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Semantic Category Effect and Emotional Valence in Female University Students

by

Ruby Geraldine Brousseau

A Thesis

**Submitted to the Faculty of Graduate Studies and Research
through the Department of Psychology
in Partial Fulfillment of the Requirements for
the degree of Master of Arts at the
University of Windsor**

Windsor, Ontario, Canada

2002

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Abstract

The semantic category effect is a phenomenon of semantic memory revealing a category dissociation of biological and nonbiological objects on picture naming and other tasks of semantic memory. In patients with Alzheimer's Disease, category dissociation typically reflects a nonbiological advantage in that these patients are more proficient at naming artifacts over biological stimuli. In contrast, younger, healthy individuals appear to show the opposite pattern of performance in that they are generally more adept at naming biological items. Several diverse theories have been posited to explicate the possible basis of this phenomenon. A new hypothesis presented in this study proposed that the emotional content associated with various stimuli is mediated by the amygdala to influence semantic memory performance. The purpose of this study was to further investigate the semantic category effect in young, healthy participants, and concurrently, to explore the possible connection between emotion and semantic memory. Using a speeded picture naming task, vocal reaction times and emotional valence ratings for 45 items divided into four categories based on emotional valence rating (i.e., high and low) and semantic category (i.e., biological and nonbiological) were examined in thirty-six female university students. Analyses of the data indicated an "animate/inanimate" category dissociation favouring animate objects, in tandem with an intricate relationship between emotional valence and semantic memory performance. Notwithstanding the limitations of this study, the results provide evidence of a link between the subjective emotional content of objects and semantic memory for those objects. Implications of the findings and approaches for future research are also discussed.

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Chapter I

Introduction

Models of semantic memory incorporate a structured body of knowledge including the meaning and associations of words, as well as the rules for manipulating these concepts (Nebes, 1989; Graham, Becker & Hodges, 1997). Semantic memory is evaluated through tests of vocabulary, word association, category membership and concept properties (Nebes, 1989). Although many older people report frequent lapses in recalling a word that was on the “tip of the tongue” (Perlmutter & Hall, 1992), memory disturbance in the normal elderly population, in contrast to those suffering from Alzheimer’s Disease (AD), worsens very little over a period of many years and does not interfere significantly with work performance or activities of daily living (Victor & Ropper, 2001). Actual impairment of semantic memory, however, is a common feature of AD: Anomia (i.e., word finding difficulty) and difficulties in object naming tasks are widespread problems in the early stages, and are symptomatic of semantic memory disorder (Montanes, Goldblum & Boller, 1995; Hodges & Patterson, 1995; Salmon, Heindel & Lange, 1999). The general course of AD is characterized by a progressive semantic memory impairment (Chertkow & Bub, 1990; Garrard et al., 2001).

Interestingly, it is a well-documented finding that investigations of semantic memory impairment generally demonstrate a category dissociation that reflects an advantage for nonbiological items on simple picture naming trials (Laws, 2000). Specifically, AD patients are more accurate naming nonbiological items such as tools and clothing over biological items such as animals and fruits (Whatmough et al., in press). This dissociation has also been reported in healthy young participants who are slower and less accurate with respect to biological items on speeded picture naming trials and other tasks (Vitkovitch, Humphreys, &

Lloyd-Jones, 1993; Gerlach, Law, Gade and Paulson, 2000). However, several recent studies using undergraduate students have demonstrated the reverse pattern; a biological advantage as reflected by faster and more accurate responses for natural items over artifacts (Laws & Neve, 1999; Laws 2000; Laws, Leeson & Gale, 2002). A biological disadvantage is more consistently reported in AD patients than in the normal population, and may be a hallmark of semantic memory impairment. Various theories have been posited to explain the possible basis of the semantic category effect including cognitive models, neuroanatomical perspectives and artifactual differences in stimuli. Indeed, endeavors to account for category-specific deficits have attempted to relate these effects back to variables that may systematically differ between living and nonliving things (Laws, Leeson, & Gale, 2002). For instance, living items are judged to be lower in familiarity (i.e., subjective rating of how well represented an item is in an individual's particular experience), have lower word frequency (i.e., the number of times a word occurs in print), and show greater visual complexity (i.e., number of lines in a drawing) in comparison to nonliving items. The purpose of this study was to further investigate the semantic category effect in healthy young participants, and to advance an alternative neuroanatomical framework that may help to account for some of the discrepancies currently found in the literature.

Possible Influencing Variables on Picture Naming Tasks

It is not yet established whether category-specific advantages in neuropathological patients and normal participants are a function of methodological artifacts or processing differences. Resolution for this matter has been sought through experiments that attempt to match stimuli across categories on a number of variables including word frequency, familiarity and visual complexity (McKenna & Parry, 1994), to name just a few. The

following section will describe those studies that examine the variables that may influence picture naming tasks.

Snodgrass and Yuditsky (1996) investigated the effect of several independent variables on a speeded picture naming task using both voice key and key press responses. Undergraduate students named 250 black and white line drawings of animate and inanimate objects from the Snodgrass and Vanderwart (1980) stimulus set. Vocal responses were recorded in one experiment whereas key press responses were recorded in another. Vocal reaction time (RT) was a more sensitive and valid indicator of picture naming difficulty than key press latencies. There was no effect of name length (i.e., number of letters, syllables and phonemes) or name dominance (e.g., sofa versus couch), and only a small effect of word frequency. However, name agreement (i.e., the number of different names an object can have such as a sofa, couch or chesterfield) was an important predictor of naming time (i.e., the fewer names an object possessed predicted shorter voice response latencies) as was age of acquisition (i.e., the age at which the name of the object was most likely to be first learned such as elephant versus barometer), with earlier acquisition predicting quicker response time.

In another speeded naming test, Vitkovitch and Humphreys (1991) asked undergraduates to name forty pictures (Snodgrass & Vanderwart, 1980) that were classified as having either high word frequency or low word frequency names. The images were controlled for familiarity, image agreement (i.e., the degree to which the image of the object generated to the object's name resembled the drawn object) and visual complexity, and were presented to each participant using a response deadline of 600 milliseconds. A greater number of errors was made in response to images with low relative to high frequency names, indicating that word frequency was an important variable in speeded picture naming tasks.

Using a masking paradigm (i.e., pictures were “peppered” with pixels that covered 10% and 20% of each picture thereby reducing transparency of the image) to study the effects of a number of variables thought to impinge upon picture naming, Laws, Leeson and Gales (2002) presented 120 stimuli (Snodgrass & Vanderwart, 1980) reflecting a wide range of values for age of acquisition, Euclidean Overlap (i.e., a measure of pixel by pixel visual overlap), familiarity, word frequency, and visual complexity to participants on a computer screen. The items were divided into three blocks each containing all three variants of the same item (i.e., clear picture, 10% masking and 20% masking) and vocal RTs were recorded. Simultaneous regression analyses revealed that under all three conditions, only age of acquisition and Euclidean Overlap consistently predicted naming latencies. Accordingly, the age that a word was initially learned and the perceptual quality of a picture were important variables to picture naming.

In a further examination of the interplay between age of acquisition and word frequency, Barry, Hirsh, Johnston and Williams (2001) used 48 pictures from Snodgrass and Vanderwart that were controlled for word frequency, but divided into “words acquired early” and “words acquired late” categories. In part two of their study, pictures were divided into high and low frequency words and matched for age of acquisition. Drawings were presented on a computer screen and participants were requested to say the names as distinctly and accurately as possible. Results from voice key response latencies revealed an effect of age of acquisition, with faster RTs for earlier age of acquisition. However, when pictures were matched for age of acquisition, there was no effect of frequency.

The above studies were conducted on English speaking participants, but the effects reported are not specific to that language. Kremin, Hamerel, Dordain, De Wilde and Perrier

(2000) investigated the effect of five variables (word frequency, age of acquisition, word length, name agreement and visual complexity) in French picture naming using keypress latencies. The study used 140 black and white drawings from a European database (Kremin et al., 1994) and participants named the pictures as rapidly as possible. A multiple regression analysis of the data showed that only two of the five variables, age of acquisition and name agreement, made independent contributions to mean response latencies, and these variables accounted for 32% of the variance.

A German study by Pechmann, Reetz and Zerbst (1989) reported that first phoneme may present a frication confound in speeded picture naming tasks in that consonants and vowels might activate computer voice-key measurements differentially (e.g., the sound made by a consonant such as “t” in the word “telephone” could activate the voice-key quicker than the sound made by a vowel such as “a” as in the word “apple”). Results showed that these measurements were sometimes unreliable and could lead to significant errors in latency recordings. However, a more recent Italian investigation by Bates, Burani, D’Amico and Barca (2001) examined naming latencies for both word reading and picture naming for 128 items taken from various sources. In both tasks, items were presented by computer and vocal RTs were recorded. Only the word reading task was appreciably affected by initial phoneme, whereas picture naming was strongly affected by familiarity and age of acquisition. Consequently, this study may suggest that first phoneme might not be as significant in voice-key measurements in picture naming tasks as in word reading tasks.

The foregoing investigations focused on the performance of healthy young participants to evaluate the impact of variables thought to play a role in picture naming. The effects of these variables have also been examined in various patient populations. For

example, Kremin et al. (2001) investigated factors predicting success in picture naming in AD and Primary Progressive Aphasia. Both groups of patients were presented with 100 black and white drawings selected from a European database (Kremin et al., 1994). Multiple regression analysis indicated that the majority of patients from both groups exhibited a significant effect of age of acquisition and name agreement, whereas other variables including familiarity, frequency and visual complexity, were less consequential.

A case study (Funnell and Sheridan, 1992) of a young woman diagnosed with semantic memory impairment following traumatic brain injury pitted semantic category against familiarity in a picture naming task. Twenty-four pictures (12 living and 12 nonliving) matched for word frequency, visual complexity and name agreement from the Snodgrass and Vanderwart corpus were subdivided into high and low levels of familiarity and randomly presented to the patient. Naming responses did not differ significantly across the two categories (i.e., living and nonliving), and varied only with the degree of familiarity, prompting the authors to reject the view that semantic memory was organized into dissociable categories of living and nonliving things. The authors suggested that category dissociation reflecting a biological deficit occurs because most objects classified as living things are poorly represented by properties such as familiarity, which may serve to facilitate object identification and naming. However, it is important to note that results from a single case study of post traumatic brain injury, a neuropathology with variable outcomes, may be insufficient to make broad generalizations regarding the basis of the semantic category effect.

