國立臺灣大學文學院語言學研究所

碩士論文

Graduate Institute of Linguistics
College of Liberal Arts
National Taiwan University

Master Thesis

隱喻多義詞之心理處理歷程：語境、詞義頻率與詞義顯著性

Processing of Metaphorical Polysemy: Context, Frequency, & Salience

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中華民國 98 年 6 月

June, 2009

誌謝

『你以你的恩惠為年歲的冠冕，你的路徑都滴下脂油。』（詩篇六五篇 11 節。）

當我回頭細數人生路途上的每一經歷，以及太多我所不配得蒙的恩惠，我心裡總對這位在已過二十四年間用祂永遠的愛愛我，又巧妙安排我一切境遇的神，滿了感謝。是祂的慈繩愛索牽引，帶領我走每一步路，也是祂奇妙的牧養、豫備，使我一路走來不至缺乏。

而對我而言，這一路上巧遇的許多人、事、物，也就是神所差遣最美麗的使者，在我最需要時，帶來應時的指引、策勵、供備、扶持。安可思老師是這一生改變我最多的老師，我無法說明我有多麼感謝她。在學術上，她治學嚴謹、原則分明、訓練嚴格卻不苛刻；在生活中，她為人正直、良善，顧到學生的需要甚於自己。林千哲老師對學生寬厚仁慈、積極而富有耐心，是他循序漸進的指導，使我得以漸漸認識這塊領域，也是他兩年來許多的包容、體諒，才使我走到如今。我感謝身邊的師長和學長姐們這些年間無私的幫助和鼓勵。我想我會永遠記得張顯達老師幫我準備了那台實驗用的電腦，使我能以走出膠著的困境，順利完成之後的實驗。而馮怡蓁老師不厭其煩的指導統計、黃宣範老師和其他老師多次的討論和生活中的關心…也成為我往前的動力。我也感謝中研院的黃居仁老師適時讓我進到中文詞彙小組幫忙，使我有機會藉由實際處理語料更深入認識詞義區分，也因此啟發了此論文中的許多想法。此外，我非常感激嘉棐學姊從提供實驗材料到陪同討論過程中的種種幫助，以及對我生活、論文進度各方面的關心；書萍學姐從我懵懂的碩一時起一步步教我跑實驗、設計實驗，經常多方鼓勵，又從不吝惜時間解答我的困惑；曉芳學姊在語料庫工具使用和相關概念上啟迪我許多，而她勤奮專注的工作態度也讓我引以為榜樣。

其實，這段時間還有一班默默在背後扶持我的人，是我最感謝的，就是和我同住弟兄之家的弟兄們，以及召會中的弟兄姊妹。謝謝他們無盡的愛和扶持，在我最軟弱、黑暗的時候仍舊接納我。沒有他們的代禱，我很難經過這段時日，也無法完成此一論文。逸威等弟兄們不論早晚、不嫌麻煩的到實驗室幫我做了無數次各種前測、陪伴我跑實驗。雅芬姐和弟兄們動用 PTT 個板、網誌、好友名單…，為了幫我找一個又一個問卷受試者。許多夜晚，聖讓辛苦地來實驗室幫忙錄完了幾百個音檔。明龍幫忙架設問卷網站，不知幾次幫我處理電腦問題。興睿、顥正溫暖的支持並提出富建設性的建議；黃弟兄不時提醒我讀書；王弟兄應時的陪伴我禱告；三總區的弟兄姊妹常在禱告中記念我。此外，還有許許多多的營養品、維他命、特製中藥…以及其它許多我無法在此一一提起的名字和事件。許多次，我看著一位位來幫忙的弟兄面對電腦按反應盒的情景，心裡只覺得不配和感激，也覺得我所得到的 data 之寶貴，是過於筆墨所能形容的。

最後，我要特別感謝我的父母和家人。父親張廣群樸實公義，一生勞苦為孩子打算，母親李素琴這些年間每日勞力工作，但卻單純喜樂信靠神；他們總是無私無悔的付出，不求自己的益處，竭力讓孩子幸福。我願向他們學習，一生在愛中捨己為人。而哥哥有一坦誠率直，是我的好同伴，總會為我禱告，往往就在陪我吃飯的談笑聲中，讓我心情舒緩許多。

謝謝你們。我想，論文結果的好、壞、成、敗還在其次，對我而言最重要的是一頁頁的論文，代表著在已過路上一次次的困難中所經歷的安慰和扶持，還有你們一次次的愛心和關懷。

謹將這篇論文獻給所有曾為此付出的人。

中文摘要

隱喻的心理處理歷程早有學者研究，因其對了解人類認知饒具意義。然而，隱喻和詞彙擷取過程之間的關聯卻少有人探討。此議題十分重要，因為理解約定俗成隱喻的基礎在於激發已然詞彙化的隱喻詞義，但早期的詞彙擷取模型卻鮮少區別出隱喻義和字面義這兩種性質不同的意義，並探討其處理歷程。本文嘗試整合隱喻和詞彙擷取研究，從 Giora (2003) 提出的層次顯著性假說出發，探討詞彙隱喻，也就是隱喻多義詞（例如：「壓力」）的心理處理歷程。根據層次顯著性假說，在認知上較為顯著的詞義，意即「較高頻、為人熟悉、或約定俗成程度高」的意義在語境中總是會在先期被激發。Giora (2003) 的模型不同於前人的模型，因其能廣泛的解釋詞彙擷取以及比喻語言的處理歷程，也因此在文獻中受到相當的重視 (Gibbs, 2001)。但其兩大主要問題在於：第一，對意義顯著性的定義模糊，尤其未清楚陳明意義顯著性和意義頻率之間的關係；第二，在語意分析和詞義區分上缺乏清楚的操作型定義。

針對這些議題，本研究採取了語料庫語言學方法及認知語意學理論，並將其與心理語言學實驗結合。我們根據中文詞彙網路區別「詞義」和「義面」兩種不同層次的意義，並計算這些詞義在語料庫中的頻率。在一系列詞彙聯想作業和跨模組詞彙激發作業中，我們發現：顯著性高而屬於「詞義」層次的字面意義無法充分在偏向隱喻義的語境中被激發。此結果和層次顯著性假說的預測相反，卻與 Ahrens 等 (1998) 和 Croft 與 Cruse (2004) 的詞彙語意理論相符，他們主張「詞義」層次的詞彙語意不能共存於同一語境之中。此研究的結果因此對層次顯著性假說並隱喻和詞彙擷取研究具有重要意義；我們特別認為，基於認知語言學的精細詞彙語意分析對此類研究十分必要。除此之外，本研究並闡明了詞義頻率與詞義顯著性的關係，亦即語料庫反映人類認知的程度，也顯示認知語意學理論能裨益心理語言學研究中對意義的詮釋。因此，此論文的成果對於認知科學研究將具有跨領域的貢獻。

關鍵詞：層次顯著性假說，詞義顯著性，語料庫詞義頻率，隱喻多義詞，詞彙隱喻，語境效應，約定俗成隱喻，認知語意學。

English Abstract

Processing of metaphor has long been studied due to implications on human cognition. But less has been explored as to its relationship with lexical access. This is important, because comprehension of conventional metaphors fundamentally hinges on activation of lexicalized metaphorical meanings, but early lexical access models rarely consider a distinction between literal and metaphorical meanings. This study attempts to bring these two lines of research together by investigating processing of lexical metaphors, i.e., metaphorical polysemy (e.g., "pressure") based on Giora's (2003) graded salience hypothesis. The graded salience hypothesis states that salient meanings, i.e., "more frequent, more familiar, or more conventional" meanings, are always initially accessed in context. Giora's model differs from previous models because it comprehensively interprets lexical access as well as figurative language processing, thus receiving much attention in literature (Gibbs, 2001). But it has two major problems: (1) Vague definition of *salience*, particularly its relationship with frequency, and (2) Unclear criteria for semantic analysis and meaning distinction.

To address these issues, this thesis combined a corpus linguistic approach and recent cognitive semantic theories with psycholinguistic experiments. I distinguished *sense*-level meanings from *facet*-level meanings based on Chinese Wordnet and calculate their sense frequencies in corpus. In one offline word association task and two online cross-modal lexical priming tasks, I found: Salient, sense-level literal meanings cannot be sufficiently activated in metaphorically-biased contexts. This contradicted the graded salience hypothesis's prediction but corresponded to Ahrens et al.'s (1998) and Croft and Cruse's (2004) lexical semantic theories that sense-level meanings cannot coexist in the same context. The study thus has significant implications on the graded salience hypothesis and for metaphor and lexical access research in general; particularly, a refined lexical semantic analysis based on cognitive linguistic theories is necessary. Besides, the results shed light on the relationship between frequency and salience, i.e., how corpus reflects human cognition, as well as how cognitive semantic theories can refine interpretations in psycholinguistic studies. Therefore, the study is expected to have a cross-domain contribution to the general field of cognitive science.

Keywords: Graded salience hypothesis, Salience, Corpus sense frequency, Metaphorical polysemy, Lexical metaphor, Contextual effects, Conventional Metaphor, Cognitive semantics.

Table of Contents

List of Figures

List of Tables

Chapter 1 Introduction[1]

How can meaning salience interact with contextual effects in the processing of metaphorical polysemy?

This is the fundamental question I ask in this thesis. The issue is important for psycholinguistic work on lexical ambiguity resolution and metaphor comprehension, and has implications for lexical semantic theories and computational linguistic models, because it specifically deals with the processing of conventional, lexicalized literal and metaphorical meanings (i.e. metaphorical polysemy, or *lexical metaphor*), as well as accompanying theoretical and methodological issues, such as meaning representation and effects of frequency and salience.[2]

An example for a metaphorical polysemy or lexical metaphor is the word *pressure*, which has both a literal meaning (referring to physical force) and a conventional, lexicalized metaphorical meaning (referring to psychological weight), as exemplified by an excerpt of *pressure*'s definitions in WordNet 3.0:

Pressure

Noun

(n) **pressure**, pressure level, force per unit area (the force applied to a unit area of surface; measured in pascals (SI unit) or in dynes (cgs unit)) *"the compressed gas exerts an increased pressure"*

(n) **pressure** (a force that compels) *"the public brought pressure to bear on the government"*

[1] This introduction organizes the ideas in a way similar to that in Ahrens (1995).

[2] In this thesis, *frequency* is taken as an objective measure, referring to the exact times a meaning occurs (in corpus). In contrast, *salience* is taken as an subjective measure, referring to meanings that are cognitively "foremost on one's mind" (Giora, 2003). This term's usage in psycholinguistic work is to be distinguished from that in computational linguistic work (Kilgarriff, 2004), where it refers to a computed value similar to mutual information (MI) value, according to which lexical items' collocates in corpus are ranked. Also notice that in this thesis I operationally define *salience* based on a comparison of different measures and do not take a particular measure, e.g., association, as the sole standard, since different measures' results may be inconsistent (see discussions in Chapter Two and Four).

In this thesis I explore how these two kinds of meanings, literal meanings and metaphorical meanings, are accessed in biased contexts when their frequencies and degrees of salience vary.

In what follows, I briefly introduce one important model that addresses the above question, i.e., the graded salience hypothesis (Giora, 2003) and its limitations. Then, I present the issues I explore in this thesis, in particular the accessibility of salient meanings in incompatible contexts and the consequence of a refined semantic analysis in an lexical ambiguity study. Finally, I outline the structure of the thesis.

1.1 The Graded Salience Hypothesis & Prediction

Giora (2003) proposes the *graded salience hypothesis*, which addresses lexical access as well as figurative language processing, thus appropriate for the current issue. The graded salience hypothesis states that salient meanings, i.e., "more frequent, more familiar, or more conventional" meanings that are "foremost on one's mind", are always initially accessed in context. Based on this hypothesis, conventional, lexicalized meanings in metaphorical polysemy will always be accessed as long as they are salient. Whether meanings are literal or metaphorical, and whether context biases the literal or metaphorical meaning will not lead to any difference in an initial processing stage.

