blirt (97)	5	2	Scriped (112)	7	4
Chooce (98)	6	2	Gised (113)	5	3
Trand (99)	5	3	Steef (114)	5	4
Plood (100)	5	1	Dess (115)	4	10
Splots (101)	6	2	Antitude (116)	8	3
Tisc (102)	4	2	Strassed (117)	8	1
Trowned (103)	7	4	Spooved (118)	7	5
Firt (104)	4	8	Crouched (119)	8	1
Metched (105)	7	2	Screnned (120)	8	1

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*Note.* The number in parenthesis ( ) indicates the sentence number to which the word corresponds (see Appendix A). The mean number of letters was 6.03 letters and the median was 6.00 letters; the mean number of orthographic neighbors (N) was 4.04 and the median was 2.50.

Appendix D

Before participating in this study, all participants are asked to answer the questions below.

1. Have you been diagnosed with depression by a mental health professional?

Yes ☐ No ☐

2. Are you currently being treated for depression (e.g., are you taking medication or receiving psychotherapy)?

Yes ☐ No ☐

If you answered “Yes” to **either or both** of these questions, you will not be able to participate in this study. Please inform the researcher that you will not be able to participate. This document will be destroyed by the researcher.

If you answered “No” to **both** of these questions, please fill in the information below. This document will be stored in a secure location for one year, separate from all other data.

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Print Name

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Signature

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Date

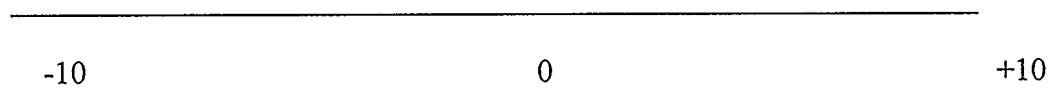
## Appendix E

Please indicate your current mood by writing a number anywhere across the line below.

You can use decimals if you wish. Negative ten (-10) indicates a very negative mood

(e.g., very sad), and positive ten (+10) indicates a very positive mood (e.g., very happy).

The zero (0) indicates a neutral mood (neither happy nor sad).



## Appendix F

In the space provided, please write a brief paragraph describing the person's funeral, including the music, the ambience, and your feelings about the event.

[illegible]

## Appendix G

Having participated in a negative mood induction procedure, we believe it is important for you to participate in a positive mood induction procedure. We do not want you to leave the study in a mood more negative than the one, which you entered. While listening to the music, please imagine you won 10 million dollars in a lottery. Tell us what you would do with the money and what changes would occur in your life. Write a short paragraph about this event.

[illegible]

## Appendix H

Table H1

*Experiment 1A: Mean Response Latencies, Error Rates, and Semantic Priming Effects for the Positively-related, Negatively-related, Neutrally-related, and Unrelated Condition at the 0 ms and 1000 ms Interstimulus Interval (ISI,) for all 120 Participants.*

Relatedness	Response latency (ms)		Semantic priming effect (ms)	
	0 ms ISI	1000 ms ISI	0 ms ISI	1000 ms ISI
Positive	612 (97; 1.0)	570 (85; 1.2)	53	40
Negative	616 (88; 1.0)	570 (80; 0.8)	49	40
Neutral	609 (85; 1.5)	558 (82; 0.9)	56	52
Unrelated	665 (94; 6.5)	610 (90; 6.7)		

*Note.* Standard deviations and percentage errors in parenthesis (*SD*; %). The mean response latency for the nonwords was 722 ms (*SD* = 93) when the ISI was 0 ms and 682 ms (*SD* = 91) when the ISI was 1000 ms; the mean error rates were 4.6% and 4.5% respectively.

Table H2

*Experiment 1B: Mean Response Latencies, Error Rates, and Semantic Priming Effects for the Positively-related, Negatively-related, Neutrally-related, and Unrelated Condition at the 0 ms and 2000 ms Interstimulus Interval (ISI,) for all 140 Participants.*

Relatedness	Response latency (ms)		Semantic priming effect (ms)	
	0 ms ISI	2000 ms ISI	0 ms ISI	2000 ms ISI
Positive	644 (104; 1.2)	596 (83; 1.2)	57	52
Negative	645 (102; 1.4)	600 (89; 1.0)	56	48
Neutral	631 (96; 1.6)	594 (88; 0.5)	70	54
Unrelated	701 (104; 6.0)	648 (99; 4.8)		

*Note.* Standard deviations and percentage errors in parenthesis (*SD*; %). The mean response latency for the nonwords was 756 ms (*SD* = 88) when the ISI was 0 ms and 718 ms (*SD* = 99) when the ISI was 2000 ms; the mean error rates were 4.8% and 4.8% respectively.

Table H3

*Experiment 2: Mean Response Latencies, Error Rates, and Semantic Priming Effects for the Positively-related, Negatively-related, Neutrally-related, and Unrelated Condition at the 0 ms and 1000 ms Interstimulus Interval (ISI), for all 155 Mood Induced Participants.*

Relatedness	Response latency (ms)		Semantic priming effect (ms)	
	0 ms ISI	1000 ms ISI	0 ms ISI	1000 ms ISI
Positive	632 (101; 2.1)	576 (79; 0.9)	48	46
Negative	632 (96; 1.0)	576 (77; 1.0)	48	46
Neutral	618 (90; 1.9)	573 (82; 1.5)	62	49
Unrelated	680 (95; 6.6)	622 (83; 5.2)		

*Note.* Standard deviations and percentage errors in parenthesis (*SD*; %). The mean response latency for the nonwords was 730 ms (*SD* = 88) when the ISI was 0 ms and 690 ms (*SD* = 88) when the ISI was 1000 ms; the mean error rates were 5.0% and 4.8% respectively.