Perceptual, lexical and semantic factors influencing picture naming in mild to moderate aphasia were considered in a study by Laiacona, Luzzatti, Zonca, Guarnaschelli and Capitani (2000). Results demonstrated that, overall, name agreement was the best predictor of

correct responses, followed by word frequency, image agreement, familiarity, prototypicality (i.e., degree of representativeness of the object) and visual complexity. These findings were not homogeneous in single case analyses, however, with individual patients being differentially sensitive to variables in that the effects of certain variables were present in some, but not all patients. Moreover, participants in this study varied with respect to age (between 17 and 65 years), gender and degree of severity of aphasia.

On a simple picture naming task (Montanes, Goldblum & Boller, 1995), 25 AD patients and 25 normal elderly controls named black and white line drawings that varied with respect to visual complexity, word frequency and semantic category. These variables all played an important role in the naming ability of only AD patients. However, in the second part of their study, the same participants were presented with coloured pictures matched for word frequency. The findings from part two of this investigation, contrary to results from the first experiment, showed no effect of semantic category indicating that the perceptual quality of colour was a significant feature in picture naming. The authors concluded that factors such as visual complexity, word frequency and colour might be highly salient artifacts in studies that show a semantic category effect.

As indicated by the aforementioned studies, many factors appear to contribute to latency and accuracy in picture naming tasks including age of acquisition, name agreement, word frequency and familiarity. Nevertheless, none of these effects are consistently reported. For example, although age of acquisition is strongly implicated in picture naming performance, Berman, Friedman, Hamberger and Snodgrass (1989) stated that children (mean age 8.7 years) and adults demonstrated significant agreement on the names of pictures. Moreover, this naming ability was based primarily on information gained prior to 7 years of

age. Furthermore, as will be illustrated in subsequent sections, the research has been largely inconsistent in controlling for variables (e.g., word frequency, familiarity and visual complexity are most commonly used), and often disregards possible influencing factors such as age of acquisition. That said, however, with increasingly arcane and controversial variables being added to the mix, it may become extremely difficult, if not virtually impossible, to match items on all variables (McKenna & Parry, 1994). Despite this difficulty, investigations of the semantic category effect in picture naming in both healthy participants and AD patients may provide a privileged window into the cognitive progression of AD. The following sections will describe these investigations.

The Semantic Category Effect in AD

Although not consistently reported, it will be demonstrated that most studies examining error rates in simple picture naming paradigms have found a category-specific effect to be in the direction of poorer accuracy on items from a biological category (Whatmough et al., in press). Silveri, Daniele, Giustolisi and Gainotti (1991) investigated a possible dissociation of knowledge between living and nonliving things in AD patients. Fifteen AD patients were diagnosed with mild to moderate semantic-lexical disorders and matched by age and education to a group of 10 normal controls. Twenty coloured pictures of living things (i.e., flowers, fruits and animals) and 20 coloured pictures of nonliving things (i.e., toys, furniture, clothing, vehicles and kitchen items) matched for word frequency and prototypicality were presented to participants. An analysis of the data indicated that the AD group performed significantly worse on living items as compared to nonliving items, but no significant difference was found in the control group. The authors concluded that a category-specific semantic impairment for living items was present in the early stages of AD. They

suggested that the temporolimbic structures, which are severely affected in this disorder, might be critically involved in the recognition of living things.

Fung et al. (2001) studied 20 mildly to moderately impaired AD patients, and 60 elderly control participants (assessed as being clinically normal without memory complaints) from the same local community. A total of 350 black and white line drawings (independently created or extracted from the Snodgrass and Vanderwart stimulus set, the Boston Naming Test and the Psycholinguistic Assessment of Language Test) matched for visual complexity and familiarity (as rated by participants) as well as word frequency were presented to individuals. Results showed a disproportionate naming deficit for biological objects relative to their own naming deficit in the AD group only. The authors concluded that this finding provided strong evidence for a semantic memory impairment preferentially affecting biological items to a greater extent than nonbiological items in patients with AD.

Comparing AD patients to individuals with Parkinson's Disease and normal controls, Daum, Riesch, Sartori and Birbaumer (1996) investigated semantic memory impairment in AD. In a simple picture naming task, line drawings of common animate and inanimate objects matched for visual complexity, word frequency and familiarity were presented to participants. The results of this study revealed that AD patients were significantly more adept at naming inanimate items in comparison to animate items. There was no evidence of a semantic category effect in either of the other groups.

Using a unique and more complex test of semantic association judgement, Fung, Chertkow and Templeman (2000) examined 9 AD patients and 11 normal participants matched for age, gender and education. Participants were requested to decide which of two given words was most like a target word (e.g., lamb: goat, sheep). A total of 150 common

target words matched for frequency, word length and regularity from 6 semantic categories consisting of biological and nonbiological objects (i.e., animals, clothing, furniture, fruits, vegetables, and tools) were presented. Results revealed that AD patients were less accurate in the categories of animals, fruits and vegetables relative to the control participants, but were as accurate as controls in the nonbiological categories. The authors concluded that the study demonstrated a category-specific semantic memory deficit in AD patients with selective impairment of biological nouns.

The study by Montanes, Goldblum and Boller (1995) examined 25 patients diagnosed with moderate AD, and 25 normal elderly participants matched for age and cultural level (not defined). Forty-eight black and white line drawings were selected from the Snodgrass and Vanderwart corpus consisting of 24 pictures of items in the biological category (i.e., animals) and 24 pictures of objects in the nonbiological category (i.e., nonliving objects). Within each category, the pictures were further subdivided into those high in visual complexity and those low in visual complexity. The results indicated that a clear effect of semantic category emerged in the AD patients as demonstrated by poorer performance on the biological category as compared to non-living objects in both the high and low visual complexity subcategories. In contrast, there was a biological/nonbiological difference (poorer performance for living objects) only in the subcategory of high visual complexity for the control group. Interestingly, in the second part of this study using 44 coloured pictures of living and nonliving items (matched for word length) and subdivided into high and low frequency categories, only an effect for word frequency was found in the AD group, and there was no effect of category for either group.

An investigation by Gonnerman, Andersen, Devlin, Kempler and Seidenberg (1997) showed a double dissociation of semantic categories in AD based on the progression of the disease. Fifteen patients diagnosed with mild to moderate AD were requested to name 36 black and white line drawings matched for word frequency in six categories: animals, fruits and vegetables, furniture, vehicles, clothing and tools. Results from individual participants showed that three of the five highest functioning participants had more difficulty with artifacts than biological items, and the other two participants performed equally well in both categories. The 10 remaining participants who were diagnosed as being more impaired performed worse on biological items relative to artifacts. The authors concluded that the pattern presented in this study showed that semantic category effects of either biological or artifact deficits might reflect different points in a single progression of impairment.

A longitudinal study by Garrard et al. (2001) examined profiles of semantic impairment for living and nonliving concepts in 58 AD patients and 46 controls matched for age and education. Each participant was required to name line drawings of biological and nonbiological items (matched for prototypicality and word frequency) from the Snodgrass and Vanderwart corpus. An analysis of the overall findings showed that the representations of living concepts deteriorated at a consistently and significantly faster rate than those of nonliving concepts over the course of the disease. Interestingly, in contrast to the Gonnerman et al. (1997) study, there was no evidence of a crossover effect with respect to advantage of one domain (i.e., biological and nonbiological) over the other as a function of disease severity.

Whatmough et al. (in press) conducted picture naming trials on 56 patients with probable AD, as well as 16 individuals diagnosed as being mildly cognitively impaired

(known to be high risk of AD progression), 15 participants who had been diagnosed with other forms of dementia (i.e., Lewy Body, hydrocephalus, etc.) and a control group of 40 elderly participants. AD patients were stratified by overall naming impairment rather than the more commonly used criteria of dementia severity due to the fact that the rate of semantic loss is variable across patients deemed to be at equivalent levels of disease progression. Fifty-six black and white pictures (equal numbers of animals, fruits or vegetables, tools, and clothing or furniture) from the Categorical Picture Naming Task matched for accuracy and familiarity (based on norms collected from elderly normal individuals) were presented. Results showed an increasing category effect with progressing anomia, and a distinct nonbiological advantage for the AD and mildly cognitively impaired groups. No category effect was found in the control group, and findings in the group classified as having another type of dementia were mixed. The authors concluded that a category effect favouring nonbiological items produced a predictable pattern across progressive levels of semantic impairment.

Garrard, Patterson, Watson and Hodges (1998) explored functional-anatomical correlations of category specific semantic loss in AD patients. Fifty-eight patients diagnosed with AD were matched to normal control participants on the basis of age and education level. Participants were tested on category fluency, picture naming using 48 items matched for prototypicality and frequency from the Snodgrass and Vanderwart corpus, and a naming in response to verbal description test. Consistent with the findings in the Gonnerman et al. (1997) study, overall results showed that, in the majority of AD cases, the advantage was for artifacts, but in a small number of patients, there was an advantage for biological objects resulting from selective brain damage to either the temporal or frontoparietal brain regions respectively. Furthermore, corresponding to findings in the Whatmough et al. (in press)

investigation, this study also demonstrated a correlation between the degree of anomia and the strength of the nonbiological advantage. The authors reported that a disadvantage for biological items increased with the severity of anomia.

While most investigations of semantic memory in AD indicate a category effect, other studies have reported contradictory results. Tippett, Grossman and Farah (1996) examined category specific effects in AD patients to address the question of selective impairment for knowledge of living things. Fourteen participants diagnosed with AD were administered pictures from the Silveri et al. (1991) study. Initial results reflected a semantic category dissociation as reported by Silveri et al. (i.e., AD participants were significantly less accurate naming living items than naming nonliving items). In the second part of their investigation using different sets of stimuli better matched for familiarity, participants showed equivalent performance in naming living and nonliving items. The authors concluded that AD did not generally cause a selective impairment in knowledge of living things, and suggested that the results from previous studies were probably an artifact of imperfectly matched stimulus sets. However, presentation of the stimulus sets in this study was separated only by a brief unrelated task, and the influence of practice effects was not considered.