1.2 Limitations of the Graded Salience Hypothesis

The graded salience hypothesis gained much support (see Giora (2003) for meta-analyses on previous studies and discussions on her own experimental results) and received much attention in the literature (Ahrens et al., 2007; Ariel, 2002; Gibbs, 2001; Mashal & Faust, 2008; Peleg & Eviatar, 2008; Peleg, Giora & Fein, 2001). But it has the following limitations: (1) Unlimited size of linguistic units, (2) unclear definition of salience, (3) unclear criteria for meaning distinction. Testing the hypothesis requires a control over these limitations. And this study claims that once the limitations are

controlled for, results deviate from the hypothesis' prediction. I briefly describe the limitations—linguistic unit size, definition of salience, and meaning distinction criteria— as following:[3]

1.2.1 Unlimited Size of Linguistic Units

The graded salience hypothesis does not distinguish word-level meanings from phrasal-level or sentential-level meanings (see Gibbs (2001) for further discussion). An example in Giora's (2003) work is *Jump on it!*, which has both a phrasal-level 'utilize' meaning and a literal 'hop' meaning, composed by individual words. In this case, observed activation of both meanings may result from the fact that the meanings pertain to linguistic units on different levels. The current study focuses on word-level meanings to address this issue.

1.2.2 Unclear Definition of Salience

The graded salience hypothesis lacks clear criteria to determine or operationalize degree of salience. Gibbs and Colston (2006) indicates that the measures of salience proposed by Giora, such as word association and online priming results, may not lead to "the same salient meaning". Particularly, it is unclear how frequency[4] of meanings may or may not correspond to results from other measures. To clarify this issue, three measures of salience were adopted in this study: (1) Corpus-based relative sense frequency, (2) offline word association task, and (3) online priming task for words out of context. Results from each measure were then compared and taken as the basis for later discussion on salient meaning activation in context.

1.2.3 Unclear Criteria for Meaning Distinction

A more general and fundamental problem that plagues all lexical access models, including the graded salience hypothesis, is a lack of clear, theoretically-driven criteria

[3] See Chapter Two for further necessary details.
[4] See footnote 1 for distinction between *frequency* and *salience* in this study and Chapter Two for further details.

to distinguish different types of meaning. Particularly, recent cognitive semantic theories promote an distinction between *senses* and *facets* (Ahrens et al., 1998; Ahrens, Huang & Chuang, 2003; Croft & Cruse, 2004). These two kinds of meanings differ mainly because sense-level meanings cannot coexist in the same context, while facet-level meanings can. Such a distinction is crucial for lexical ambiguity research, because without this, any observed contextual effects—i.e., any claim for an exhaustive access or selective access of meaning—are questionable. The current study deals with this issue by focusing on words with only sense-level meanings (Lin & Ahrens, forthcoming).

To summarize, I examine activation of salient and nonsalient literal and metaphorical meanings in contexts biasing to either meanings by:

- Focusing on word-level meanings,
- Defining salience by comparing different measures such as corpus frequency, association data, and priming results, and
- Focusing on sense-level meanings.

The major issues center around the effect of context and salience on processing of metaphorical polysemy when the above factors are controlled or considered. How will salient meanings be activated in compatible and incompatible contexts? Will literal or metaphorical meanings differ in their access in context? Can such meanings be coactivated in the same context when only sense-level lexical meanings are involved? These are the major questions that will be addressed in this study.

1.3 Overview of Thesis

The access of sense-level, salient/nonsalient, literal and metaphorical meanings in compatible and incompatible contexts will be examined in an online cross-modal lexical priming experiment. Degree of salience will primarily be based on frequency and then

discussed in terms of results in a word association task and in an online cross-modal priming experiment for words out of context. Contrary to the graded salience hypothesis' prediction that salient (literal or metaphorical) meanings will always be accessed in incompatible contexts, it is found that salient sense-level literal meanings are only accessed in compatible contexts and that conventional literal and metaphorical meanings differ in their accessibility in biased contexts.

This study thus is important in the following ways:

- The applicability of the graded salience hypothesis to sense-level, lexicalized literal and metaphorical meanings is reconsidered based on the results.
- As the present lexical ambiguity research requires a finer semantic analysis, the study implicates that a distinction between literal and metaphorical, and sense-level and facet-level meanings is necessary for a more accurate examination of meaning access issues.
- The traditional notion that conventional literal and metaphorical meanings do not differ in processing is reconsidered for metaphor research, which mainly found a contrast between conventional and novel metaphorical meanings but not within salient and nonsalient conventional metaphorical meanings.
- Different measures of salience are compared and evaluated, which methodologically contributes to later psycholinguistic as well as computational linguistic work to select salient meanings, particularly because the relationship between frequency and salience is clarified.

The following chapters are structured as follows: Chapter Two reviews a recent cognitive semantic account of meaning which is incorporated into the current study, processing of metaphorical polysemy, and other minor, methodological issues. Chapter Three then introduces the methodology for material preparation. Chapter Four provides

a comparison and evaluation of three measures of salience—frequency, association, and priming data—as well as criteria in the current study to determine salience. Chapter Five describes an online cross-modal priming experiment for words presented in context that aims to examine how salient meanings are activated in different types of contexts. Finally, Chapter Six provides a general discussion and conclusion.

Chapter 2 Literature Review

2.1 Overview of Chapter

The earlier discussion on the graded salience hypothesis is not complete if the background is ignored, because the graded salience hypothesis fills up gaps in lexical ambiguity resolution literature, while the hypothesis itself has gaps to be filled up. The goal of this chapter is to firstly review problematic issues in lexical ambiguity literature, and then to specifically review the problems in the graded salience hypothesis in detail. Then, I provide the motivation, research question, and research hypothesis for the current research. I review methodological issues related with the current study in the end.

2.2 Problematic Issues in Lexical Ambiguity Resolution Literature

In this section I expose several inadequacies in lexical ambiguity resolution literature by reviewing fundamental theoretical issues concerning representation and distinction of polysemous meanings, as well as how meaning is treated in previous experimental works on lexical ambiguity resolution. Two major inadequacies are (1) lack of clear criteria for meaning distinction, and (2) lack of investigation on abstract meanings. As a consequence, I propose to compensate for the insufficiencies by adopting the meaning distinction criteria developed by Croft and Cruse (2004) and by Ahrens et al (1998; 2003) to differentiate sense-level and facet-level meanings, and to focus on polysemous words with both concrete, literal meanings and abstract, metaphorical meanings, i.e., metaphorical polysemy. This section is important because it lays the groundwork for hypothesis formulation in the study by demonstrating the potential impact of meaning distinction on the examination of contextual effects.

In what follows, I firstly review the aforementioned cognitive semantic approach to meaning distinction, which I consider an improved approach than those before. Then

I briefly discuss the need to investigate abstract meanings. These points will be further contrasted to the traditional approaches to meaning distinction in psycholinguistic experiments, which generally lacks clear meaning distinction and investigation on abstract meanings. Finally, I propose the importance of the thesis in terms of the approach it adopts and the range of meanings it covers.

2.2.1 Distinction of Polysemous Meanings: A Cognitive Approach

Polysemy is broadly defined as a lexical item having multiple meanings.[5] And the boundary and relationship among these multiple meanings have been major issues in the study of polysemy, i.e., how polysemous meanings can be distinguished and categorized. Putsejovsky (1991), for example, follows Weinreich (1964) and categorizes polysemy into *contrastive ambiguity* and *complementary polysemy.* The former describes unrelated meanings sharing the same word form, i.e., homonymy, while the latter, also termed as *logical polysemy*, involves meanings that are systematically related, which can be derived through a couple of generative devices, e.g., co-ercion and type shifting. Recent cognitive semantic theories further promote a distinction between *senses* and *facets* (Ahrens et al., 1998; Ahrens et al., 2003; Croft & Cruse, 2004), which is important for lexical ambiguity research. I provide an overview, the operational definitions, the underlying mechnisms, and their differences from homonymy and polysemy as below:

2.2.1.1 Sense and Facet: An Overview

For an overview, senses and facets mainly differ in the fact that sense-level meanings cannot coexist in the same context, while facet-level meanings can. Such a distinction is claimed to be cognitively more precise than the traditional

[5] I currently do not distinguish *lexical units* and *lexemes* in Cruse's (1986) sense. Cruse (1986) suggests that a lexical unit involves a unique meaning and a lexical form (with its alternative inflectional manifestations), while a lexeme can consist of multiple related lexical units. I use the term *lexeme* to mean a correspondence of a word's (phonological and orthographical) form and its meaning.

homonymy-polysemy distinction, because it reflects a dynamic construal process occurring in ongoing context that leads to the sense-facet difference (see below for a detailed discussion). This approach to meaning distinction is hence crucial for lexical ambiguity studies, because without distinguishing senses from facets, any observed contextual effects—i.e., any claim for an exhaustive access or selective access of meaning—are questionable. Specific details concerning the definition and formation of such meanings are provided as following:

2.2.1.2 Operational Definitions of Sense and Facet

Ahrens et al. (1998; 2003) propose two sets of clear criteria to define senses and facets: Sense-level meanings are separate, distinct meanings of a lexical item, which (1) cannot coexist in the same context, (2) are not extended from a core sense, and (3) have no logical/conceptual mappings in between, and cannot inherit a link between senses from a class of nouns[6]. In contrast, facet-level meanings can simultaneously reflect different aspects of a sense in the context, which (1) can coexist in the same context, (2) are (metonymically or meronymically) extended from a core sense or another facet, and (3) can inherit similar sense extension method from the class of nouns it belongs to (Ahrens et al., 1998; Ahrens et al., 2003). A typical example for facet-level meanings is *newspaper*, whose text (the content of newspaper) and tome (the material part) meanings can coexist in context.

In this study, I follow Ahrens et al. (1998; 2003) in defining sense and facet, because of its clarity, and because their criteria are observed in the construction of Chinese Wordnet, a large-scale Chinese lexical resource. I then collect materials mainly from Chinese Wordnet, which allows me to maintain consistent criteria to define senses and facets.

[6] As noted by Ahrens et al. (2003), however, at least in the case of verbal meanings (and presumably also for nominal meanings), the coexistence criterion can take precedence over the third criterion.

2.2.1.3 Intrinsic Reason: A Dynamic View on Lexical Meaning

The above discussion only touches upon the superficial sense-facet distinction, and not the intrinsic reason that underlies the meanings' formation. In this section I briefly review Croft and Cruse's (2004) cognitive account of senses and facets and contrast it with the traditional homonymy-polysemy distinction. I will show that this view is more persuasive than the traditional approach because it is in accordance with basic human cognitive abilities; it also allows a greater explanatory power for the current research as a lexical ambiguity study, because it captures delicate aspects of the construal of lexical meanings.

Cognitive linguists view language as a "particular configuration of general human cognitive abilities", e.g., attention, categorization, perspectivization, etc., as found in cognitive psychology (Croft & Cruse, 2004: 2-3). In this sense, they consider language in use essentially reflects the process of conceptualization. Hence, semantics is conceptualization, since meaning is dynamically construed in ongoing context (ibid.: 97-98).

The consequence of this view is that context, temporal factors, together with construal of "raw materials" of meaning are crucial for interpreting the polysemous phenomenon:

First of all, under such a dynamic view, context is crucial because it is in ongoing context that the conceptualization process occurs. Croft & Cruse (2004) quoted from Wittenstein (2001, from *The Guardians,* Sept. 7, 2001): "Every sign by itself seems dead. What gives it life? In use it is alive. Is life breathed into it there?—Or is the use its life?" Croft & Cruse (2004) even claim that "without context, words have no meanings", where "meanings" refer to the final, comprehended meanings that have undergone the conceptualization process in context.

Secondly, this dynamic view also highlights the importance to consider temporal differences. Since comprehension is a process, meaning (as a general term) in different temporal stages should be distinguished. Croft and Cruse (2004) specify three types of meanings throughout the process they undergo: (1) *purport* refers to the material to form a meaning before it is construed; (2) *pre-meanings* refers to stages after *purport*, where meanings take on some "logical properties" such as sense boundaries; and (3) *interpretation* refers to the final "contextually construed meanings". The formation of senses and facets is in context and mainly in the interpretation stage.

Thirdly, human construal and inherent properties of word meanings are also important for the formation of senses and facets. The extent to which one meaning can be distinguished from another meaning in a polysemous lexical item depends on the extent to which people construe the meanings' inherent differences. Croft and Cruse (2004) use the term "autonomy" to describe the degree in which a portion of meaning potentials in a lexical item can be independent to the other parts in construal. Inherent differences in lexical meanings lead to "autonomy" of different strengths, which, when construed, forms "sense boundary" that varies in their strength and hence the distinction between senses and facets. Sense-level meanings involve stronger "autonomy" and facet-level meanings, weaker "autonomy". For example, the two meanings of *bank* ('financial institution' and 'riverbank') involve the strongest *attentional autonomy*, because the appearance of one sense occupies the focus of attention (which is one human cognitive ability), and disallows the coexistence of another sense in the same context.[7] Such an autonomy thus leads to a full sense boundary in construal, rendering the two meanings sense-level meanings. Polysemy[8], therefore, is defined as a "process

[7] For a more complete discussion of different types of autonomy, and how it influences the sense boundary effect, see Croft and Cruse (2004); the details about autonomy, however, is not the focus of this study.