Table H4

*Experiment 2: Mean Response Latencies, Error Rates, and Semantic Priming Effects for the Positively-related, Negatively-related, Neutrally-related, and Unrelated Condition at the 0 ms and 1000 ms Interstimulus Interval (ISI), for the 24 Participants.*

Relatedness	Response latency (ms)		Semantic priming effect (ms)	
	0 ms ISI	1000 ms ISI	0 ms ISI	1000 ms ISI
Positive	631 (102; 0.4)	558 (68; 0.4)	45	52
Negative	634 (87; 0.8)	574 (72; 0.4)	42	36
Neutral	601 (95; 1.2)	558 (71; 0.4)	75	52
Unrelated	676 (87, 6.6)	610 (73; 5.4)		

*Note.* Standard deviations and percentage errors in parenthesis (*SD*; %). The mean response latency for the nonwords was 731 ms (*SD* = 83.7) when the ISI was 0 ms and 682 ms (*SD* = 78.3) when the ISI was 1000 ms; the mean error rates were 4.1% and 4.0% respectively.

Appendix I

*Ethics Approval for Experiment 1*

**University of Calgary  
Department of Psychology Research Ethics Board**

Dr. G. Badner  
Dr. M. Bayes (Chair)  
Dr. G. Fauts  
Dr. D. Hadgins  
Dr. S. Graham  
Dr. J. Ellard  
Dr. P. Pexman  
Dr. K. van Ransan



Suzie Bisson

October 23, 2002

Dear Suzie:

I'm happy to inform you that the Psychology Department Ethics Review Committee (Human Participants) has given clearance to your project **mood and the interpretation of ambiguity**. Please consider this letter official notification of the Committee's decision. I enclose signed copies of your proposal that you should retain for the duration of your project.

Both myself and the Committee members who reviewed your proposal wish you all the best with this project. **Please be sure to inform either myself or Alison Wiigs when you have completed your project.**

If you have any comments or concerns about the review process, do not hesitate to contact me (220- 7724; email: boyes@ucalgary .ca).

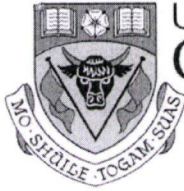
Sincerely,

A handwritten signature in black ink, appearing to be 'M. Boyes', written over a horizontal line.

M. Boyes: Chair

The "Psychology Department Ethics Page" can be seen at  
<http://www.psych.ucalgary.ca/Research/Ethics>

*Ethics Approval for Experiment 2*



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**CERTIFICATION OF INSTITUTIONAL ETHICS REVIEW**

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This is to certify that the Conjoint Faculties Research Ethics Board at the University of Calgary has examined the following research proposal and found the proposed research involving human subjects to be in accordance with University of Calgary Guidelines and the Tri-Council Policy Statement on *"Ethical Conduct in Research Using Human Subjects"*. This form and accompanying letter constitute the Certification of Institutional Ethics Review.

File no: CE101-3825  
Applicant(s): Suzie Bisson  
Department: Applied Psychology, Division of  
Project Title: Mood and the Interpretation of Ambiguity  
Sponsor (if applicable): NSERC

**Restrictions:**

**This Certification is subject to the following conditions:**

1. Approval is granted only for the project and purposes described in the application.
2. Any modifications to the authorized protocol must be submitted to the Chair, Conjoint Faculties Research Ethics Board for approval.
3. A progress report must be submitted 12 months from the date of this Certification, and should provide the expected completion date for the project.
4. Written notification must be sent to the Board when the project is complete or terminated.

  
Janice Dickin, Ph.D, LLB,  
Chair  
Conjoint Faculties Research Ethics Board

March 11, 2004  
Date:

**Distribution:** (1) Applicant, (2) Supervisor (if applicable), (3) Chair, Department/Faculty Research Ethics Committee, (4) Sponsor, (5) Conjoint Faculties Research Ethics Board (6) Research Services.



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MEMO

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CONJOINT FACULTIES RESEARCH ETHICS BOARD

c/o Research Services  
Telephone: (403) 220-3782  
Fax: (403) 289-0693  
Email: plevans@ucalgary.ca

To: Ms. Suzie Bission  
Department of Applied Psychology

Date: May 26, 2004

Dr. Janice P. Dickin, Chair  
Conjoint Faculties Research Ethics Board (CFREB)

**Ethics Proposal Modification: Mood and the Interpretation of Ambiguity**  
**File No. CE101-3825**

The Certificate of Ethical Approval issued on March 11, 2004 continues in force and extends to the modifications as set out in your request for approval dated May 12, 2004. Your request to modify your mood induction procedure as described is approved. You should attach a copy of the documentation you provided in order to request this amendment, together with a copy of this memorandum, to the original Ethics Certification in your files.

Sincerely,

Janice Dickin, Ph.D., LL.B., Professor  
Faculty of Communication and Culture and  
Chair, Conjoint Faculties Research Ethics Committee

Cc: Chair, Department/Faculty Ethics Subcommittee  
Dr. C. Sears, Supervisor