Grossman, Robinson, Biassou, White-Devine and D'Esposito (1998) compared 10 AD patients with semantic memory difficulties in addition to 6 AD patients with relatively preserved semantic memory to 14 healthy participants matched for age and education. Patients were presented 72 coloured photographs from natural and artifactual categories (i.e., fruits and vegetables and tools and furniture respectively) matched for word frequency and representativeness. The study failed to demonstrate a category effect in either of the AD subgroups or the control group.

In an investigation of the possible effects of gender on category dissociation in Italian AD patients (Laiacina, Barbarotto and Capitani, 1998), 11 males and 15 females and were requested to name black and white drawings adapted from the Snodgrass and Vanderwart series. Analysis of the raw data demonstrated better performance on nonliving items; however, the authors reported that when concomitant variables such as word frequency, prototypicality, visual complexity and name and image agreement were taken into account, the category effect disappeared. Nevertheless, single case analyses showed a true dissociation, with more participants displaying a nonliving item advantage. Interestingly, a closer inspection of the data revealed that a distinct cluster of males performed better with nonbiological stimuli. This finding may have been a function of the items selected in the nonbiological category which included mainly tools and vehicles, and were, in effect, possibly more well-known to males in this cohort.

Although there is some evidence to refute the findings of a semantic category effect in AD, most studies, even when using diverse approaches, demonstrate that these patients predominantly show a nonbiological advantage on picture naming and other tests of semantic memory, whereas the performance of normal elderly individuals appears to be equivalent.

The Semantic Category Effect in a Healthy, Younger Population

Surprisingly, there are relatively few studies that test the semantic category effect in healthy, younger participants, perhaps because it is assumed that this phenomenon occurs only in association with some neuropathology. Another explanation proposes that the biological deficit in picture naming in AD patients reflects an exaggeration of the normal tendency due to artifactual features such as familiarity or visual complexity. For example, if biological items are less familiar and more visually complex, more difficulty should be

experienced in this category in normal participants (Laws, 2000). Although a review of the literature demonstrates a category-specific effect in this population, the findings are somewhat mixed as to direction, with earlier studies reflecting the nonbiological advantage that is typically found in impaired populations, and more recent studies showing the reverse pattern. However, in contrast to studies on AD patients, the preponderance of evidence in this area reports a biological advantage. The next section will review the literature with respect to category specificity in younger, healthy participants.

Vitkovitch, Humphreys and Lloyd-Jones (1993) tested 14 students from the University of London on 76 pictures (matched for word frequency) from the Snodgrass and Vanderwart norms in speeded picture naming trials. The pictures presented were defined as belonging to categories as being structurally similar (i.e., biological items such as animals, fruits and vegetables) or structurally dissimilar (i.e., nonbiological items such as tools, musical instruments, etc.) based on attributes and average level of overlap between outline contours of the pictures as defined by participants. To induce speeded responding, a buzzer deadline of 600 milliseconds was chosen and participants were instructed to beat the buzzer with speed emphasized over accuracy. Results indicated that more errors were made on the structurally similar items (biological) than the structurally dissimilar items (nonbiological), indicating a nonbiological advantage.

In a study by Gaffan and Heywood (1993), line drawings were presented to 5 observers (normal participants ages 23 to 45 years) who were requested to name items (living and nonliving) selected from the Snodgrass and Vanderwart corpus. The participants made more errors with living things than with nonliving things, and the authors reported greater accuracy in naming nonliving things when rapid presentation time was used. In a unique

investigation in the second part of their study, monkeys were trained to discriminate between pairs of pictures of living or nonliving things. Findings demonstrated that a longer time was needed for the animals to learn responses associated with living items. The authors interpreted this finding as strong evidence in support of the view that biological items were more difficult to discriminate visually, particularly in light of the fact that variables such as familiarity and frequency were improbable confounds when testing animals.

Using an atypical paradigm, a positron emission tomography (PET) study examined categorization and category effects in normal object recognition (Gerlach, Law, Gade and Paulson, 2000) using 15 healthy volunteers (ages 22 to 30 years) who were presented with pictures from the Snodgrass and Vanderwart norms matched for familiarity, image agreement and visual complexity. Results of the object decision task requiring participants to identify whether an object was real or not using a keypress response revealed an effect of category, with quicker responses to artifacts. Findings from the PET images revealed a greater activation of the left premotor cortex for nonbiological over biological items.

In contrast to the aforementioned studies, McKenna and Parry (1994) found that the mean number of misnamings per person was greater for nonbiological items, and a developmental category dissociation was found in children. In their two-part investigation, 400 adult participants (20 to 70 years of age), deemed to be representative of the normal population in terms of demographic features and performance on psychological tests, were presented with 120 coloured photographs of items from equally divided categories (i.e., animals, fruits and vegetables, and inanimate objects). An analysis of the data indicated that, although there was no overall significant difference between biological and nonbiological categories on mean naming accuracy, participants' naming errors were greater in the

nonbiological category. Additionally, a category by gender interaction was found, with men scoring highest in the animal category whereas women scored highest on fruits and vegetables. It is feasible that this phenomenon may support an evolutionary perspective (Gurian, Henley and Trueman, 2001) proposing that the brain evolved according to gender. The authors suggested that survival of the human species required divergent sex roles, with males responsible for hunting (i.e., animals) and females responsible for gathering fruits and vegetables. In the second part of the McKenna and Parry (1994) study, children between four and eleven years of age were presented with the same pictures used in the first part of the study. Results showed a developmental advantage in naming the animate categories, with greater naming accuracy for animals, fruits and vegetables with increasing age, commensurate with another evolutionary theory suggesting a domain-specific organization of semantic knowledge favouring animals, fruits and vegetables (Caramazza & Shelton, 1998).

Laws and Neve (1999) tested normal participants (mean age 23.4 years) on a speeded picture naming task. Sixty-two black and white line drawings taken from the Snodgrass and Vanderwart corpus were matched for visual complexity, familiarity and word frequency and randomly presented for 20 milliseconds followed by a blank white screen until a response was elicited. An analysis of the data measuring error rate revealed an effect of category, with participants making significantly more errors on nonliving in comparison to living items.

In another investigation, Laws (1999) tested undergraduate students on a speeded picture naming task. Sixty-four black and white line drawings (some overlap with the previous Laws & Neve, 1999, study) were taken from the Snodgrass and Vanderwart stimulus set consisting of 32 living and 32 nonliving items matched for visual complexity, word frequency, number of syllables and number of phonemes. Participants were requested to name

the pictures as quickly and accurately as possible, and number of errors and vocal RTs were recorded. The results reflected a significant main effect of category across participants for errors (greater number of errors in the nonliving category), and lower vocal RTs for biological objects. Interestingly however, the major finding demonstrated a strong gender by category interaction across both participant and item, with males demonstrating a better ability at naming nonbiological items, and females demonstrating a better ability at naming biological items concordant with the results of the Laiacona et al. (1998) study on AD patients.

Akin to the above studies, a speeded picture naming task (Laws, 2000) examining category specific naming errors in undergraduate students (ages 18 to 40 years) used black and white line drawings from the Snodgrass and Vanderwart corpus which included equal numbers of living and nonliving items (matched for familiarity, visual complexity and word frequency). The study confirmed that normal participants made more nonliving than living naming errors. Similarly, recent studies (Laws & Gale, 2002; Laws, Leeson & Gale, 2002) using undergraduates and variations of the speeded picture naming task also demonstrated a category-specific effect reflecting a biological advantage.

As previously mentioned, although the research has produced somewhat mixed findings in this area, the majority of studies, particularly more recent investigations, identify a biological advantage on picture naming in younger healthy participants. The following section will attempt to elucidate some of the theories of the semantic category effect.

Theories of the Semantic Category Effect

Despite the contradictory results, a variety of theories have been presented to explain category dissociation of semantic memory for living and nonliving items. In the PET study by Gerlach et al. (2000), the authors proposed that category effects in object recognition

suggested that the semantic and structural stages were dissociable, and, in contrast to natural objects, artifact categorization was based in part by action knowledge mediated by the left premotor cortex. They stipulated, however, that both artifacts and natural objects often caused activation of the same brain regions, and that processing of these categories was not totally segregated. More precisely, they suggested that the categories differed in their weight on different forms of knowledge in particular tasks. This conclusion echoes that of an earlier group of researchers who proposed, on the basis of their neuroanatomical findings, that semantic knowledge was segregated in specific brain regions with perceptual information of natural objects maintained by the temporal regions and functional knowledge of artifacts maintained by the frontoparietal lobes (Garrard et al., 1998).

The study by Gonnerman et al. (1997) purported that concepts were represented by a pattern of activation across a distribution of features of objects. For example, intercorrelated features were frequently activated together and so developed strong bonds among themselves (e.g., wings are frequently associated with flight and beaks). Conversely, distinguishing features were connected more to specific concepts, such as black stripes in the case of zebras, and these features were less affected by coactivation of other features. The critical difference between the two categories was that more intercorrelated features were represented to a greater extent in biological items. The authors speculated that, as the weight of loss accumulated, correlated activity would fail to support concepts and whole categories of biological items which were mutually dependent on each other, and consequently, as reflected in the literature, a greater impairment of semantic memory for natural objects would be evidenced in AD.

Results of the Tippet et al. (1996) study prompted the authors to postulate that category effects were a spurious outcome of artifactual features of the stimuli. Because their findings showed no naming differences between nonbiological and biological categories in pictures closely matched for familiarity, frequency and visual complexity, the authors claimed that the purported category effect was strictly a function of these variables.

Vitkovitch et al. (1993) supported the theory that, under speeded naming conditions, a wider range of within-category naming errors should be made to structurally similar category members (i.e., biological items) versus structurally dissimilar items (i.e., nonbiological). The authors proposed that objects from structurally similar categories activated a broader set of visually related neighbours from within their categories, and verbal production errors frequently reflected the names of other visually similar category member, (e.g., a lemon misnamed as a pear, etc.). Consequently, it was concluded that the normal pattern of category effects would reveal a nonbiological advantage. It is important to note, however, that studies reflecting a biological advantage serve to counter this argument, as well as arguments that maintain that the semantic category effect is a function of other artifactual variables such as familiarity, visual complexity and word frequency.