[8] Here in its broad sense.

of isolating a portion of meaning potential", where "a sense boundary delimiting an autonomous unit of sense" is immediately created in context (ibid.: 109).

Adopting such a dynamic view on lexical meanings for lexical ambiguity studies is important and has the following advantages: (1) It explains polysemy based on the operation of basic human cognitive abilities, e.g., *attention*, which is long studied in cognitive psychology. The explanation thus is natural and compatible with findings in the general field of cognitive science. (2) This view distinguishes meanings at different temporal stages of construal, thus allowing a greater explanatory power for lexical ambiguity studies to differentiate effects at different temporal points. (3) This view distinguishes sense-level meanings and facet-level meanings in the final stage of construal. This is crucial for lexical ambiguity studies because the distinction of senses and facets directly impacts the results and interpretation, i.e., whether coactivation of lexical meanings in the same context can be observed.

This dynamic view contrasts with the traditional approach to meaning in psycholinguistic studies. That is, meanings are not merely invariant, static entries in the lexicon, an assumption underlying many lexical access studies (Forster & Bednall, 1976; Hino, Pexman & Lupker, 2006; Piercey & Joordens, 2000; Siakaluk et al., 2007), but rather are products of a dynamic construal in ongoing context. I detail the contrasts between this dynamic view and the traditional approach to polysemous meanings in experimental works on lexical ambiguity in 2.2.3.

2.2.1.4 Sense-facet Distinction vs. Homonymy-Polysemy Distinction

It should be particularly noted that the distinction between senses and facets cannot be equated with the notion of *homonymy* and *polysemy*, since in recent years researchers begin to notice the processing differences between the two (Beretta, Fiorentino & Poeppel, 2005; Klepousniotou, 2002; Klepousniotou & Baum, 2005a; Klepousniotou,

Titone & Romero, 2008). Traditionally, *homonymy* refers to two distinct, unrelated lexemes that coincidentally share the identical word form, which may or may not be due to historical reasons. *Polysemy* (in its narrow sense), on the other hand, refers to one single lexeme that has multiple related meanings, as in the case of *mouth* (i.e., referring to physical *mouth* or to *mouth* of a river; Klepousniotou & Baum, 2005a). While the *homonymy-polysemy* distinction hinges on the relatedness of meanings, either diachronic or synchronic (Croft & Cruse, 2004), the distinction between sense and facet much depends on the co-existence of meanings in context.

The homonymy-polysemy distinction therefore is vague and cognitively imprecise (see ibid., for a detailed discussion), since homonymy involves only sense-level meanings, but polysemy, which covers a wide range of metaphorically, metonymically, or meronymically extended meanings, involves meanings on sense and facet levels. This study thus adopts the sense-facet distinction together with its underlying dynamic view to approach lexical meanings, for sake of clear criteria for semantic analysis and a finer-grained approach closer to the reality in lexical ambiguity. The relationship of homonymy, polysemy, sense, and facet is illustrated in Figure 1:

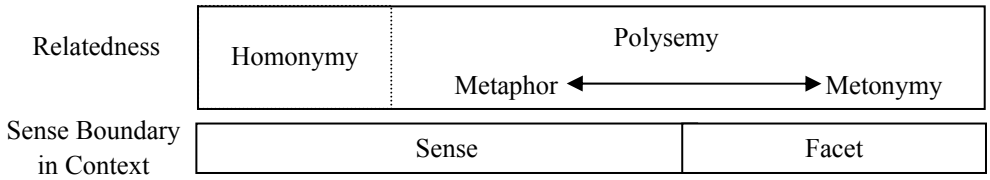

Figure 1. Homonymy, Polysemy, Sense, & Facet.

2.2.2 Investigation on Abstract Meanings

2.2.2.1 The Need to Investigate Abstract Meanings

The second major inadequacy in lexical ambiguity research is a lack of investigation on abstract meanings. Because abstract meanings may be processed differently from concrete meanings there is a need to investigate such meanings. First of

all, there is a contrast between concrete and abstract words. Vigliocco & Vinson (2007), citing Barsalou & Wiemer-Hasting (2005), states that concrete and abstract words (e.g. *freedom*) may be comprehended with different focus of attention, which is placed either more on the object itself or on contextual information. Secondly, and more accurately, there is a contrast between concrete and abstract meanings. Because a single lexical item's multiple meanings may also vary in their degree of concreteness, it is more accurate to investigate access of the particular concrete and abstract meaning. In other words, because the frequency of an individual word's abstract meaning influences the word's degree of concreteness, it is not enough to rate individual words' degree of concreteness and compare reaction times between concrete and abstract words (Gernsbacher, 1984; Tokowicz & Kroll, 2007; Tyler et al., 2002). However, Vigliocco & Vinson (2007) indicates that most lexical memory studies tend to focus on access of nouns, and "more precisely nouns referring to concrete objects". Processing of abstract meanings is ignored in lexical access studies.

2.2.2.2 Defining Abstract Meanings

The premise to investigate processing of abstract meanings is to define them based on clear criteria. This study adopts a theoretically-driven criterion to define abstract meanings, that is metaphorical meanings are identified as abstract (Chung, 2007; Lakoff, 1993; Lakoff & Johnson, 1980), in contrast with literal meanings. This partly motivates the current study to investigate processing of metaphorically-based polysemy[9] (which have both literal and metaphorical meanings), since in this way abstract and concrete meanings can be clearly defined and contrasted.

[9] More reasons will be provided in a later section discussing metaphorical polysemy.

2.2.3 Problematic Meaning Distinction in Lexical Ambiguity Literature

This section focuses on how lexical meanings are dealt with in lexical ambiguity literature. The goal is to show that, contrary to the clear meaning distinction criteria presented in earlier sections, early lexical access models or previous studies of lexical ambiguity did not attain an accurate meaning distinction. Hence, this study deals with lexical meanings based on the sense-facet distinction criteria mentioned above.

2.2.3.1 Early Lexical Access Models

Early lexical access models supporting different processing accounts are proposed and applied to central issues in lexical ambiguity studies, such as meaning activation in context (e.g., Glucksberg, Kreuz & Rho, 1986; Simpson, 1984; Simpson & Burgess, 1985; Swinney, 1979; Tabossi, 1987) or ambiguity advantage/disadvantage effects (i.e., are multiple-meaning words accessed faster?; Adelman, Brown & Quesada, 2006; Borowsky & Masson, 1996; Joordens & Besner, 1994; Kawamoto, Farrar & Kello, 1994; Klepousniotou & Baum, 2007; Lin & Ahrens, forthcoming; Masson & Borowsky, 1995). These models hold either a modular, an interactive, or a hybrid view of processing. The modular view considers meaning access unaffected by contextual information (Fodor, 1983). Under this general point of view, the exhaustive access model assumes immediate activation of all meanings (Kintsch & Mross, 1985; Onifer & Swinney, 1981; Seidenberg et al., 1982; Swinney, 1979; Tanenhaus, Leiman & Seidenberg, 1979), and the ordered access model assumes faster activation for frequent meanings than for infrequent meanings. In contrast, the interactive view generally considers meaning access affected by contextual information; meanings can be directly and appropriately activated in context (McClelland & Rumelhart, 1981; Simpson, 1981; Tabossi, 1988; Tabossi & Zardon, 1993). The hybrid view in turn regards both frequency of meaning and context as influential factors, as in the reordered access

model (Chen & Boland, 2008; See Giora, 2003, for a succinct review; Kawamoto, 1993; cf. Tabossi, Colombo & Job, 1987; Vu et al., 2000; Vu, Kellas & Paul, 1998).

These models however are designed without solid, linguistically-based treatment of lexical meanings, e.g., the framework proposed in 2.2.1, thus ignoring comprehension differences produced in the dynamic construal process. Contrary to the delicate distinction of meanings in ongoing temporal stages and the sense-facet distinction in the interpretation stage, the basic conceptual deficit underlying these early models is to view mental lexicon as dictionary-like, and to postulate lexical meanings as homogeneous, static entries that are "selected" or "activated" when being accessed, but remain unchanged *per se* throughout the whole process of comprehension. Such a view is naturally assumed in the 1970s, but may be inadequate in light of today's lexical semantic theories, since these models do not distinguish homonymy from polysemy, let alone sense from facet, literal meanings from metaphorical meanings, or concrete from abstract meanings. Therefore, a considerable gap is left in the pursuit of nature of meaning comprehension, because recent theoretical accounts of lexical meanings have not been considered in these models. Table 1 aims to show how important aspects of meaning are ignored in earlier lexical access models:

Table 1. Lexical Access Models in Ambiguity Literature.

	Model	Levels of Meaning	Context	Lexical Category	Metaphor -icity	Salience
Modular	Random Access Model	×	×	×	×	×
	Ordered Access Model	×	×	×	×	✓
Interactive	Selective Access Model	×	✓	×	×	×
	Reordered Access Model	×	✓	×	×	✓

For the aforementioned reasons, the current study does not adopt these lexical access models, but will focus on one recently developed model, the graded salience hypothesis (Ahrens et al., 2007; Giora, 1997; Giora, 2003; Giora & Fein, 1999a; Giora

& Fein, 1999b; Mashal & Faust, 2008), which takes metaphoricity, degree of salience, and context, etc. into consideration and will be introduced and critiqued in 2.3.

2.2.3.2 Meaning Distinction in Lexical Ambiguity Literature

This section specifically examines how different types of meanings are dealt with in ambiguity studies, which then demonstrates the need for refined semantic analyses in such studies. Three major approaches to lexical meanings are identified: (1) The no-distinction approach, (2) the homonymy-polysemy approach, and (3) the sense-facet approach, based on the criteria introduced in 2.2.1. I show that these previous studies do not yet attain an adequately clear meaning distinction. Hence, it is the goal of the current study to further pursue improvement in meaning distinction.

No-distinction Approach

The no-distinction approach regards meanings as homogeneous static entries in the mental lexicon without concerning the need to distinguish different types of meanings (e.g., Ahrens, 2001; Forster & Bednall, 1976; Hino et al., 2006; Siakaluk et al., 2007; Swinney, 1979). In other words, this approach, generally gathering meanings from meaning generation tasks, does not discern whether multiple meanings in a lexical items are related (polysemous) or unrelated (homonymous), able or unable to coexist in the same context (sense-level or facet-level), concrete or abstract, literal or metaphorical, etc., nor does this approach discern meanings in different temporal stages. The term "ambiguity" thus unrestrictively refers to various different phenomena. For example, Onifer and Swinney (1981), examining activation of ambiguous meanings in context, included in their "ambiguous" stimuli words with unrelated homonymous meanings and related polysemous meanings (e.g. *bank* and *star* as in *star in the heaven* or *movie star*, the former also being a concrete literal meaning, and the latter, an abstract, metaphorically-extended meaning), an item whose meanings involved different lexical

categories (*cold*), and even homophones (e.g. *flower-flour*, *choose-chews*, *chord-cord*), the ambiguity of which did not result from multiple meanings pertaining to the same lexeme like the others. This approach thus ignores possible processing differences between different types of meanings, and will not be adopted in the current study.

Homonymy-Polysemy Approach

The homonymy-polysemy approach, based on various criteria, distinguishes homonymous meanings from polysemous meanings as researchers define. As reviewed in 2.2.1.4, homonymy typically involves unrelated meanings that share the same word form, which may or may not result from historical coincidence (Croft & Cruse, 2004). Polysemy, on the other hand, involves related meanings, the relationship of which could be metaphorical, metonymical, meronymical, etc. (Ahrens et al., 1998). In practice, researchers observe different criteria to distinguish the two types of meanings. Rodd et al. (2002) and Beretta et al. (2005), for example, adopted Wordsmyth Dictionary (http://www.wordsmyth.net/live/home.php) as the standard to distinguish polysemy (also referred to as *systematic ambiguity*, having multiple related *senses* under one dictionary entry) and homonymy (also referred to as *unsystematic ambiguity*, having multiple *meanings* under different dictionary entries).[10] Klepousniotou and colleagues (Klepousniotou, 2002; Klepousniotou & Baum, 2005a; Klepousniotou & Baum, 2005b; Klepousniotou & Baum, 2007; Klepousniotou et al., 2008), on the other hand, collected homonyms from standardized norms (which are based on offline production tasks, rating tasks, etc.; e.g. Gilhooly & Logie, 1980) while further distinguished polysemy into metaphorical polysemy and metonymical polysemy and chose materials from those "documented in the theoretical linguistic literature".