The hypothesis presented by Silveri et al. (1991) advanced the view that category-specific semantic impairment for living items in the early stages of AD might be related to temporolimbic structures that were critically involved in their recognition. They suggested that the amygdala and hippocampus played an important role in the identification, learning and assignment of biological significance to complex visual stimuli. Recently, an important theory on the link between the amygdala and learning has been advanced by Gurian, Henley and Trueman (2001), and will be discussed in some detail in the next section of this paper.

Taking a somewhat unique perspective, Caramazza and Shelton (1998) argued that animate and inanimate conceptual categories represented evolutionarily adapted domain-specific knowledge. They postulated that the domain-specific organization of semantic knowledge oriented semantic information in terms of evolutionary pressures, thereby establishing three domains: Animals, fruits and vegetables and artifacts. The authors proposed that the category of biological objects was further structured to distinguish potential food and predators (i.e., animals) from possible medicine and food (i.e., fruits, vegetables, plants). Consequently, because semantic memory for biological objects possibly reflected a greater degree of neuroanatomical localization, these items were more vulnerable to loss. Extrapolating from this account, Laws (2000) argued that the recognition of living things might be given some processing advantage in the normal brain.

Perhaps, the most widely recognized theory of category-specific effects of semantic memory was posited by Warrington and Shallice (1984). Derived from a study on patients recovering from herpes simplex encephalitis who demonstrated a biological disadvantage in semantic memory, the authors presented a sensory-functional theory that proposed segregated knowledge stores. In essence, Warrington and Shallice suggested that inanimate objects such as tools and utensils were predominantly defined by their functional significance, whereas living things such as animals and plants were primarily identified through their sensory (primarily visual) features. For example, cups are used for drinking which distinguishes them from other dishes. Fruits such as apples and bananas differ in their shape and colour, but their function (i.e., food) is the same.

As illustrated in this section, a number of diverse theories have been developed to account for the semantic category effect observed in studies on impaired and normal

populations. Before considering an alternative explanation of the possible basis for category-specific effects, a brief look at the limbic system, learning and memory as well as the pathology of the amygdala in AD is presented in the next sections to help expound on a new hypothesis presented in this thesis.

The Amygdala, Learning and Memory

The limbic system is a collection of nuclei and tracts that borders the thalamus with its key structures that include the amygdala, hippocampus, fornix and septum. Of particular interest in this study is the amygdala, which is thought to be associated with emotional reaction (Pinel, 1997). An effective and practical account by Gurian, Henley and Trueman (2001) depicts the interplay between the limbic system and the cortex in the learning process. They state that when a sensory stimulant is observed through any modality (e.g., visual, auditory), an individual experiences an emotive response to that stimulant through the limbic system, specifically the amygdala, which impacts on the learning process. For example, when a child is taught to solve a problem in mathematics, the neocortex may process the information, but an emotional response to that information will be interspersed via the limbic system, and will ultimately influence the child's capacity to learn. To illustrate, if a child believes that a mathematical problem is too difficult to comprehend, the limbic system may act in a detrimental way to slow down or shut off cognitive processing, thus thwarting the child's ability to learn. Conversely, when a child is learning to comprehend the nuances of a particularly interesting novel, the emotive reaction to the story may help to facilitate learning. In essence, the authors maintained that learning was not an isolated function of the cerebral cortex, but was, in fact, part of an integrated process in which cognition and emotion worked hand in hand.

In a similar way, the ability to recall events or objects may also be influenced by emotional content, and affect performance on memory tasks. For instance, material that is associated with high emotional content may be recognized and remembered more quickly than neutral or low emotive material. A study by Adolphs, Cahill, Schul and Babinsky (1997) examined declarative memory (i.e., memory for facts and events) for emotional material in two patients with bilateral amygdala damage, six normal control participants and six patients with brain damage with no amygdala involvement. All groups were requested to rate a series of slides on emotional valence and complete a memory questionnaire on the content of the slides 24 hours later. Although the amygdala-injured patients' ratings of emotional content were comparable to the other groups, the findings indicated that, while the control and brain-damaged groups demonstrated enhanced memory of the emotionally arousing stimuli, neither of the patients with amygdala injuries showed an effect of increased emotional valence on memory.

Mori et al. (1999) conducted a unique examination of the relationship between medial temporal damage and impaired memory of real-life emotional events in AD patients in Japan. AD patients who had experienced the 1995 Kobe earthquake were tested on their memories of events surrounding the earthquake through a semistructured interview, and amygdalar and hippocampal volumes were quantified. Results showed that emotional memory was correlated more with normalized amygdalar volume than with normalized hippocampal volume, but that general knowledge of the event showed no correlation with either of these structures. The authors concluded that this study provided important evidence of the amygdala's involvement of emotional memory in humans.

As demonstrated in this section, the amygdala appears to play a fundamental role in the acquisition and recall of emotional stimuli.

Amygdala Pathology in AD

Despite the fact that the neuropathology of AD generally reflects a heterogeneous pattern of brain deterioration, widespread atrophy is associated with cell loss in specific neuronal populations which includes the entorhinal cortex, the hippocampus, and the amygdala, all of which are structures involved in various aspects of memory (Whitehouse, Lerner & Hedera, 1993; Pinel, 1997; Victor & Ropper, 2001). Neuroimaging studies suggest that the hippocampus and entorhinal cortex are involved in the earliest stage of the disease, and that frontal, temporal and parietal association cortices become increasingly involved as the disease progresses (Salmon, Butters and Chan, 1999). Additionally, Damasio, Van Hoesen and Hyman (1990) maintained that many nuclei of the amygdala were seriously disrupted by neurofibrillary tangles, while other nuclei in this structure contained large amounts of neuritic plaques.

In a magnetic resonance imaging study (MRI), Heun et al. (1997) examined the involvement of the amygdala-hippocampal complex in 14 patients diagnosed with AD. An important finding showed that specific atrophy of both the temporal lobes and the amygdala-hippocampal complex was more pronounced than atrophy in other brain structures. The data also provided further evidence of the fact that hippocampal atrophy was directly related to memory impairment. The authors concluded that deterioration of the temporal lobe and the amygdala seemed highly linked in AD, and was correlated in both structures with memory dysfunction.

An MRI study by Callen, Gao, Caldwell and Szalai (2001) investigated volumetric changes in limbic structures in patients with mild to moderate AD and control participants matched for age, education and gender. Overall, limbic structures showed significant atrophy in AD patients, and a large percentage (21%) of volumetric loss was found in the amygdala. The authors also reported that by combining volumetric measures of amygdala and septal area, AD patients could be distinguished from controls with a 93% accuracy rate.

In effect, the literature shows that amygdalar damage is a common feature of AD.

Goals and Hypothesis of the Present Study

Several studies of the semantic category effect have been reviewed in this paper and various hypotheses have been presented to help explain this phenomenon. Although the majority of work with AD patients appears to show a category dissociation with a nonbiological advantage, some patients reflect the reverse pattern, demonstrating a biological advantage in single case analyses (Gonnerman et al., 1997; Garrard et al., 1998). In a similar vein, while the majority of findings show a biological advantage in studies on young, healthy participants, the results are mixed revealing both a biological and nonbiological advantage. Currently, the basis for this disparity has been explained primarily in terms of methodological differences in research and heterogeneous participants. Notwithstanding the possible validity of these issues, however, a different and more uniform approach to the problem may help to account for some of the inconsistencies. As previously stated, it is currently believed that the amygdala plays a specific role in memory for emotional significance. Based on the known pathology of AD at present, as well as reports of category-specific effects in AD patients and young, healthy individuals, a plausible alternative explanation for this category dissociation may reflect additional emotional content for biological over nonbiological items associated

with the amygdala. For example, with respect to younger participants who frequently demonstrate a biological advantage, the amygdala may have a specific function in mediating learning and recall of objects with high (e.g., biological objects) emotional content concordant with the theories of evolutionary predisposition for natural items as advanced by Caramazza and Shelton (1998) and extended by Laws (2000), as well as the learning theory presented by Gurian and colleagues (2001). With regard to AD patients who generally show the opposite pattern of performance (i.e., nonbiological advantage), varying degrees of damage to the amygdala, and therefore, possible loss of emotional content, may adversely affect semantic memory for biological items, and conceivably, reverse the more frequently evidenced biological advantage generally found in young healthy participants.

Goals

The aim of this study was to further examine the semantic category effect to ascertain the possible presence and direction of this phenomenon in a younger, healthy population. Concurrently, the effect of subjective emotional valence was investigated in order to explore the possible connection between emotion and its potential influence on semantic memory.

Research Hypothesis

The hypothesis of this study proposed a link between emotional valence and semantic memory. This study was designed to complete a number of research objectives regarding the semantic category effect which included (a) further investigation of semantic category dissociation (i.e., biological vs. nonbiological) in young, healthy participants, (b) exploring the previously unexamined possibility of emotional valence impact on category dissociation, and (c) examining the potential relationship between semantic memory performance for items and the subjective emotional content of those items. In support of these objectives, a paired t-

test and factorial and correlational analyses were employed to examine the following predictions: (a) faster vocal RTs for biological items over nonbiological items, (b) attenuation of the semantic category effect when items were better balanced for emotional valence (i.e., a comparison between the biological category assigned as being “high” in emotional content and the nonbiological category assigned as being “high” in emotional content as well as the biological category assigned as being “low” in emotional content compared to the nonbiological category assigned as being “low” in emotional content), and (c) a negative correlation between emotional valence ratings and vocal RTs (i.e., higher emotional content corresponding to shorter vocal RTs).

Chapter II

Method

Participants

Previous studies on the semantic category effect have found a gender by semantic category interaction (McKenna & Parry, 1994; Laws, 1999). Therefore, to control for the possibility of gender confounds, only female participants ($N = 36$) were used in this study. All participants were recruited from the University of Windsor's undergraduate voluntary participant pool. Ethics approval was granted by the University of Windsor Research Ethics Board (REB) and all regulations and procedures relating to consent and information were adhered to (see Appendices A and B).

Materials and Procedure

In the first part of this study testing semantic memory (i.e., speeded picture naming task), 80 black and white drawings of common biological and nonbiological objects were chosen from various internet sites (see Appendix C). These objects were then divided into four "item by emotional valence" categories (20 items per category) based on the "predicted" emotional content of categories as follows: Biological High Emotional valence (e.g., primarily animals such as a rabbit, lion, camel, etc.); Biological Low Emotional valence (e.g., primarily fruits and vegetables such as banana, corn, carrot, etc.); Nonbiological High Emotional valence (e.g., a variety of items thought to be associated with higher emotional content such as weapons, musical instruments, etc. examples are bomb, needle, piano) and; Nonbiological Low Emotional valence (e.g., various items believed to be low in emotional content such as tools, clothes, and utensils. Examples were saw, fork and tie). The rationale for designating the animal items as the high emotional valence biological category was based

on the premise that sentient objects would likely trigger greater emotional arousal as compared to plant life and food items. However, it should be noted that categories would be reassigned as necessary based on participant ratings as indicated in the second part of this procedure. Standardized stimulus sets (e.g., Snodgrass & Vanderwart) were not considered practical for use in this study because of the limitations on the emotional content of the types of items available (e.g., nonbiological items with high emotional valence such as guns and bombs), thereby compromising a primary objective of this study. That is, a requirement for drawings that reflected potentially high and low emotional content in two semantic categories precluded the use of standardized stimulus sets. All items were controlled, to the fullest extent possible, for word frequency and familiarity using the MRC Psycholinguistic Database. Previous studies have identified familiarity and word frequency as pertinent artifactual variables in picture naming, and research shows that these variables have been employed most frequently in picture naming paradigms (see Table 1). Subsequently, items were matched for either first phoneme or first letter across the four categories in an attempt to control for possible frication confounds. A 30 centimeter Apple Macintosh computer monitor presented images of each item against a white background using Psychlab software. Each drawing was sized to a relatively uniform horizontal and vertical measurement. Pictures were presented to participants in random order, and remained onscreen until the participant gave a verbal response. Vocal RTs were recorded by computer in milliseconds using a free-standing microphone. All participants received verbal and written instructions (see Appendix D) prior to the commencement of the task, and five practice sessions immediately preceded the trial to familiarize students with the procedure. The participants were then asked to name the pictures

as quickly and accurately as possible. An investigator remained with the participant in order to record inaccurate responses.

In the second part of this study, participants were requested to rate each of the drawings that were previously presented on emotional content. These ratings were then used to establish final category designations (e.g., Biological High Emotional Valence, etc.), and revisions would be made as necessary. The participants reviewed each picture at their own pace (also on Macintosh computer) and rated each item on a Likert-like scale for emotional valence (i.e., 0 – neutral, 1 – a little, 2 – somewhat, and 3 – very). Participants were instructed prior to completing the ratings that this was not a test of skill or knowledge, but rather it was their personal opinion about the emotional content of the item that was being sought (see Appendix E). Total time for the experimental session was approximately 20 minutes.

Table 1

Artifactual Variables Identified in Studies of the Semantic Category Effect

STUDY	AGE OF ACQUISITION	NAME AGREEMENT	FAMILIARITY	WORD FREQUENCY	PROTOTYPICAL	IMAGE AGREEMENT	VISUAL COMPLEXITY
Snodgrass & Yuditsky (1996)	✓	✓		✓			
Vitkovitch & Humphreys (1991)				✓			
Laws et al. (2002)	✓						
Bates et al. (2001)	✓		✓				
Barry et al. (2001)	✓						
Kremlin et al. (2000)	✓	✓					
Kremlin et al. (2001)	✓	✓	✓	✓			✓
Funnell & Sheridan (1992)			✓				
Laiacona et al. (2000)		✓	✓	✓	✓	✓	✓
Montanes et al. (1995)				✓			✓
Silveri et al. (1991)				✓	✓		
Fung et al. (2001)			✓	✓			✓
Daum et al. (1996)			✓	✓			✓
Fung et al. (2000)			✓				
Gonnerman et al. (1997)			✓				
Garrard et al. (1997)			✓	✓			
Whatmough et al. (in press)			✓				
Garrard et al. (1998)				✓	✓		
Tippet et al. (1996)			✓				
Grossman et al. (1996)				✓	✓		
Laiacona et al. (1998)		✓		✓	✓		✓
Vitkovitch et al. (1993)				✓			
Gerlach et al. (2000)			✓			✓	✓
Laws & Neve (1999)			✓	✓			✓
Laws (1999)				✓			✓
Laws & Gale (2002)			✓	✓			✓
Laws et al. (2002)			✓	✓			✓
Laws (2000)			✓	✓			✓

Chapter III

Results

Preliminary Analyses

An initial review of the raw data revealed that several pictures in the stimulus set presented an inordinate amount of difficulty in that only a few participants provided correct responses, possibly due to the ambiguity of black and white line drawings for certain objects (e.g., melon, apricot, radish, walnut, tangerine, coffin, cigarette, lock, nail, chimney, thermometer, etc.). Additionally, various pictures tended to produce a variety of responses (e.g., the drawing of a chicken frequently elicited a response of either “hen” or “rooster”; the drawing of a “mop” was frequently confused with “broom” or “rake”; the drawing of a “revolver” frequently elicited the words “gun” or “pistol”; the drawing of an “ant” was confused with “spider” or “insect”, etc.). Although certain responses were not necessarily incorrect, only one dominant name was considered appropriate in order to avoid possible between-subject friction confounds in vocal RTs measurements. As such, only pictures with at least a two-third accurate response rate (i.e., only one correct name acceptable) were employed in this study. Furthermore, many of the items within categories were subsequently deemed to be incongruent with the majority of items within that category (e.g., body parts such as “thumb” and “teeth” in the Biological High Emotional category which consisted of primarily animals; the word “nest” in the Biological Low Emotional category which consisted primarily of fruits, vegetables, and plants; the word “angel” which could be misconstrued as representing a person in the Nonbiological High Emotional category), and were therefore eliminated. Finally, an analysis of category means of vocal RTs across subject was conducted.

An inspection of the raw data identified outliers (2.5 SDs above or below the category mean), which were removed.

In the final selection, 45 pictures in four categories with reasonably homogeneous items per category were deemed suitable for use in the data analyses. Accurate response rates for this stimulus set ranged from 67% to 100% (see Appendix F).

Artifactual Variables Across the Four Revised Item by Emotional Valence Categories

A one-way analysis of variance (ANOVA) was carried out to investigate possible differences in familiarity ratings and word frequency across category. The findings showed no differences of either familiarity, $F(3, 41) = 2.22, p = .10$, or word frequency, $F(3, 41) = 1.36, p = .27$. Furthermore, because the overall accuracy ratings (i.e., percentage of subjects giving a correct response to a given item) differed among items and could conceivably become a confounding factor as a result of picture feature or quality, it was considered necessary to examine this variable. The results of a one-way ANOVA showed no difference of item accuracy, $F(3, 41) = .92, p = .44$, across category.

Comparison of Emotional Valence Ratings - Biological Category vs. Nonbiological Category

A paired t -test was performed to compare overall means of the biological and the nonbiological categories for emotional valence (see Table 2). Results demonstrated that mean emotional valence was significantly higher in the biological category as compared to the nonbiological category, $t(35) = 4.22, p = .00$.

Table 2

Summary of Means and Standard Deviations of Emotional Valence Ratings for the Biological Category and Nonbiological Category

Variable	M	SD
Emotional Valence		
Biological	1.28	.68
Nonbiological	.98	.60

Comparisons of Emotional Valence across the Four Revised Item by Emotional Valence Categories

A repeated measures ANOVA was conducted to compare the participant emotional valence rating means of the four categories (i.e., Biological High Emotional Valence, Biological Low Emotional Valence, Nonbiological High Emotional Valence and Nonbiological Low Emotional Valence). An analysis of the data showed a main effect of category, $F(1, 35) = 29.66, p = .00$. The Nonbiological High Emotional Valence category (weapons and musical instruments) demonstrated the highest mean emotional valence rating, followed by the Biological Low Emotional Valence (fruits and vegetables) and Biological High Emotional Valence (animals) categories. The Nonbiological Low Emotional Valence category (tools and clothing) showed the lowest mean emotional valence rating. Within the biological category, an unanticipated finding was that the “fruit and vegetable” item category, which was initially predicted to be low in emotional valence, was rated by participants as being somewhat higher in emotional valence than the “animal” item category. Consequently, it was required that the originally assigned category designations in the biological category be reversed (i.e., the fruit and vegetable items became the Biological High Emotional Valence category, and the animal items became the Biological Low Emotional Valence category) due to participant valence ratings. Within the nonbiological category, the items initially designated as being high in emotional content (e.g., weapons, musical instruments, etc.) reflected a higher mean than items designated as being low in emotional content (e.g., tools, clothes, etc.) as anticipated (see Table 3). Accordingly, the four item by emotional valence categories were revised as follows (see Appendix F): Biological High Emotional (fruits and vegetables),

Biological Low Emotional (animals), Nonbiological High Emotional (weapons, musical instruments, etc.) and Nonbiological Low Emotional (tools, clothes, etc.).

Pairwise comparisons (see Table 4) demonstrated significant differences between the Biological High Emotional (fruits and vegetables) and the Nonbiological Low Emotional (tools, clothing, etc.) categories ($p = .00$), the Biological Low Emotional (animals) and the Nonbiological High Emotional (weapons, musical instruments, etc.) categories ($p = .03$), the Biological Low Emotional (animals) and the Nonbiological Low Emotional (tools, clothing, etc.) categories ($p = .00$) and the Nonbiological High Emotional (weapons, musical instruments, etc.) and the Nonbiological Low Emotional (tools, clothing, etc.) categories ($p = .00$). No other significant differences were found.