[10] In Rodd et al.'s (2002) terms, *sense* refers to related meanings and *meaning* refers to unrelated meanings. Hence their terminology is different from the current study. Here I maintain their original usage.

The homonymy-polysemy approach improves the semantic analyses in ambiguity literature, but still has the following insufficiencies:

(1) Vague definitions of homonymy and polysemy: As argued in 2.2.1.4, the homonymy-polysemy distinction is cognitively vague and imprecise because it hinges on either diachronic or synchronic relatedness of meanings. Hence two meanings may at present seem barely related owing to long period of development, while they are still etymologically related for, e.g., a lexicographer. In other words, relatedness of meanings varies from person to person, thus blurring the boundary between homonymy and polysemy.

(2) Inconsistent operational criteria and meaning distinction: Vague definitions also lead to the second inadequacy, i.e., difficulty to maintain a consistent meaning distinction. Meanings may be judged as homonymous based on standardized norms (production tasks), but polysemous based on dictionary meanings, depending on the operational criteria and the lexicographers' decision. For example, *coach* is a homonym in Klepousniotou and colleagues' studies, but is a polysemy based on Rodd et al.'s criteria (Wordsmyth dictionary). This renders comparison and generalization of the findings difficult, if not impossible.

(3) Most importantly, the homonymy-polysemy approach ignores potentially confounding multiple related meanings. That is, under each unrelated homonymous meaning entry there still can be multiple related polysemous meanings. For example, Klepousniotou and colleague (2007) obtained slowest reaction times for homonymy, faster reaction times for metaphorical polysemy, and the fastest reaction times for metonymical polysemy in auditory lexical decision tasks, thus claiming an advantage for related meanings and a disadvantage for unrelated meanings. However, they only highlighted the homonymous, metaphorical, and metonymical meanings in the

polysemous lexical items without noticing a cluster of other related meanings in these words. It is thus difficult to tease apart effects of the whole bunch of multiple related meanings from effects of, e.g., homonymy. Table 2 demonstrates the reanalyzed number of meanings of Klepousniotou & Baum's (2007) stimuli based on WordNet 3.0 definitions. This reanalysis suggests that besides their specified homonymous, metaphorical, or metonymical meanings, there are still many unspecified related meanings. Given the fact that the numbers of meanings significantly differ between most of the groups [$F(4,85)=10.54$, $p<.001$; separate independent t-tests: Unbalanced Homonymy vs. Metaphorical Polysemy, $t(34)=-2.82$, $p<.01$; Unbalanced Homonymy vs. Metonymic Polysemy, $t(34)=-3.57$, $p=.001$; Balanced Homonymy vs. Metonymic Polysemy, $t(34)=-2.52$, $p<.02$; Balanced Homonymy vs. Metaphorical Polysemy (near-significance), $t(34)=-1.81$, $p=.08$; Unbalanced Homonymy vs. Unambiguous Words, $t(34)=-7.16$, $p<.001$; Balanced Homonymy vs. Unambiguous Words, $t(34)=-4.78$, $p<.001$; Metaphorical Polysemy vs. Unambiguous Words, $t(34)=4.67$, $p<.001$; Metonymic Polysemy vs. Unambiguous Words, $t(34)=-2.51$, $p<.02$], it is very difficult to conclude that the observed homonymy, metaphor, and metonymy effects purely result from the particular types of meanings and not from differences in the numbers of related meanings. Therefore, although the homonymy-polysemy approach already improves the semantic analyses in ambiguity studies, given the above concerns it will not be adopted in the current study.

Table 2. Reanalysis of Stimuli's Number of Meanings (NOM) in Klepousniotou & Baum (2007) Based on WordNet 3.0.

Metaphorical Polysemy	NOM	Metonymic Polysemy	NOM	Unambiguous Words	NOM	Balanced Homonymy	NOM	Unbalanced Homonymy	NOM
Mouth	11	glass	12	seven	3	mass	11	march	14
Arm	8	bottle	5	clay	5	china	4	race	10
Neck	6	fig	4	region	5	cell	7	file	9
Shoulder	8	cup	11	notion	4	mold	14	scale	18
Tongue	10	bag	14	guest	4	match	19	count	12
Cow	4	theater	3	myth	1	panel	10	yard	9
Star	12	pipe	9	noon	1	bowl	12	drill	9
Sheep	3	lemon	5	planet	3	pitcher	5	coach	7
Lip	5	onion	3	tent	3	cape	2	port	14
Fox	10	oak	2	monk	2	pupil	3	foil	8
Nucleus	6	pine	3	lagoon	1	bat	10	fan	7
Doll	2	tub	3	razor	2	tap	20	toll	5
Pig	9	bin	4	cigar	1	seal	15	bolt	16
Worm	5	cage	6	dusk	2	bass	9	mint	8
Gem	5	alley	2	ink	5	hail	8	sage	5
Spice	5	maple	2	chalk	5	spade	4	racket	7
Pillar	5	arena	4	thorn	3	cricket	3	mole	6
Parrot	3	chimney	2	gust	1	tick	8	perch	10
Mean	**6.50**		**5.22**		**2.83**		**9.11**		**9.67**

*NOM sums up number of meanings in nominal, verbal, or adjectival meanings.

Sense-Facet Approach

The sense-facet approach distinguishes sense-level meanings and facet-level meanings based on Ahrens et al.'s (1998; 2003) criteria, thus having the aforementioned advantages, although to date only two studies (Lin & Ahrens, forthcoming; Tsai, 2005) followed this approach, both failing to attain an appropriate application. The reasons are stated below:

First of all, the sense-facet distinction was not carefully done in Lin & Ahrens' (forthcoming) and Tsai's (2005) studies. Based on analyses of meaning generation tasks and Ahrens et al.'s (1998; 2003) meaning distinction criteria, Lin and Ahrens (forthcoming) conducted lexical decision tasks on Chinese nouns that had multiple sense-level meanings, obtaining an ambiguity advantage effect. Based on a more accurate meaning distinction in Chinese Wordnet,[11] Tsai (2005) however found contrary effects for nouns and verbs having multiple senses or multiple facets.

[11] A large-scale Chinese lexical resource developed based on Ahrens et al.'s (1998; 2003) criteria for sense-facet distinction. See introduction in later sections.

Multiple-sense nouns obtained slower reaction times than one-sense nouns and vice versa for verbs; multiple-facet nouns obtain faster reaction times than one-facet nouns and vice versa for verbs. She then reanalyzed Lin and Ahrens' (forthcoming) *multiple-sense nouns* and found them in fact involve a significantly greater number of facet-level meanings than their *one-sense nouns*, which confounded their effects and suggested an unsatisfactory meaning distinction. On the other hand, Tsai's (2005) stimuli were not without problems. For one thing, she took words with only sense-level meanings[12] but no facet-level meanings in Chinese Wordnet as her *one-facet* words, thus falsely equating facet-level meanings with sense-level meanings. For another, her *multiple-sense* and *one-sense verbs* may have facet-level meanings, and her *multiple-facet* and *one-facet* words may have multiple senses. Although between groups the number of uninterested facets or senses did not differ, it is not totally convincing that her effects avoid any influence caused by these uninterested meanings.

Secondly, back to the big issue, the sense-facet distinction is theoretically not meaningful if there is no context. It is indicated in 2.2.1.3 that senses and facets are formed through the conceptualization process occurring in ongoing context and mainly in the final interpretation stage. Hence, the distinction of sense-level meaning and facet-level meaning, i.e., whether meanings can or cannot coexist in the same context loses its significance if the lexical items are only examined in simple lexical decision tasks, as in Lin & Ahrens' (forthcoming) and Tsai's (2005) studies.

Thirdly, although they attempted to adopt the sense-facet approach, Lin & Ahrens (forthcoming) and Tsai (2005) did not further distinguish concrete and abstract meanings. Although sense-facet distinction may account for context effects, it is indicated in 2.2.2.1 that concrete and abstract meanings may also involve potential

[12] They involve one or more sense-level meanings.

processing differences. However, such a difference was not considered in Lin & Ahrens' (forthcoming) and Tsai's (2005) studies, since concrete and abstract meanings were all included and not specifically distinguished in their stimuli.

Fourthly, besides the sense-facet distinction, Lin & Ahrens (forthcoming) and Tsai (2005) did not deal with the relationship between the lexical meanings. Again, the sense-facet distinction deals with the construed boundary effects in context, but does not deal with the issue of meaning relatedness.[13] However, meanings related in different ways (unrelated, metaphorically related, metonymically related, etc.) may still be processed differently (Azuma & VanOrden, 1997; Frisson & Pickering, 1999; Geiger & Ward, 1999; Hino et al., 2006; Klein & Murphy, 2001; cf. Klepousniotou, 2002; Klepousniotou & Baum, 2005a; Klepousniotou et al., 2008).[14] But Lin & Ahrens' (forthcoming) and Tsai's (2005) stimuli involved unrelated meanings, metaphorically extended meanings, as well as metonymically related meanings.[15] Hence, their studies were not powerful enough to avoid varied semantic relationships as one confounding factor.

Lastly, the stimuli selection in Lin & Ahrens (forthcoming) and Tsai (2005) was problematic. Lin & Ahrens (forthcoming) claimed to focus on nouns, while their stimuli included an item that was not really a noun (其他 *qi2 ta1* 'other', tagged not as a noun but as *數量定詞* 'quantitative determinative' (Neqa) in CKIP corpus, and defined as a determinative in Chinese Wordnet; it belonged to a class of words meaning *many, some,*

[13] Because relatedness is a matter of degree, it cannot be adopted as the basis for a clear-cut distention of meanings.

[14] Klepousniotou and colleagues have not successfully dealt with this issue because they do not control for the total number of meanings between groups, or at least confirm the meanings under examination are the strongest meanings in the lexical items, which can be done by checking the metaphorical or metonymic meanings' frequency or salience (see the discussions below). However, I support the view that meanings extended in different ways should be differentiated.

[15] Tsai (2005) claims her stimuli do not involve "clear metaphoric extensions" (p. 99). This however is not the fact, because Chinese Wordnet clearly indicates metaphorical meanings by adding 比喻 *bi3 yu4* 'metaphorical' in the definitions, which was found in her stimuli.

these, etc., in Chinese). Tsai (2005) in turn included synonyms in her *multiple-sense nouns* (兄弟 *xiong1 di4* 'brother' and 弟兄 *di4 xiong1* 'brother'—which have four overlapping synonymous senses—let alone another very similar word 弟弟 *di4 di5* 'younger brother'). Their stimuli selection hence rendered their results less convincing.

2.2.4 Summary: An Integrated Approach and the Range of Meaning Covered in the Current Study

In 2.2 I have dealt with fundamental meaning representation issues and suggested that previous approaches to lexical meaning should be improved to fill up the gaps in psycholinguistic studies on lexical ambiguity, that is, lack of clear criteria for meaning distinction and lack of investigation on abstract meanings. While the homonymy-polysemy approach fails to be clear meaning distinction criteria, the sense-facet approach does not specifically address the relationship between lexical meanings, e.g., metaphorically related meanings. Since both approaches show signs that semantic relationship and meaning distinction are important factors to be considered in lexical ambiguity resolution, this study attempts to adopt both: On the one hand, the sense-facet approach will be the most fundamental approach I take due to the advantages discussed before; on the other hand, I specifically address one kind of semantic relationship, i.e., metaphorically extended meanings, in order to fill up the gap of lack of investigation on abstract meanings. That is, I will particularly limit the scope of study to lexical items that have sense-level literal or metaphorical meanings, i.e., metaphorical polysemy or lexical metaphors. In this way, I attempt to take important factors in the homonymy-polysemy approach and sense-facet approach into consideration. The range of meanings covered in this study is illustrated in Fig. 2:

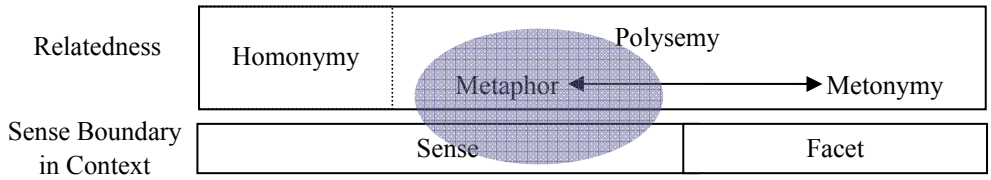

Figure 2. Range of Meaning Covered in the Study.