Table 3

Summary of Means and Standard Deviations of Emotional Valence Ratings for the Four Revised Item X Emotional Valence Categories

Variable	Biological		Nonbiological	
	M	SD	M	SD
Emotional Valence				
High	1.35	.76	1.40	.69
Low	1.23	.72	.67	.59

Table 4

Pairwise Comparisons of Emotional Valence Ratings for the Four Revised Item X Emotional Valence Categories

Category	Biological Low (animals)	Nonbiological High (weapons, etc.)	Nonbiological Low (tools, etc.)
Biological High (fruits, etc.)	.18	.52	.00*
Biological Low (animals)		.03*	.00*
Nonbiological High (weapons, etc.)			.00*
*The mean difference is significant at the .05 level			

Main Analyses

A paired *t*-test, repeated measures ANOVA and correlational analyses were conducted to examine semantic category dissociation as well as the hypothesis of the present study.

Comparison of Vocal RTs – Biological Category vs. Nonbiological Category

A paired *t*-test was performed to compare overall means of the biological and nonbiological categories for vocal RT (see Table 5). The biological category indicated a lower mean vocal RT as compared to the nonbiological category, $t(35) = -3.00, p = .01$.

Table 5

Summary of Means and Standard Deviations of Vocal RTs for the Biological Category and Nonbiological Category

Variable	M	SD
Vocal RT		
Biological	901	113
Nonbiological	956	119

Comparison of Vocal RTs Across the Four Revised Item by Emotional Valence Categories

A repeated measures ANOVA was performed to compare vocal RT means across the four categories (see Table 6). The findings demonstrated a main effect of category, $F(1, 35) = 6.27, p = .00$. Analyses of the data showed that the Biological Low Emotional category (animals) reflected the fastest mean vocal RT, followed by the Biological High Emotional (fruits and vegetables) and the Nonbiological High Emotional (weapons, musical instruments, etc.). The Nonbiological Low Emotional category (tools, clothing, etc.) reflected the slowest mean vocal RT.

Pairwise comparisons (see Table 7) of the four category mean vocal RTs demonstrated a difference between the Biological Low Emotional (animals) category and the Biological High Emotional (fruits and vegetables) category ($p = .01$), the Nonbiological High Emotional (weapons, musical instruments, etc.) category ($p = .00$) and the Nonbiological Low Emotional (tools, clothing, etc.) category ($p = .00$) respectively. No other differences were found.

Table 6

*Summary of Means and Standard Deviations of Vocal RTs for the Four Revised Item X
Emotional Valence Categories*

Variable	Biological		Nonbiological	
	M	SD	M	SD
Vocal RTs				
High	930	147	948	123
Low	860	127	957	144

Table 7

*Pairwise Comparisons of Vocal RTs for the Four Revised Item X Emotional Valence**Categories*

Category	Biological Low	Nonbiological High	Nonbiological Low
Biological High	.01*	.53	.34
Biological Low		.00*	.00*
Nonbiological High			.68

*The mean difference is significant at the .05 level

Correlations Between Vocal RTs and Emotional Valence Ratings

An overall positive correlation of mean vocal RT and mean emotional valence across subject approached significance, $r(36) = .32, p = .06$. A breakdown of the data by category showed positive correlations in the Nonbiological Low Emotional (tools, clothing etc.) category, $r(36) = .44, p = .01$ and the Biological High Emotional (fruits and vegetables) category, $r(36) = .36, p = .03$. There were no correlations in either of the other categories (see Table 8).

Table 8

Correlations Between Mean Vocal RT and Mean Emotional Valence for the Four Revised Categories

Participants (n = 36)

Revised Category

Biological High	.36*
Biological Low	-.05
Nonbiological High	-.20
Nonbiological Low	.44**

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

Chapter IV

Discussion

The objective of this study was to further explore the semantic category effect in young healthy participants, and, concurrently, to examine the potential influence of emotional valence on semantic memory. Investigations of semantic category dissociation, the effect of emotional content on semantic category differences, and relationships between semantic memory performance and emotional valence were undertaken. Overall, the results of this study supported the hypothesis that the emotional content of items would impact on semantic memory for those items. Nevertheless, it was found that the association between emotional valence and semantic memory was more complex than originally predicted. A discussion of the hypothesis and findings that address the study objectives will follow.

The preliminary analysis revealed that picture ambiguity, diversity of response name and incongruity with item category necessitated the elimination of several pictures from the original stimulus set. It was subsequently established that 45 of the original 80 picture items were suitable for analysis.

Results of the analyses on artifactual variables (i.e., familiarity ratings, word frequency and accuracy ratings) demonstrated no differences among the four revised categories. Consequently, artifactual variables were deemed to have little effect on the findings. As such, evidence of a category dissociation in this study served to contest the theory that category dissociation is a spurious outcome of artifactual features of stimuli as posited by Tippett et al. (1996).

Hypothesis and Findings of the Present Study

The prediction of a semantic category effect reflecting a biological advantage and the hypothesis of an association between the emotional valence and semantic memory are discussed below in terms of the findings.

Biological/Nonbiological Category Dissociation

An examination of the general categories of biological (animals and fruits and vegetables) and nonbiological (weapons, musical instruments, clothing, and tools, etc.) items demonstrated that the biological items were typically rated as being higher in emotional content than the nonbiological items. Results of the mean vocal RT category comparisons were in accord with recent studies that reflected better performance in the biological category over the nonbiological category in young healthy participants in general (McKenna & Parry, 1994; Laws, 2000; Laws, & Gale, 2002; Laws, Leeson & Gale, 2002), and females in particular (Laws & Neve, 1999). Conversely, the findings in this study tended to counter the theory that structural similarity of biological items was a problematic aspect in the recognition and identification of those items (Vitkovitch et al., 1993), as well as argue against the Gaffin and Heywood (1993) suggestion that it was more difficult to visually discriminate biological over nonbiological objects.

In brief, the results of this analysis demonstrated a biological/nonbiological category dissociation reflecting higher emotional valence and better naming times for the biological category as predicted.

Category Dissociation of Items Balanced for High and Low Emotional Content

In this analysis, an attempt was made to balance the emotional content of the biological and nonbiological categories by further subdividing them into high and low

emotional valence categories. As previously mentioned, an unforeseen finding was that the fruit and vegetable item category was rated by participants as being somewhat higher in emotional content over the animal item category, thus reversing the original “predicted” category designations. Evidently, the significance of food in this sample was largely underestimated. This unexpected outcome may suggest that, among university students who are generally at the lower end of the socio economic scale, the fruit and vegetable items representing healthy “food” may hold greater import as compared to animal items such as lions and camels. Although the results showed no significant mean valence difference between the two “high” emotional categories (i.e., fruits and vegetables in the biological category and weapons, musical instruments, etc. in the nonbiological category), a significant mean valence difference was found between the two “low” emotional categories (i.e., animals in the biological category and tools, clothing, etc. in the nonbiological category). It is suggested that endeavoring to balance biological and nonbiological categories for low emotional valence may prove to be exceedingly difficult in view of indications that biological items tend to be rated as being generally higher in emotional content.

Examination of mean vocal RT revealed that the Biological Low Emotional Valence category (animal items) showed the shortest latency time (best semantic memory performance), followed by the Biological High Emotional Valence category (fruits and vegetables) and the Nonbiological High Emotional Valence category (weapons and musical instruments). The longest latency time (poorest semantic memory performance) was for the Nonbiological Low Emotional Valence category (tools and clothing).

A comparison of the Biological High Emotional category (fruits and vegetables) with the Nonbiological High Emotional category (weapons, musical instruments, etc.) failed to

demonstrate a significant difference in mean vocal RT, thus indicating that emotional valence might be an important factor in category dissociation as hypothesized. However, contrary to anticipated results, a semantic category effect was evidenced between the Biological Low Emotional category (animals) and the Nonbiological Low Emotional category (tools, clothing, etc.). As formerly stated, there was a notable difference in the emotional valence ratings between these two categories in that the Biological Low Emotional Category mean emotional valence rating was significantly higher than the Nonbiological Low Emotional Category mean emotional valence rating. As such, the mean emotional valence rating difference between categories was a confounding factor in this particular analysis.

Perhaps the most conspicuous finding was the considerably lower mean vocal RT in the Biological Low Emotional Valence category, indicating enhanced semantic memory performance for animal items relative to any of the other item categories. Keeping in mind that only females participated in this study, this result contradicts a previous finding which showed that women scored highest on fruits and vegetables relative to other item categories (McKenna & Parry, 1994), and challenges the proposal of gender evolution and divergent sex roles as advanced by Gurian et al. (2001).

Above all, the results of this component of the study better demonstrated an “animate/inanimate” category dissociation as opposed to a biological/nonbiological dissociation, and may corroborate the Caramazza and Shelton (1998) contention that animate and inanimate conceptual categories may represent evolutionarily adapted domain-specific knowledge, along with the theory that living things might have some processing advantage in healthy brains (Laws, 2000).

In contrast, the data do not fully support the sensory-functional theory as proposed by Warrington and Shallice (1984), which postulated that artifactual objects were defined by their functional significance whereas living things were identified primarily through their visual features. An examination of the breakdown of category items in this study revealed that participant performance in picture naming, although somewhat better in the inanimate “biological” item category (i.e., fruits and vegetables), was not significantly different from participant performance in the two “nonbiological” categories, and emotional valence rather than semantic category appeared to be a significant factor. Therefore, the findings from this study tend to contradict the sensory-perceptual theory.

The prediction that the semantic category effect would disappear when biological and nonbiological objects were better matched for emotional valence was only partially supported by the results of this analysis. Although the semantic category effect between biological and nonbiological items was no longer present when items were matched for “high” emotional valence, this study was unsuccessful in attempting to match biological and nonbiological items for “low” emotional valence, therefore making these results difficult to interpret.

Relationships Between Semantic Memory and Emotional Valence

The positive trend of the overall correlational analysis of semantic memory performance and emotional valence rating across subjects indicated a decline in semantic memory performance as emotional valence increased, contrary to anticipated results. Additionally, investigations of correlations by category produced some interesting, if complex, findings. For instance, in the biological categories, there was no significant correlation of vocal RT and emotional valence rating in the Biological Low Emotional Valence group (animals), but there was a significant positive correlation in the Biological

High Emotional Valence group (fruits and vegetables). In the nonbiological categories, there was no significant correlation in the Nonbiological High Emotional Valence category (weapons and musical instruments), but there was a strong positive correlation in the Nonbiological Low Emotional Valence category (tools and clothing). In effect, the data from the correlational analyses revealed a strong positive relationship between vocal RT and emotional valence in the Biological High Emotional category as well as the Nonbiological Low Emotional category, indicating that, as emotional valence increased, semantic memory performance declined. In contrast, there was no significant association between emotional valence and semantic memory performance in either the Biological Low Emotional category or the Nonbiological High Emotional Category. It is interesting to note, however, that despite the lack of significant results in these two categories, the data demonstrated a negative pattern of association in contrast to the previously observed positive directions. Consequently, with respect to the item categories of animals, and weapons and musical instruments, the data may suggest that, as emotional valence increased, semantic memory performance tended to improve to some extent.