Based on the above discussion, I claim that the study of sense-level metaphorical polysemy is crucial for the pursuit of the nature of meaning comprehension. First of all, these lexical items only have sense-level meanings, thus allowing the researcher to clearly observe whether there is a contextual effect. Secondly, these lexical items have clearly defined concrete (literal) and abstract (metaphorical) meaning, which allows the researcher to observe if there is any processing contrast between concrete and abstract lexical meanings. Thirdly, in terms of meaning relatedness and semantic relationship, the meanings in the items are clearly related in one particular, well-defined way (i.e., metaphorical extension), while in terms of sense boundary in context, they can be isolated, i.e., theoretically they cannot coexist in the same context. Therefore, this class of words constitutes an excellent candidate for examination of sense-facet effects and processing of abstract meanings. After all, early studies mostly focus on resolution of homonymousy ambiguous meanings, where it is natural that unrelated meanings will simply be deactivated sometime later in an incompatible context. However, it is not clear whether the related sense-level literal/metaphorical meanings will be easily activated or deactivated in compatible or incompatible contexts. I therefore suggest that studying metaphorical polysemy is crucial for lexical ambiguity research to press forward for a bettered understanding of meaning activation in the human mind.

2.3 Processing of Metaphorical Polysemy

This section focuses on linguistic and processing issues concerning metaphorical polysemy, which ultimately leads to the main concern of study, i.e., how meaning

salience interacts with contextual effects in the processing of metaphorical polysemy, given the sense-facet distinction criteria presented above. Linguistic issues include the basic categorization of metaphors and lexicalization of metaphorical meanings. Processing issues center around the problems in Giora's (2003) graded salience hypothesis, particularly the unclear definition of salience. The discussion together with that in the previous section will motivate the research hypothesis in the current study.

2.3.1 Conventional, Lexicalized Metaphorical Meanings

In this section I review linguistic issues concerning metaphorical polysemy or lexical metaphors, particularly the categorization of metaphors and its significance in terms of processing.

2.3.1.1 Definition and Differentiation

From a general cognitive point of view, metaphor is the operation[16] of *comparison* as one of human beings' cognitive abilities, because metaphor essentially involves comparing one thing to another (Croft & Cruse, 2004). However, the term *metaphor* in fact denotes a wide spectrum of phenomena and thus needs clear delineation. Because the study on metaphor has a long history (since Aristotle), and has been addressed by various research areas, ranging from literature, politics and political discourse analysis, etc., to brain-imaging studies (Ahrens, 2002; Ahrens, 2008; Ahrens et al., 2007; Allbritton, McKoon & Gerrig, 1995; Anaki, Faust & Kravetz, 1998; Arzouan, Goldstein & Faust, 2007; Cienki, 2005; Ferrari, 2007; Flowerdew, 1997; Flowerdew & Leong, 2007; Gong & Ahrens, 2007; Hobbs, 2008; Lakoff, 1996/2002, to name a few), numerous ways have been proposed to categorize metaphors. For processing of conventional, lexicalized metaphorical meanings (Blank, 1988; Geiger & Ward, 1999), the most relevant ways of categorization are: (1) A distinction between conceptual and

[16] In Croft and Cruse's (2004) terms, *linguistic construal operation*.

image metaphors, (2) A distinction between conventional and novel metaphors, and (3) A distinction between conceptual and lexical metaphors.

Conceptual and Image Metaphors

Conceptual metaphors contrast with image metaphors in conceptual mapping, which is important for the current study. Image metaphors involve a one-shot mapping of visual images, as in *Her waist is an hour glass* (Ahrens, 2002; Croft & Cruse, 2004). Conceptual metaphors on the other hand involve mappings of multiple concepts or image schemas from source domain (concrete concepts) to target domain (abstract concepts), as in the case of LIFE IS JOURNEY (i.e. involving cross-domain concepts; Ahrens, 2002; Deignan, 2005; Lakoff & Johnson, 1980; thus they differ from metonymy, which involves only concepts in a single domain). Croft and Cruse (2004) further describe conceptual metaphors in a similar vein:

> "Metaphor involves an interaction between two domains construed from two regions of purport, and the content of the vehicle [i.e., source] domain is an ingredient of the construed target through processes of correspondence and blending."

Because conceptual metaphors reveal patterns of conceptual mappings, cognitive scientists recognize them as an important means to study how human beings understand one (abstract) thing in terms of another (concrete thing) or how people conceptualize the world (Gibbs, 1994; Lakoff & Johnson, 1980; Taylor, 2002), and even claim that human thinking is essentially metaphorical (Gibbs, 1994). Therefore, in this study, I primarily adopt lexical items used in conceptual metaphors.[17]

[17] Except for one item that arguably can have 'metonymy-based metaphor' meanings.

Conventional and Novel Metaphors

The distinction between conventional and novel metaphors is relevant to the study of processing of conventional, lexicalized metaphorical meanings. Conventional metaphors contrast with novel metaphors in that novel metaphors denote brand-new meanings while the meanings of conventional metaphors are familiar to people in varied degree.[18] It has been found that novel metaphors are reacted to slower than conventional metaphors and tend to employ more right-hemisphere resource; accompanying this, it is suggested that conventional metaphors are accessed virtually in the same way with literal senses in terms of reaction times (cf. Ahrens et al., 2007; Amanzio et al., 2008; Arzouan et al., 2007; Blank, 1988; Blasko & Connine, 1993; Brisard, Frisson & Sandra, 2001; Eviatar & Just, 2006; Giora, 1999; Giora & Fein, 1999b; Glucksberg, 2003; Glucksberg, Gildea & Bookin, 1982; Gong & Ahrens, 2007; Mashal & Faust, 2008; Tartter et al., 2002; Thibodeau & Durgin, 2008). In the current study, I focus on conventional metaphorical meanings.[19]

Conceptual and Lexical Metaphors

Conceptual metaphors may be very conventionalized and so encoded in the lexicon (Ahrens et al., 2007; Blank, 1988; Geiger & Ward, 1999; also see Tyler & Evans, 2001). According to Svanlund (2007), conceptual metaphors can be regarded as fixed, conventional conceptual patterns of cross-domain mappings of certain concepts. As such conceptual-level metaphors are instantiated in lexical expressions, their conventional usages may become encoded meanings in the lexical items, hence forming "lexical metaphors" or "lexicalized metaphors" (Blank, 1988; Geiger & Ward, 1999). For example, the sentence *I would like to spend the weekend with my wife* is a

[18] A similar contrast is between familiar and less familiar metaphor.
[19] The criterion in this study is that the meanings must be already documented in Chinese Wordnet. See Chapter Three for details.

conventional instantiation of the TIME IS MONEY metaphor, and the word *spend* can be so commonly used this way that the metaphorical meaning has been encoded in the lexical item and documented in dictionaries.

Lexical metaphors subtly differ from conceptual metaphors. Svanlund (2007) criticizes conceptual metaphor theory (CMT) for its naïve treatment of conceptual-level metaphors and conventional metaphorical expressions. It neglects the varied degree of conventionality and metaphorical strength in lexical metaphors, and tends to view metaphors, novel or conventional, as homogeneously motivated by the cross-domain mappings. Svanlund's comments on the CMT notion of metaphors: "… metaphors generally constitute systematic conventional patterns, both lexical and conceptual, and […] lexical patterns are secondary. They are reflections of the more basic conceptual patterns (e.g. Lakoff and Johnson 1999: 123)." In this way, the CMT notion does not distinguish novel metaphors from conventional metaphors, which may be entrenched in the lexicon. Contrary to this notion, Svanlund proposes that lexical metaphors has a "graded nature", that is, "[lexical metaphors] differ in their conventionalized ability to activate concepts from the source domain". Based on corpus data, Svanlund claims some lexical metaphors hardly activate source domain concepts (e.g., Svanlund provides the example *comprehend*, which meant 'hold tightly' in Latin), while many conventional metaphorical expressions, though having a long history, still retain their *metaphorical strength* to activate source domain concepts (e.g., Svanlund provides examples of weight metaphors in Swedish).[20] In this sense, Svanlund states the relationship between conceptual and lexical metaphors: "conceptual metaphors do not *govern* lexical metaphors, although they may sometimes *guide* them" because there are

[20] When I examine conventional conceptual metaphor meanings that are encoded in lexical forms, in fact I am examining lexical items in the source domain, because their literal meanings provide source domain information, while their encoded, conventional metaphorical meanings are related to target domain information. For example, the literal sense of 廢物 fei4 wu4 'waste' refers to material trash, while its metaphorical sense refers to a person.

many different factors (other than conceptual metaphor alone) involved in forming an entrenched, lexicalized metaphorical meaning.

In this study, I accept Svalund's (2007) view and consider that although conceptual metaphors and lexical metaphors are interconnected, lexical metaphors still have a graded nature because the metaphorical meanings may be conventionalized, lexicalized, or "consolidated" (Giora, 2003) in varied degree. This view is crucial for interpreting the relationship between frequency and salience, and will be further developed in Chapter Four when frequency is compared with other salience measures to determine salient meanings.

2.3.1.2 Significance of Conventional, Lexicalized Metaphorical Meanings

The significance of conventional, lexicalized metaphorical meanings to processing lies in the fact that these meanings stand at the crossroads of metaphor research and lexical ambiguity research. Since conventional, lexicalized metaphorical meanings involve both lexical access and metaphor comprehension, examining such meanings will have implications for both lines of research. I have stated the importance of studying metaphorical polysemy for lexical ambiguity research in 2.2.4. From the viewpoint of metaphor processing, the study of conventional, lexicalized, metaphorical meanings based on discussions in earlier sections is important because researchers mostly contrast conventional metaphors with novel metaphors, but rarely seek potential contrasts within conventional metaphorical meanings that are lexicalized to different extent. As a consequence, researchers may inaccurately assume no differences between literal meanings and conventional metaphorical meanings. Focusing on conventional metaphorical meanings will enhance clarification of this issue. In all, investigating processing of conventional lexicalized metaphorical meanings will shed light on both metaphor processing and lexical ambiguity research.

2.3.2 The Graded Salience Hypothesis

In this section I detail Giora's (2003) graded salience hypothesis, already briefly introduced in Chapter One, in order to take it as a basis for later discussion on processing of lexical metaphors. This recently proposed hypothesis is chosen because previous metaphor comprehension models do not address lexical access, and previous lexical access models do not address metaphor processing, while the graded salience hypothesis is applicable to research areas from lexical access, figurative language processing, to discourse analysis, etc., hence appropriate for the study of metaphorical polysemy.

The graded salience hypothesis stands as a hybrid model that incorporates and improves the traditional views on metaphor comprehension. When reviewing metaphor comprehension models, Gibbs (2001)[21] states that two major approaches traditionally adopted are the "standard pragmatic model" and the "direct access model", from which later hybrid models are generated, including the graded salience hypothesis. These two contrastive views either state that metaphorical meanings are never accessed without activation of literal meanings (Grice, 1975), which is in line with a modular view of processing, or that metaphorical meanings can be directly accessed in an appropriate context without activation of literal meanings (Gibbs, 1994), which is closer to an interactive view of processing. Giora (2003) criticizes these two views and argues that the former has received little support in later studies (Blank, 1988; Glucksberg et al., 1982), while the latter does not address the issue of salience, thus reducing its explanatory power.[22] Giora emphasizes the role of salience in comprehension, and incorporates the traditional views in her graded salience hypothesis:

[21] See Giora (2003) for a similar view.

[22] For detailed criticisms on these views, see Giora (2003). I focus on the graded salience hypothesis also because Giora already presents a comprehensive comparison of her model and the other two models. And so I do not compare them again, but instead focus on Giora's hypothesis.

"This hypothesis… [presumes] two distinct mechanisms: one bottom-up, sensitive only to domain-specific (linguistic) information, and another, top-down, sensitive to contextual (both linguistic and extralinguistic) knowledge. However, unlike the traditional modular assumption, the graded salience hypothesis assumes that the modular, lexical access mechanism is ordered: more salient meanings—coded meanings foremost on our mind due to conventionality, frequency, familiarity, or prototypicality—are accessed faster than and reach sufficient levels of activation before less salient meanings."

"[The graded salience hypothesis]…assumes that language comprehension involves two distinct mechanisms that do not interact initially but run in parallel: a linguistic mechanism (lexical access) that is modular and stimulus-driven and operates locally, and an expectation-driven, contextual mechanism that operates globally, accumulating information that has already been processed and interfaced with other cognitive processes."

According to the graded salience hypothesis' prediction, "coded meanings would be accessed upon encounter", and meanings that are more salient, i.e., "more frequent, more familiar, or more conventional" will *always* be accessed initially. Hence in the initial processing stage, salient conventional, lexicalized meanings in metaphorical polysemy will be activated before the less salient meanings,[23] and context (regardless

[23] In the initial processing stage, Giora considers literal and nonliteral meanings do not differ in activation, that is, meanings will be activated as long as they are salient. However, this does not mean Giora neglects the relationship between literal and metaphorical meanings. In fact, she states the possible effects of literal and metaphorical meanings in a later processing stage in 'retention hypothesis', which supplements the graded salience hypothesis in her book (2003) to cover a wider range of time course. The retention hypothesis predicts that whether a meaning will be suppressed depends on its function to the intended meaning. In the case of metaphorical meaning access, literal meanings will be retained in a later processing stage, since such meanings enable conceptual mappings and support the metaphorical meanings. As Giora states: "While the literality/nonliterality variable does not play a relevant factor at the initial stage of language comprehension, it may be a factor in the processes following that stage"; "literal

of its bias) can facilitate access of less salient meanings but will not inhibit salient meanings.

2.3.3 Inadequacies of the Graded Salience Hypothesis & Resolutions

This section states inadequacies found in the graded salience hypothesis and resolutions in this study, in order to examine the processing of metaphorical polysemy. The inadequacies, briefly described in Chapter One, include: (1) Unclear criteria for meaning distinction, (2) unlimited size of linguistic units, and (3) unclear definition of salience. I discuss them in sequence with necessary details, and specifically examine the notion of salience in Giora's (2003) work. In the end, I introduce the measures used and evaluated in the study, among which f requency will be the main basis for later discussion on Giora's work and the processing of metaphorical polysemy.

2.3.3.1 Unclear Criteria for Meaning Distinction and Resolution

Like all lexical access models, the graded salience hypothesis does not distinguish meanings on different levels and undiscerningly predicts that *all* salient meanings will be accessed regardless of contextual bias. Hence I propose to adopt the sense-facet distinction criteria introduced in 2.2 in order to reduce confounding factors and properly investigate the processing of metaphorical polysemy. Given the sense boundary effect discussed in the earlier section, it is likely that salient *sense-level* meanings cannot be fully activated in incompatible contexts, thus contradicting the graded salience hypothesis' prediction. For an accurate observation of the processing of metaphorical polysemy, this study will currently focus on metaphorical polysemy with only sense-level meanings.

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meanings of metaphors need not be suppressed, since it is assumed, it is supportive of the intended metaphorical meaning." Although I currently focus on graded salience hypothesis, it is still possible to discuss the results based on retention hypothesis due to timing issues, discussed later in the chapter.

2.3.3.2 Unlimited Size of Linguistic Units and Resolution

Gibbs (2001) criticizes that the graded salience hypothesis does not clearly indicate how word-level information interacts with phrasal-level information. Although Giora (2003) supports the idea that "some strings have stored meanings above and beyond the individual meanings of the words that make them up", in most of her discussion on metaphor processing she does not distinguish meanings pertaining to different levels of linguistic units—metaphors on the phrasal or sentential level and literal meanings on a decomposed word level (e.g. two meanings of *Jump on it!*, 'utilize' or 'hop'). That is, as Gibbs (2001) indicates:

> "... context quickly shapes the actual meanings people interpret for words they read, yet context does not work to constrain the meaning of an entire phrase until after the salient, and contextually inappropriate, meaning of that phrase has been understood. It appears that the contextually appropriate word meanings are ignored during some aspects of utterance interpretation (i.e., when the utterance meaning varies from the salient interpretation associated with some phrase)."

While this suggests that "there may not be a single contextual processor at work during linguistic processing" (Gibbs, 2001), it is unclear how the graded salience hypothesis deals with this issue. Hence, activation of salient, phrasal-level metaphorical meanings and their nonsalient, word-level literal meanings (e.g., *Jump on it!*) in a literally-biased context may occur at different temporal points and involve different "contextual processors". Therefore, it is unfair to claim, based on such meaning activation, that "salient meanings will always be activated".

Because this study specifically addresses meaning activation in metaphorical polysemy, thus naturally focusing on word-level meanings, coactivation of word-level

and phrasal-level meanings that may involve different processing mechanisms is avoided, and the study is allowed to examine whether the graded salience hypothesis holds when this potential confounding factor is controlled.

2.3.3.3 Unclear Definition of Salience and Resolution

The major problem in the graded salience hypothesis is unclear definition of salience. A very general description of salient meanings Giora (2003) provides is "…for information to be *salient*—to be foremost on one's mind—it needs to undergo consolidation, that is, to be stored or coded in the mental lexicon," while it is not certain what kind of meanings can be regarded as coded. In addition to this, Giora further proposes that frequency (Kawamoto, 1993; Rubenstein, Garfield & Millikan, 1970),[24] familiarity (Blasko & Connine, 1993; Gernsbacher, 1984; Wiley & Rayner, 2000), conventionality (Nunberg, Sag & Wasow, 1994), and prototypicality (Rosch, 1973) are four important factors. The relationship between these factors and salience however is vague. For example, since she states familiarity is "more crucial" because frequent/infrequent meanings can be either familiar or unfamiliar, it is unclear how frequency (or even familiarity) actually correlates with salience.[25] Moreover, it is unclear whether the other two minor factors, conventionality and prototypicality, which are never mentioned in Giora's discussion on metaphor comprehension, are optional. On the one hand, in Giora's (2003) work, conventionality refers to regular linguistic expressions used in a certain situation, and in this sense is a pragmatic factor. She defines it based on Nunberg et al. (1994): "[…conventionality is] a relation among a linguistic regularity, a situation of use, and a population that has implicitly agreed to conform to that regularity in that situation out of preference for general uniformity." On

[24] Note that she also mentions that frequency may not only relate to real world occurrences but also to probability of occurrence (Burgess & Lund, 1997), and 'frequency of co-occurrence of meanings in the mental lexicon'.

[25] See footnote 1 in Chapter One for the terminology in this thesis.

the other hand, Giora (2003) refers to prototypicality as centrality of membership in a category (e.g., *sparrow* is a more typical member in the *bird* category than, e.g. *ostrich*), although there is relatively little description of this factor in her work. In both cases, it is not clear whether the factors can be applied to other situations or meanings investigated in lexical access or metaphor comprehension literature. It is, therefore, totally unclear how the proposed four factors weight or interact in a meaning for it to be "foremost on one's mind".

Besides the vague (theoretical) definitions, Giora (2003) also proposes practical methodological measures of salience, which are also problematic. In the following sections, I will discuss them and then propose the current resolution to the unclear definition of salience, i.e., comparing results from three important measures of salience, with frequency as the main measure for discussion in the study.

2.3.3.3.1 Measures of Salience Proposed in Giora (2003)

Methodologically, Giora (2003) proposes five probable measures of salience: (1) "Measures of word frequency and probability" (Burgess & Lund, 1997), (2) "Frequency or familiarity ratings of both meanings of words and phrases", (3) Response times to probes related and unrelated to meanings of a word (i.e., priming effects when the word is out of context or in a neutral context); faster responses mean greater salience (Williams, 1992), and (4) Meaning generation tasks in which participants are required to provide the first meanings (of lexical items) that come to their mind (although not mentioned, similar offline production tasks used to estimate meaning dominance include word association (association norms), and sentence generation task; Rayner, Pacht & Duffy, 1994; Simpson, 1981; Simpson & Krueger, 1991), and (5) Word fragment completion tasks in which participants are required to complete a word

fragment (e.g. “b-tt-r”) in an intuitive way (e.g. *better, bitter,* or *butter*), which is believed to “measure salience out of context”.

Still, Gibbs and Colston (2006) indicates it is not clear whether different methods will lead to consistent results. And moreover it is not clear how these methods should cooperate or be combined at what time. The current study therefore suggests that three representative measures be compared for a proper estimation of degree of salience: (1) Corpus-based relative sense frequency, (2) an word association task, and (3) an online priming task for words out of context. These three measures are representative for a corpus approach, for an offline measure, and for an online measure. The motivating reasons, as well as specific concerns for each measure will be presented below:

2.3.3.3.2 Measures of Salience Evaluated in this Study

Corpus-based Sense Frequency

Corpus-based sense frequency, as the main measure of salience in this study, is adopted for the following reasons:

First of all, it is a general assumption that corpus reflects human cognition. This is very much spelled out by Schmid’s (2000) From-Corpus-to-Cognition Principle: “Frequency in text instantiates entrenchment in the cognitive system” (p. 39). Hence, high frequency may indicate deep entrenchment, and therefore high degree of salience. Indeed, corpus word frequency has long been found to have robust effects on word recognition times (Gernsbacher, 1984), and has been an important index in psycholinguistic studies of virtually all fields. However, while corpus word frequency represents how often a word is used, and corpus sense frequency no less importantly represents how often a word is used *in which way*, to date relatively few researchers address how corpus sense frequency works. Therefore, the current study mainly adopts

this measure,[26] since it is potentially an important index that reflects a sense's degree of salience.

A second, and a very direct reason is that Giora (2003) explicitly proposes this measure. And moreover frequency is an important notion in her discussion of salience measures (see discussion in the previous section).

A third reason is that corpus-based sense frequency has obvious methodological advantages, because it is more accurate, objective, operationalizable, and even more economical[27] than traditional offline or online measures. The development of novel corpus-based tools and lexical resources such as Sketch Engine, Chinese Word Sketch (Kilgarriff et al., 2004), WordNet, and Chinese Wordnet, etc. allows exact qualitative/ quantitative observations of semantic contents and lexical relations, etc. Particularly, since Chinese Wordnet, as the only lexical resource (to date in Chinese) that principally respects the sense-facet distinction in Ahrens et al. (1998; 2003), compiles word definitions mainly based on corpus data, researchers are allowed to calculate corpus-based sense-level meaning frequency based on clear criteria. Moreover, accurately calculating frequency of facet-level meanings becomes possible, since corpus data provide complete natural language data with abundant contextual information, which is necessary for sense-facet distinction (see 2.2.1 for relevant discussion). Compared with production data, which are often chaotic and can hardly allow observation of e.g., facet-level meanings, corpus analysis is easier and more principled, potentially a better candidate for lexical ambiguity research, which advances toward a refined semantic analysis in the present day.

[26] Since few investigates this measure, it is a minor purpose of the study to evaluate its significance for psycholinguistic studies by comparing it with other measures.

[27] In terms of cost, time to gather data, recruiting of participants, controlling of language background, etc.

Although corpus sense frequency has the aforementioned advantages, when and how it renders the best estimation of salience is yet to be explored by comparing it to other measures. It is likely that printed sense frequency is not totally equal to meaning salience, which is in principle similar to the fact that printed word frequency is not totally equal to experiential familiarity (Gernsbacher, 1984). Hence, in estimating salience I will compare results from this measure and other measures in order to achieve a reasonable interpretation of salience effects. This being said, I will adopt corpus sense frequency as the primary basis to categorize high-frequency and low-frequency meanings due to the need to explore this measure and its potential advantages presented above.

Offline Measure: Word Association Task

Word association is a second measure used in this study to supplement the analysis.[28] Despite its long tradition of study (Boring, 1950; Deese, 1965; Ferrand & Alario, 1998; Nelson, 2004; Nelson, McEvoy & Dennis, 2000), and researchers' belief that it reveals "important aspects of meaning or the semantic representation of words" and "organization of word knowledge" (De Deyne & Storms, 2008), this relatively simple task (or its product, association norms) is adopted in many lexical ambiguity studies to estimate meaning dominance (e.g. Simpson, 1981; Simpson & Burgess, 1985). In such a task, participants are typically required to provide the words they think of when they see a lexical item (e.g. table-chair). The number of associates required of the participants ranges from strictly one (i.e., a discrete association task) to a certain number or an unlimited number (i.e. a continuous association task). The continuous association task is believed to be more revealing regarding the association mechanism and minor

[28] Although Giora does not explicitly mention this task, it is in a similar vein with meaning generation task (see the above discussion on measures proposed by Giora) and is adopted by many studies (e.g. Simpson, 1981; Simpson & Burgess, 1985) to estimate meaning salience.

associates (De Deyne & Storms, 2008), thus appropriate for salience estimation of polysemous meanings in the current study.[29]

Using word association tasks or association norms to estimate meaning dominance or salience (e.g. Simpson, 1981; Simpson & Burgess, 1985) is plagued with inaccuracy and vagueness. The primary problem raised by Hino and colleagues (1997) is a biased estimation of meaning frequency and associative strength for relatively balanced ambiguities. To illustrate, suppose the *financial institution* meaning of *bank* is in reality used 60% of the time, and the *riverbank* meaning, 40% of the time, in an association task this relatively balanced ambiguity will still obtain over 90% of the first associates related to the *financial institution* meaning, thus biasing the estimation. The second problem is that association tasks can only allow coarse-grained semantic analyses. Few if any studies report clear operational criteria based on which they regard an associate as related to a particular meaning of a lexical item, which suggests that most choices are simply done by intuition. This is acceptable for homonymous lexical items (having unrelated meanings) but inappropriate for polysemous lexical items, which often involve related meanings and serious semantic overlappings. Moreover, it is virtually impossible to calcualte frequencies of the delicately distinguished facet-level meanings (e.g., the tome-text distinction of *book*) based on association data, which indicates that this traditional task may not fully satisfy the need for a refined semantic analysis in recent lexical ambiguity research.[30]

Due to the above reasons, this measure is adopted not as the primary measure, but mainly for the comparison and evaluation of different measures of salience.