An explanation of the implications for these findings proved to be somewhat awkward as significant results were indicated for both emotional valence levels as well as both semantic categories. To clarify, positive significant correlations were evidenced for high and low emotional valences as well as biological and nonbiological items.

Nevertheless, the following is an attempt to interpret these results. To begin, in the biological categories, higher emotional valence for, perhaps, highly emotional stimuli such as fruits and vegetables appeared to weaken semantic memory performance as demonstrated by the positive association between increasing emotional content and longer vocal RTs.

However, in the other biological category of animal items, emotional valence did not appear to influence semantic memory performance significantly, possibly because animate biological stimuli have a natural advantage with respect to semantic memory. However, the negative correlational trend in this category may indicate that increasing emotional valence corresponds to better semantic memory. In the nonbiological categories, lower emotional stimuli such as tools and clothes showed an association indicating weakened semantic memory performance as emotional valence increased, comparable to results in the fruit and vegetable item-category. However, for nonbiological items that were generally rated as being high in emotional content such as weapons and musical instruments, there was no significant association, but a negative trend was again observed, comparable to the findings in the animal item category.

On the whole, it would seem that biological items deemed to be higher in emotional valence (i.e., fruits and vegetables) and nonbiological items deemed to be low in emotional valence (tools, clothes, etc.) revealed a relationship showing increasing emotional content corresponded to a decline in semantic memory. On the other hand, biological objects rated as being somewhat lower in emotional valence (i.e., animals) and nonbiological objects rated as high in emotional content (weapons, etc.) demonstrated no significant association, but a slight negative trend was observed, perhaps indicative of better semantic memory with higher emotional valence as predicted.

In brief, results of the correlation analyses in this study revealed that, overall, higher emotional valence was associated with longer vocal reaction times, contrary to the prediction. Moreover, a break down by item category showed divergent relationships between emotional valence, semantic category and semantic memory.

To summarize, the following conclusions are presented based on the results of the data analyses of this study: (a) on a speeded picture naming task, there was an animate/inanimate category dissociation reflecting an animate item advantage in young, healthy female participants, (b) in young, healthy female participants, the semantic category effect disappeared when biological and nonbiological items were balanced for “high” emotional content, and (c) using a speeded picture naming paradigm, in young, healthy, female participants there was an intricate relationship between the subjective emotional valence rating of items and vocal RTs for those items.

Although not every prediction in this study was corroborated by the findings, the overall results support the hypothesis of a link between emotional valence and semantic memory. Based on our current knowledge of cognition in general and memory in particular, it may be reasonable to assume that semantic memory is a multifaceted rather than an isolated process, and “emotion” may be one of the components that is integrated to complete that process. As stated earlier, the amygdala appears to play a significant role in memory for emotional experiences and material (Adolphs et al., 1997; Mori et al., 1999), and, correspondingly, this neuroanatomical structure may also be implicated in the emotional content of semantic knowledge and memory for objects. Damage to the amygdala, as in the case of AD, may interfere with the processing of emotional content, and consequently, impair semantic memory for objects with typically higher emotional content (i.e., biological) resulting in a category dissociation reflecting a nonbiological advantage as generally evidenced in the literature. With respect to young participants with healthy brains, the evidence largely demonstrates an inverse pattern of category dissociation that generally “favours” biological objects, which is, conceivably, a result of a natural advantage.

Discrepancies in the findings of the semantic category effect for both AD patients and healthy individuals have been previously accounted for in terms of methodological differences in research and heterogeneous participants. However, another feasible explanation may be closely linked to the associated emotional content of the various stimuli employed in picture naming studies. Possibly, a stimulus set that included several pictures of animate items such as animals, and few inanimate items such as tools, might tend to reflect a nonbiological advantage in AD patients in light of the hypothesis that the processing of emotional content for more neutral stimuli may be less critical to semantic memory. However, a similar stimulus set would likely produce a biological advantage in young healthy individuals in accord with the evidence from the present study and theories of evolutionary pressures.

As posited by Gurian and colleagues (2001), emotion is intrinsically linked to learning, and empirical evidence has demonstrated that emotion is allied with memories for material and experiences (Adolphs et al., 1997; Mori et al., 1999). The findings of the present study serve to advance the hypothesis that emotions may also play an integral role in semantic memory for objects.

Limitations of the Present Study

An examination of the results indicates an association between emotional valence and semantic memory. However, several limitations of this study must be identified. It should be noted that, although the general hypothesis is neuroanatomical in nature in that it implicates the amygdala, this study did not examine brain structures through neuroimaging or any other technique, and all information concerning the amygdala was ascertained from the literature. As such, implications pertaining to the relationship between the amygdala and semantic memory are entirely speculative, and any comparison with other neuroanatomical theories of

the semantic category effect (Silveri et al., 1991; Garrard et al., 1998; Gerlach et al., 2000) would be highly tentative.

The characteristics of the sample in this study limit the generalizability of the findings. This sample consisted primarily of young, white, English speaking female university students, and caution must be taken when applying this research to other populations.

Furthermore, the correlational analyses in this study cannot unequivocally answer the causal question of whether emotional valence facilitates or impairs semantic memory performance.

Although the original stimulus set endeavored to control for frication confounds by matching across categories for first phoneme or first letter, the loss of 35 items from the original 80 item set invalidated this attempt. That said, however, it must be kept in mind that evidence exists demonstrating that frication confounds are only significant in speeded “word reading” tasks, but have little effect on speeded picture naming paradigms (Bates et al., 2001). Furthermore, none of the previous studies discussed in this paper on the semantic category effect using speeded picture naming paradigms on healthy individuals controlled for possible frication confounds (Vitkovitch et al., 1993; McKenna & Parry, 1994; Laws & Neve, 1999; Laws, 2000; Laws & Gale, 2002; Laws, Leeson & Gale, 2002).

Clearly, an additional significant issue that must be addressed concerns the idiosyncratic nature of the individual association of emotional content to items. For example, although a picture of an article of clothing such as a “belt” may have little emotional significance for most individuals, in certain instances, this object may hold highly negative emotional import. Moreover, culture, depression and stress may be significant influencing

variables in participant emotional valence ratings. For this reason, it was considered necessary to examine the results from this study using a “within-subject” design.

Finally, to facilitate future studies in this area, researchers wishing to employ a similar methodology are recommended to pre-test the stimulus set on a relatively large sample to ensure that selected items are suitable for use. Prior large-scale testing for this study could have avoided potential complications relating to the matching for artifactual variables of the stimuli.

Directions for Future Research

Perhaps, the most fundamental issue that should be addressed in research using speeded picture naming paradigms as well as simple picture naming tasks, is the effects of artifactual variables such as familiarity, word frequency, visual complexity, age of acquisition, and several others. At present, studies on the semantic category effect frequently appear to being inconsistent when matching for artifactual variables. It is essential that continued work in this area endeavors to identify the pertinent artifactual variables, and ensures that these variables are controlled for in a more uniform manner.

Future research should also invest more effort on examining the semantic category effect in healthy individuals, perhaps, from an “across-lifespan” perspective. For example, currently, the evidence seems to indicate that healthy young adults typically demonstrate a category dissociation with a biological advantage, whereas, in healthy elderly adults, the results show that semantic memory for biological and nonbiological items appears to be equivalent. It would be interesting to investigate this phenomenon from a developmental point of view to determine if category dissociation is a feature of all age groups. For instance, one question that could be considered is whether loss of the biological advantage with respect to

semantic memory is related to the aging process, and, if so, at what point does that loss generally occur. Before we can truly consider the implications of the semantic category effect in neuropathological patients such as those with AD, it is important to fully understand the “normal” condition and the probable changes to that condition over time.

A full understanding of the normal condition would require more research to investigate possible gender differences relating to the semantic category effect in both healthy individuals and neuropathological patients. A large sample consisting of both males and females would be required to establish possible interactions of gender and category, and a stimulus set controlled for stereotypical gender associated items would be crucial.

Research using neuroimaging techniques is necessary to better appreciate the neuroanatomical correlates of the deterioration and loss of semantic memory in AD and other neuropathologies. In relation to this study, future research might employ a simple picture naming task using a similar stimulus set comprised of objects deemed to be high and low in emotional valence, in conjunction with neuroimaging techniques such as MRI. A more comprehensive study along this line could effectively analyze deterioration of the amygdala in tandem with semantic memory performance for objects with probable high and low emotional valence to determine the possible relationships between semantic memory, emotional content and neuroanatomical structures in a more tangible way.

In conclusion, despite the limitations previously identified, the present study has contributed to the literature on the semantic category effect in young, healthy adults, and females in particular. In addition to corroborating previous research indicating a category dissociation with a biological (specifically animate items in this study) advantage, this study has demonstrated an association between the emotional valence ratings of items and semantic

memory performance for those items. Moreover, it has provided a new hypothesis of the semantic category effect that is germane to healthy individuals and patients with AD, as well as a feasible, alternative explanation for some of the observed inconsistencies relating to this phenomenon currently found in the literature. Continued investigations of the semantic category effect may afford new insights into the mechanisms of semantic memory in general. Moreover, enhanced knowledge in this area may foster an improved understanding of the subtle impact of semantic memory impairment in patients suffering from AD to help facilitate better treatment and care.

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Appendix A

Consent to Participate in Research The Semantic Category Effect and Emotional Valence in College-Age Students

You are asked to participate in a research study for a Master of Arts thesis conducted by Gari Brouseaux under the supervision of Dr. Lori Buchanan at the University of Windsor. If you have any questions or concerns about the research, please feel free to contact Gari Brouseaux at (519) 250-6274 or Dr. Buchanan at (519) 235-3000, ext 2246.