[29] To date there is not a formally published association norm in Chinese. Hence I conduct a small-scale association task in this study.

[30] It appears that the most direct way to investigate facet-level meanings is analyzing corpus data, where rich contextual information is provided.

Online Measure: Cross-modal Lexical Priming Task for Isolated Words

The third measure of salience used in this study to supplement the analysis is an online cross-modal lexical priming task for isolated words. This task is essentially a priming experiment that examines whether a visual target word is primed when it is related to a particular meaning of an auditory prime word out of context or in neutral context (see Chapter Three and Four for details of procedure and material preparation, etc.). According to Giora (2003), this is a fairly straightforward measure of salience because faster response times suggest higher degree of salience, and slower response times suggest lower degree of salience (Williams, 1992).

The online priming measure also suffers from several problems. Firstly, priming involves complicated factors (e.g. timing issues) and may not be a homogeneous phenomenon (see later discussion), thus not likely to be a consistent measure. For example, a meaning may be primed at an ISI of 0 ms and for a target duration of 500 ms, but not primed at 1500 ms ISI and a 300 ms duration. Hence, it is difficult to consistently define a meaning as salient or to compare between different studies. Moreover, if two meanings in a lexical item are both primed, it is difficult to determine if they are equally salient or one is more salient, given the variation of reaction time data. Secondly, a methodological issue lies in the difficulty to maintain exactly the same degree of relatedness between the auditory prime words and the visual target words out of context and in biased contexts. This renders a direct comparison between priming effects out of context and in context less convincing. Due to the above reasons, this measure is also not adopted as the primary measure, but mainly for the comparison and evaluation of different measures of salience.

Given the advantages and disadvantages of the three measures, I consider it appropriate to determine degree of salience based on a comparison of these measures,

rather than to complete accept (or deny) a particular measure. Through comparison of the measures, this study aims at a reasonable interpretation of effects of salience in the processing of metaphorical polysemy.

2.3.4 Summary: Issue of the Study

In this study, I investigate how meaning salience interacts with contextual effects in the processing of metaphorical polysemy. To address this issue, I focus on Giora's (2003) graded salience hypothesis and test its validity. In doing so, I seek resolutions to obvious inadequacies in the hypothesis by constraining the scope to sense-level lexical meanings and by comparing different measures of salience to properly define salient meanings. I then explore how salient/nonsalient literal or metaphorical meanings in metaphorical polysemies can be accessed in literally-biased or metaphorically-biased contexts. According to the graded salience hypothesis, salient meanings will always be initially activated, regardless of contextual bias. Hence, for metaphorical polysemies having salient literal meanings and nonsalient metaphorical meanings, for example, the graded salience hypothesis predicts that salient literal meanings will be activated in both literally- and metaphorically-biased contexts, while nonsalient metaphorical meanings will only be activated in metaphorically-biased contexts. However, I doubt the hypothesis' prediction will still hold once its inadequacies are controlled for, particularly when a clear meaning distinction is done and only sense-level lexical meanings are examined. Since sense-level lexical meanings cannot coexist in the same context, it is likely that salient, sense-level literal meanings, e.g., can only be activated in literally-biased contexts and not in metaphorically-biased contexts, which contradicts the graded salience hypothesis' prediction. In the following sections and chapters, I develop and explore this issue.

2.4 Research Question, Hypothesis, and Implications

2.4.1 Research Question

Based on the above discussion, I raise the research question presented in the beginning of Chapter One below:

- **How can meaning salience interact with contextual effects in the processing of metaphorical polysemy?**

Namely how salient/nonsalient literal or metaphorical meanings are accessed in literally- or metaphorically-biased contexts.[31]

2.4.2 Research Hypothesis

Based on the above discussions on sense-level meanings (which cannot coexist in the same context) and the inadequacies in the graded salience hypothesis (see discussions above), I propose the following hypothesis:

- **Salient or nonsalient sense-level literal and metaphorical meanings can only be activated in compatible contexts and not in incompatible contexts.**

The hypothesis is contrary to the graded salience hypothesis' prediction and will be tested in this thesis.

2.4.3 Implications

The current study has the following implications for the graded salience hypothesis, psycholinguistic research on lexical ambiguity resolution and metaphor comprehension in general, and corpus/computational linguistics:

(1) A theoretical re-evaluation of the graded salience hypothesis is suggested based on a refined semantic distinction between sense- and facet-level meanings and a

[31] Note the current limitations that in Chapter Four I only define salient literal meanings and nonsalient metaphorical meanings based on a comparison of different salience measures (see Chapter Four for details), which is considered sufficient for the current discussion for Giora' work. However, other possible definitions of salient meanings will also be discussed as minor issues in Chapter Five. For ease of discussion I maintain this statement to focus on the general purpose of the thesis.

distinction between word- and phrasal-level meanings. Methodologically, the need to develop a set of clear operational criteria to determine degree of salience is shown.

(2) For lexical ambiguity resolution research in general, a refined semantic analysis based on linguistic theories is suggested for the establishment of models. The understanding and conceptualization of "what meaning is" should be reconsidered based on recent semantic theories, and it may be insufficient to regard meanings that differ in nature as homogeneous, static entries or nodes in the mental lexicon, which is a concept underlying many lexical access studies (Forster & Bednall, 1976; Hino et al., 2006; Piercey & Joordens, 2000; Siakaluk et al., 2007). Instead, a dynamic view of lexical meanings that distinguishes temporal stages and types of meanings, particularly the sense-facet distinction, is worth considering in psycholinguistic models for a bettered understanding of comprehension and processing.

(3) For metaphor comprehension studies it is suggested that the graded nature of conventional, lexicalized metaphorical meanings makes them different from literal meanings. Since metaphorical meanings may be lexicalized to different extent, hence varying in degree of salience, the notion that conventionalized metaphorical meanings only involve automatic processing, thus similar to literal meanings (see discussions above) may require a delicate re-examination based on their graded nature.

(4) For corpus/computational linguistics, the cognitive significance of corpus-based sense frequency is explored through the evaluation of different measures of salience. Sense frequency counts are already available in WordNet. And as corpus/computational linguists now endeavor to establish a fully sense-tagged corpus (Ker et al., 2008), estimation of sense frequency becomes possible. However, how corpus sense frequency reflects cognition is yet to be explored. The results in the current

study thus may enhance future application of corpus sense frequency in relevant research.

2.5 Methodological & Minor Issues

This section reviews necessary methodological and minor issues for the current purpose, i.e., investigating the processing of metaphorical polysemy with a cross-modal lexical priming paradigm. The section will start with a specific review of Ahrens' (2006) study for an example because she clearly presents her methodology in conducting a cross-modal lexical priming experiment. Issues that need to be dealt with in a cross-modal lexical priming study are then raised and further reviewed in following sections. The purpose of the discussion is to seek methodological improvement and refinement for the current study.

2.5.1 Review of Ahrens (2006)

Ahrens (2006) reviewed previous studies that supported the modular or interactive accounts of lexical ambiguity resolution, and found that studies supporting the modular view tended to adopt a target presentation duration less than 1000 ms, while studies supporting the interactive view usually adopted a target presentation duration more than 1500 ms. She then suggested that long target presentation duration only allowed researchers to examine effects after the immediate access of meanings, and thus facilitation was only observed for contextually appropriate meanings. She examined meaning activation in unbalanced ambiguous nouns in a cross-modal lexical priming task. The primary/secondary meanings were determined based on results in meaning generation tasks, and the sentences were biased to the nouns' primary meanings. Her results showed that, when visual targets (either related to the primary meanings or the secondary meanings) were presented for 300 ms at offset of ambiguous words, both meanings were facilitated. Results were similar when visual targets were presented for

750 ms. However, when visual target words were presented for 1500 ms, only the contextually appropriate meanings were facilitated. The results supported her hypothesis and showed that there was an immediate access stage where all meanings were activated, and after a short while only contextually appropriate meanings remained.

Closely examining Ahrens' (2006) work however reveals four important problems, which need to be dealt with in a cross-modal lexical priming study and will be discussed in following sections:

Firstly, this study did not distinguish different types of meanings based on clear criteria, as discussed in 2.2.

Secondly, this study did not pay adequate attention to polysemy issues in the selection of visual target words (see later discussion for criteria in the study). Since polysemy is a permeating phenomenon in language, visual targets gathered from production tasks such as meaning generation tasks, like ambiguous primes, are likely to be polysemous too. The primary issue that follows is that meaning frequencies for polysemous meanings in visual target words should be considered, or else it is likely that the effects will be confounded with other meanings of the visual target words. Also, and more importantly, visual target words related to the auditory primes tend to have a similar direction of semantic extension or semantic contents. Hence it is very likely that the two visual targets words (assigned to the two meanings of ambiguous primes) actually overlap in their semantic contents, and the secondary-meaning target in fact relates to the primary meaning, thus leading to an inaccurate observation. For example, Ahrens' (2006) visual targets for the two meanings of the ambiguous prime word 湯 *tang1* 'soup[1]; hot spring[2]' were 飲料 *yin3 liao4* 'drink' and 熱水 *re4 shui3* 'hot water' respectively. However, most soup is a drink composed of hot water (and other stuff), and therefore facilitation of the second meaning target 'hot water' may be

partially attributed to first meaning activation. Similarly, the target words for the prime 茅房 *mao2 fang2* 'lavatory[1]; straw room[2]', namely 廁所 *ce4 suo3* 'lavatory' and 處所 *chu4 suo3* 'location', were also clearly related. Therefore, her report for secondary meaning activation was confounded due to the fact that her secondary meaning targets were related to the primary meanings. The semantic overlappings in polysemous primes and target words hence rendered her results less convincing (see discussions below; this study attempts to eliminate this by using monosemous targets).

Thirdly, repeated characters in ambiguous prime words and visual target words also led to a potential bias. Two out of the 16 experimental items had this problem. For example, the prime 河北 *he2 bei3* 'Hebei Province (in China)' was paired with the secondary meaning target 北邊 *bei3 bian1* 'north'. This may bias the results because the priming effects obtained for secondary meanings again may be attributed to phonological and semantic (and even orthographic) priming caused by the same character, since Chinese characters may carry meanings by themselves.

Fourthly, lexical meanings and phrasal meanings were not distinguished. The secondary meanings may be used idiomatically in a phrase and the meanings are not totally encoded in the specific lexical form (Tyler & Evans, 2001). For example, in the case of 架子 *jia4 zi5* 'shelf[1];arrogant manner[2]', the secondary meaning (idiomatically) co-occurs with 擺 *bai3* 'set', as it does in the sentential stimuli. Similarly, in the case of 飯碗 *fan4 wan3* 'bowl[1]; job[2]', the secondary meaning idiomatically co-occurs with 砸 *za2* 'break', as in the sentential stimuli. Placing prime words in such idiomatic expressions however may make activation of secondary meanings easier than otherwise, thus biasing the results.

The problems above pertained to the selection of primes and targets. In what follows, I continue to present crucial issues that are not problematic but should be considered in a cross-modal lexical priming experiment, and will be specifically discussed in following sections:

(1) In terms of design of the control condition, Ahrens's (2006) study adopted a matched-targets design, whose control condition was a set of visual target words unrelated to the primes and matched with the experimental related primes for reaction times out of context. This design differs from other types of design, e.g., switched-targets design and matched-primes design, and will be discussed in a later section.