Purpose of the Study

The purpose of the study is to examine how linguistic memory may be related to different categories and emotional content.

Procedures

If you volunteer to participate in this study, we would ask you to do the following things:

Part I: First, you will be asked to participate in a task that requires you to name black and white drawings of objects that will be presented individually on a computer screen. You will be required to perform this task as quickly and as accurately as you can. Total reaction time of your responses will be measured and recorded by a computer. This task should take about 10 minutes.

Part II: Later, you will be asked to complete a questionnaire rating each of the drawings that were previously presented on emotional content. For example, you will look at a drawing and decide whether you think it has positive emotional content, negative emotional content, or whether it has no emotional content (i.e., neutral). This questionnaire is *NOT* a test of knowledge, but rather seeks your personal opinion about the emotional content of the drawing. This task should take about 15 minutes. In total, your participation will likely take a maximum of 45 minutes. This study will take place in room 62 in the psychology wing of Chrysler Hall South. Once the entire study has been completed, a general summary of findings will be posted outside this laboratory. If you prefer, we can discuss the general findings of the study with you personally, either over the phone or via e-mail.

Potential Risks and Discomforts

This study does not involve any anticipated risks or discomforts.

Potential Benefits to Society

Your participation in this study will help us learn more about how linguistic memory works and about the methods we can use to investigate memory in laboratory settings.

Payment for Participation

For your participation in this study, you will be compensated one (1) course credit.

Confidentiality

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. In order to ensure confidentiality, no personal information will be in any way connected with the data you provide.

Participation and Withdrawal

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may exercise the option of removing your data from the study. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

Right of Research Subjects

You may withdraw your consent at any time and discontinue participation without penalty. This study has been reviewed and received ethics clearance through the University of Windsor Research Ethics Board. If you have questions regarding your right as a research subject, contact:

Research Ethics Co-ordinator

University of Windsor
Windsor, Ontario
N9B 3P4

Telephone: 519-253-3000, # 3016

E-Mail: ethics@uwindsor.ca

I understand the information provided for the study "The Semantic Category Effect and Emotional Valence in College-Age Students" as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

Name of Subject

Signature of Subject

In my judgment, the subject is voluntarily and knowingly giving informed consent to participate in this research study.

Signature of Investigator

Date

Appendix B

Information Form

The Semantic Category Effect and Emotional Valence in College-Age Students

You are asked to participate in a research study for a Master of Arts thesis conducted by Geri Brousseau under the supervision of Dr. Lori Buchanan at the University of Windsor. If you have any questions or concerns about the research, please feel free to contact Geri Brousseau at (519) 250-6274 or Dr. Buchanan at (519) 235-3000, ext 2246.

Purpose of the Study

The purpose of the study is to examine how linguistic memory may be related to different categories and emotional content.

Procedures

If you volunteer to participate in this study, we would ask you to do the following things:

Part I: First, you will be asked to participate in a task that requires you to name black and white drawings of objects that will be presented individually on a computer screen. You will be required to perform this task as quickly and as accurately as you can. Total reaction time of your responses will be measured and recorded by a computer. This task should take about 10 minutes.

Part II: Later, you will be asked to complete a questionnaire rating each of the drawings that were previously presented on emotional content. For example, you will look at a drawing and decide whether you think it has positive emotional content, negative emotional content, or whether it has no emotional content (i.e., neutral). This questionnaire is not a test of knowledge, but rather seeks your personal opinion about the emotional content of the drawing. This task should take about 15 minutes. In total, your participation will likely take a maximum of 45 minutes.

This study will take place in room 62 in the psychology wing of Chrysler Hall South. Once the entire study has been completed, a general summary of findings will be posted outside this laboratory. If you prefer, we can discuss the general findings of the study with you personally, either over the phone or via e-mail.

Potential Risks and Discomforts

This study does not involve any anticipated risks or discomforts.

Potential Benefits to Society

Your participation in this study will help us learn more about how linguistic memory works and about the methods we can use in investigate memory in laboratory settings.

Payment for Participation

For your participation in this study, you will be compensated one (1) course credit.

Confidentiality

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. In order to ensure confidentiality, no personal information will be in any way connected with the data you provide.

Participation and Withdrawal

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may exercise the option of removing your data from the study. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

Rights of Research Subjects

You may withdraw your consent at any time and discontinue participation without penalty. This study has been reviewed and received ethics clearance through the University of Windsor Research Ethics Board. If you have questions regarding your right as a research subject, contact:

Research Ethics Co-ordinator

University of Windsor
Windsor, Ontario
N2B 3P4

Telephone: 519-253-3000, # 3816

E-Mail:

ethics@uwindsor.ca

Appendix C

Original Stimulus Set

NONBIOLOGICAL (High Emotional)	NONBIOLOGICAL (Low Emotional)	BIOLOGICAL (High Emotional)	BIOLOGICAL (Low Emotional)
Bomb	Belt	Bear	Banana
Cross	Cup	Chicken	Corn
Guitar	Glass	Gorilla	Grapes
Needle	Nail	Nose	Nest
Ring	Ruler	Rat	Raspberry
Coffin	Crown	Cat	Cherry
Flag	Fork	Frog	Flower
Cigarette	Chimney	Cow	Carrot
Telephone	Table	Thumb	Tomato
Ship	Saw	Snake	Strawberry
Lock	Ladder	Lion	Lemon
Piano	Plug	Pig	Pear
Angel	Axe	Ant	Apricot
Tank	Tire	Teeth	Tree
Revolver	Rake	Rabbit	Radish
Thermometer	Tie	Tongue	Tangerine
Arrow	Anchor	Alligator	Asparagus
Cocktail	Chain	Camel	Clover
Maze	Mop	Moose	Melon
Watch	Whistle	Worm	Walnut

Appendix D

The Semantic Category Effect and Emotional Valence in College-Age Students**PICTURE NAMING TASK: PART I – IDENTIFYING OBJECTS**

INSTRUCTIONS: In Part I of this study, you are requested to speak into a microphone and state the name of the object that will be individually presented on the computer screen in the form of a black and white drawing. We ask you to do this as quickly and as accurately as you can.

The procedure is as follows:

- **You will commence with a practice session to help familiarize you with the procedures.**
- **A picture will appear on the computer screen.**
- **You must state the name of the object as quickly and as accurately as you can by speaking into a microphone.**
- **As soon as you speak, a new picture will appear and you are to follow the same procedure throughout until the program is completed (i.e., no pictures appear). The computer will record your reaction time.**
- **The investigator will remain in the room with you to record your responses.**

TIP 1: Each picture should be identified using only one word.

TIP 2: The words do not need to be very specific. For example, if you see a picture of a dog, just say “dog”. There is no requirement to state the breed of the dog (e.g., “poodle”).

The pictures that will be presented are common objects, and they are not intended to trick you in any way. However, some of the pictures may not be as recognizable as others, so you may have more difficulty naming some objects. If you do not know the name of the object presented, either give it your best guess, or say the word “NO” and the next object will appear. Remember, speed is very important in this task.

WE VERY MUCH APPRECIATE YOUR PARTICIPATION IN THIS STUDY.

Appendix E

PICTURE NAMING TASK: PART II – EMOTIONAL VALENCE

INSTRUCTIONS: In Part II of this study, you are requested to assign an “emotional valence” to each of the pictures that were presented previously. It is important to note that this is not a test of knowledge or skill. This section seeks your “personal” opinion about the emotional content of the drawing. For example, if a picture of a “book” was presented, you assign a valence of what you feel is the emotional content connected to a book (e.g., “0” for “neutral” which means it has no emotional content for you, “3” for “very high”, etc.). Remember, it is your personal evaluation of the object that is important.

You are requested to go through the pictures again using the following procedures:

- **Ignore the first five practice trials.**
- **When a picture shows up on the screen, write down the name of the object in the column below marked “Name”.**
- **Assign a valence to the object by circling one of the numbers in the column marked “Valence”. The valance scale is provided below.**
- **Press any key to go on to the next picture, and follow the procedures outlined above until there are no more pictures and the program is complete.**

VALENCE SCALE

0	1	2	3
Neutral	A little	Somewhat	Very
NAME		VALENCE	
		0	1 2 3
		0	1 2 3
		0	1 2 3

Appendix F

Revised Stimulus Set with Data on Artifactual Variables

BIOLOGICAL HIGH EMOTIONAL	BIOLOGICAL LOW EMOTIONAL	NONBIOLOGICAL HIGH EMOTIONAL	NONBIOLOGICAL LOW EMOTIONAL
BANANA (567/4/100%)	BEAR (526/57/94%)	BOMB (566/36/92%)	BELT (550/29/86%)
CORN (548/30/92%)	CAT (582/23/94%)	CROSS (525/55/94%)	RULER (571/3/89%)
GRAPES (532/3/81%)	FROG (507/1/97%)	GUITAR (550/19/92%)	CROWN (531/19/83%)
CHERRIES (514/6/69%)	COW (529/29/94%)	NEEDLE (533/15/78%)	FORK (584/14/100%)
FLOWER (566/23/100%)	SNAKE (501/44/92%)	RING (589/47/83%)	TABLE (599/198/75%)
CARROT (539/1/94%)	LION (511/17/94%)	FLAG (545/16/97%)	SAW (552/352/89%)
STRAWBERRY (539/33/83%)	PIG (509/8/92%)	PIANO (545/38/86%)	LADDER (507/19/94%)
LEMON (518/18/67%)	RABBIT (523/11/92%)	ARROW (490/14/89%)	PLUG (575/23/81%)
PEAR (567/6/83%)	ALLIGATOR (442/4/92%)	MAZE (434/6/78%)	AXE (461/6/83%)
TREE (613/59/97%)	CAMEL (421/1/89%)	WATCH (576/81/75%)	TIRE (546/22/86%)
CLOVER (486/16/75%)	MOOSE (518/1/72%)		TIE (559/23/94%)
			CHAIN (513/50/83%)
			WHISTLE (505/4/92%)

Note: The numbers in brackets represent the three artifactual variable ratings of familiarity, word frequency and item accuracy respectively.

Vita Auctoris

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1967 – 1970

Memorial University of Newfoundland, St John's, NF
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University of Ottawa,
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