(2) In terms of the methods for collecting visual target words and accompanying timing issues, different prime-target relationships (due to different collecting methods) may affect the timing of priming effects. Ahrens (2006) used frequently occurring words in meaning generation tasks as visual targets, which was similar to a type of association tasks. And whether associatively-related targets can be distinguished from purely semantically-related targets constitutes an important issue in literature, partly because this affects the timing of priming effects. This will be discussed later.

(3) Target presentation duration and inter-stimulus interval (ISI), the timing variables that can be manipulated, may also affect the observed results, as argued in Ahrens (2006).

(4) Types of nonwords can also affect lexical decision results. Ahrens (2006) used legal nonwords, while pseudohomophones are also used in literature (see discussions below).

(5) Lexical category is an issue in literature too. Ahrens' (2006) study focused on nouns, while other studies may employ adjectives (Williams, 1992), etc. Although this is not the primary focus in the study, the issue will be discussed in a later section.

(6) The creation of sentential stimuli is important. Ahrens (2006) claimed that her stimuli correctly biased the intended meanings based on sentence completion tasks, which will be discussed in a following section.

(7) The design of memory tests should be noted. Ahrens (2006) conducted memory tests after the whole lexical decision experiment (with a 0.8 accuracy threshold), while memory tests can also be done during the experiment. The interval between memory tests and the accuracy threshold can affect the results (see discussions below).

(8) Finally, a technical issue worth considering is how auditory stimuli are actually processed, which may affect participants' perception.

The above issues will be considered for the current study in the following sections:[32]

2.5.2 Matched-Targets, Switched-Targets, & Matched-Primes Design

I review three types of experimental design in terms of baseline data collection, the matched-targets, switched-targets, and the matched-primes design. As a consequence of discussion, I will adopt the matched-primes design for the current study. (See Chapter Three for specific details of the experimental design and materials.)

Matched-Targets Design

The matched-targets design uses control unrelated visual targets that are matched to experimental items for variables that affect lexical decision times, and compares RTs of control targets and experimental targets under the same condition. Since participants directly respond to the visual targets and not the auditory primes, and the major data for

[32] This section thus partly provides the reasons behind the methodology in Chapter Three.

analyses are lexical decision times for visual targets, it is important to mach the targets for various influential variables (see below). However, although researchers can match them in terms of mean reaction times out of context and frequency (Ahrens, 2001; Ahrens, 2006), it is hard to exhaust all factors. It is still likely that control targets differ from experimental items in terms of other important factors such as semantic contents (Cruse, 1986; Pustejovsky, 1991; Pustejovsky, 1995), number of senses (Joordens & Besner, 1994; Lin & Ahrens, forthcoming; Rodd et al., 2002), number of meaning facets (Tsai, 2005), nature of meaning relationships (Beretta et al., 2005; Giora, 2003; Klepousniotou, 2002; Klepousniotou & Baum, 2005a; Klepousniotou & Baum, 2005b; Klepousniotou et al., 2008; Rubenstein et al., 1970; Rubenstein, Lewis & Rubenstein, 1971; Simpson & Krueger, 1991), relative meaning frequency (Hino et al., 1997), degree of familiarity and concreteness (Gernsbacher, 1984), size of phonological neighborhood or orthographic neighborhood (Andrews, 1989; Carreiras, Perea & Grainger, 1997; Perea & Rosa, 2000; Sears et al., 2008; Vitevitch, 2002), lexical categories and number of lexical categories (Crepaldi et al., 2006; Tsai, 2005), or other factors on the graphematic level or phonological level, etc. Moreover, in order to find out appropriate control targets, a large number of candidate targets must be firstly pretested for the variables, and then partly by chance researchers find out good items matched for every variables for each experimental targets. Because of the difficulty to achieve a complete matching of targets with this design, and because the current study's criteria (see below) for target word selection limit the number of available candidate items, I currently do not adopt this design.

Switched-Targets Design & Matched-Primes Design

A switched-targets design and a matched-primes design are similar in comparing RTs of exactly the same visual target words under a experimental condition and a

control condition. In a switched-targets design, visual target words rotate between experimental primes, namely experimental primes are also used in a control condition. In a matched-primes design, visual target words rotate between their experiment primes and corresponding control unrelated primes that are matched to the experimental primes. In both cases all variables in visual target words (e.g., those mentioned in the previous section) are exactly matched (McKoon, Ratcliff & Ward, 1994; cf. Nicol, Fodor & Swinney, 1994),[33] thereby eliminating any potential effects caused by different visual targets. Moreover, experimental lists are also matched since exactly the same set of visual targets just rotate in different conditions in each list. Due to the advantages above and due to the limited number of experimental items in this study, I adopt a matched-primes design and aims specifically to compare exactly the same group of visual target words under the experimental (related) and control (unrelated) condition (and not across groups).[34]

2.5.3 Priming & Timing

Although on the surface only faster responses are observed, priming effects may differ in nature and in the time they occur, because factors such as prime-target relationship, target presentation duration, ISI, or even nonwords and memory tests may affect the results. In order for an appropriate observation of priming effects for the study, I review issues regarding prime/target words and relevant timing issues in this section, and review minor issues regarding nonwords and memory tests in later sections.

[33] Nicol et al. (1994) also raise their concern about how prime sentences could be "matched in complexity, plausibility," etc. However, for the current study it is considered a primary issue to achieve a better control over visual targets since response times are measured for these words.

[34] Due to the potential problems reviewed earlier, I adopt strict criteria for target word selection in the study. Moreover, due to the current focus on a specific type of polysemy, the number of experimental items is limited. Hence, a switched-targets design is not adopted because it is more suitable for experiments having a larger number of items, where matching between the primes is easier. Details concerning the experimental design as well as how stimuli are distributed in each list will be further explained in following chapters when different experiments are reported.

The methods for collecting related target words affect the timing of priming effects. Importantly, for decades researchers have attempted to examine the difference between 'associative priming' and 'semantic priming', namely whether associatively-related targets (such as those collected from association norms) produce different priming effects from semantically related targets (Alario, Segui & Ferrand, 2000; Balota & Paul, 1996; Boring, 1950; Bueno & Frenck-Mestre, 2002; Bueno & Frenck-Mestre, 2008; Collins & Loftus, 1975; Deese, 1965; Grondin, Lupker & McRae, 2009; Hino et al., 1997; Hirshman & Durante, 1992; Hutchison, 2003; Jared & Seidenberg, 1991; Joordens & Becker, 1997; Lucas, 2000; Lupker, 1984; McRae, 2004; McRae & Boisvert, 1998; Nelson et al., 2000; Perea & Rosa, 2002; Seidenberg et al., 1984; Shelton & Martin, 1992; Spence & Owens, 1990; Williams, 1996). While it is admittedly difficult to tease apart the two (Jones, Kintsch & Mewhort, 2006),[35] some researchers still propose likely differences between them. Using a cross-modal priming paradigm with single word primes, Hino et al. (1997), for example, suggests that associative priming tended to occur early, while semantic priming was only observed 750 ms after prime offset (also, see Alario et al., 2000). Hence, this is a potentially important factor that needs to be considered in order for an appropriate timing setting. Particularly, since target words (e.g., targets related to the primes' subordinate meanings) in the current study tend to be semantically related to the primes due to the criteria of selection (see discussions below; these criteria are adopted in order to avoid aforementioned problems, etc.), an ISI or target presentation duration that is too short is considered inappropriate. See Tables 3A and 3B for an overview of prime/target types, timing settings, nonword types, etc., in previous cross-modal lexical priming studies.

[35] Jones et al. suggest that "there are unlikely words that are purely semantically or associatively related", and that "the semantic-or-associated distinction is more likely to be an artificial dichotomy" (cf. Hutchison, 2003).

Tables 3A & 3B. Timing Issues in Cross-modal Lexical Priming for Isolated Words & Cross-modal Lexical Priming for Words in Context

A. Cross-modal Lexical Priming for Isolated Words

Study	Prime Type	Target Type	Nonword Type	Target Duration	Target Position	Memory Test	Results
Hino, Lupker, and Sears (1997)	Polarized ambiguities	Associative vs. semantic priming (Matched associative strength based on the norm) Switched-targets design.	Not mentioned	Until Response	a. Offset b. 700ms	N	a. Priming occurs due to word association, not semantic relatedness. Lack of meaning frequency effects. b. Priming effects for dominant meaning word pairs, regardless of prime-target relation (associative or semantic).
Tyler, Moss, Galpin, and Voice (2002)	High vs. Low imageability Nouns vs. Verbs	Semantic associates (having multiple lexical category & polysemous) Switched-targets design.	Not mentioned	200ms	a. IP b. Offset c. 250ms	N	Priming effects for all conditions.
Zwitserlood and Schriefers (1995)	Related and unrelated primes. Short/long fragments or short fragments+ISI, embedded in the end of a carrier sentence.	Semantically related targets. Category exemplars. Matched- prime design.	Legal nonwords	50ms	a. Offset b. 100ms	N	Priming effects: At long fragment offset In short fragment+ISI condition.

Moss, McCormick, and Tyler (1997)	Selected from property norms. Different in cohort-size.	1. Semantically related (Category exemplars) or semantically and associatively related targets. 2. Perceptually/ functionally similar targets (Cross-categorical & polysemous). Switched-targets design.	Legal nonwords	54ms	a. IP b. Offset	N	1. Greater priming for both target types at offset than at IP. 2. Priming for functional targets at IP and at prime offset Priming for perceptual targets at prime offset but not at IP.
Blasko & Connie (1993) Exp 5	Metaphorical primes presented in metaphorical sentences. Metaphors selected based on norms/aptness/ familiarity ratings.	Metaphorical targets based on participant answers.	Legal nonwords	250ms	Offset	N	No facilitation was found for any group of primes.

B. Cross-modal Lexical Priming for Words in Context

Study	Prime Type	Target Type	Nonword Type	Target Duration	Target Position	Memory Test	Results
Swinney (1979) Exp 2	Equibiased ambiguous nouns vs. control synonymous words in biased/unbiased contexts	Contextually (in)appropriate and unrelated targets. (Relatedness not controlled; only moderate-frequency words used, Polysemous, cross-categorical.)	Not mentioned	Not mentioned	a. Offset b. 3 sylla-bles after the offset.	Y (Twice, during/at the end of experiment)	a. Both targets are primed. Lexical Access is automatic. b. Only contextually appropriate targets are primed.
Onifer and Swinney (1981) Exp 2	Polarized ambiguities in biased contexts. (Determined by firstly generated meanings, involving homonymy, polysemy, or even homophones.)	(Associative) targets for primary/secondary meanings and matched control words. (Not clearly indicated, relatedness not equated, different word classes involved.)	Not mentioned	1000ms	a. Offset b. 1500ms	Y (Twice, during/at the end of experiment)	a. Both targets are primed. b. Only contextually appropriate targets are primed.
Simpson (1981) Exp 2	(Polarized?) ambiguities (homographs) taken from association norm. 5 types of sentences: Ambiguous and Weak/ strong dominant/ subordinate ones. (Ambiguous words presented at the end of the sentence.)	Associative targets for primary/secondary meanings. Switched-targets design.	Legal nonwords	Until Response	(0~)120ms	Y (Repeating the sentence right after it.)	Supporting context-dependent model. In strongly biased contexts, only appropriate meanings are activated. In weakly biased contexts, contextually appropriate meanings are activated, and dominant meanings are still activated in subordinate contexts.

Tabossi (1987)	9 unbalanced ambiguous nouns (meaning frequencies are based on judgers' agreement.)	Decided based on participants' answer about relevant semantic aspects of both meanings. (Not matched for frequency and length, not highly associative, but feature-noted.)	Legal nonwords (go/no-go decision)	Until response (up to 1500ms)	Offset	Y (At the end of experiment)	Priming: Dominant meanings in contexts biased to either meanings. Secondary meanings only in contexts biased to secondary meanings.
Tabossi & Zardon (1993)	9 unbalanced ambiguities (based on judgers' agreement). Constraining sentences.	Based on first associates.	(Probably— Legal nonwords; go/no-go decision)	1500ms	-100ms from the offset	Y (At the end of experiment)	Similar to Tabossi (1987)
McKoon, Ratcliff, and Ward (1996) Exp 3-5	Test of antecedent nouns.	Associative targets (Listed but unclear how they are found). Switched-targets design & Matched-targets design	Not mentioned	Until response (up to 1800 ms)	Offset	Recall	In switched-targets experiments: Priming only after the target test word, not at the gap. In matched-targets experiments: Priming usu. before the RC verb and at the gap.
Ahrens (2001)	(Roughly equibiased) verbs (involving idioms and metaphors). Contexts biased toward the secondary meaning.	Associative targets based on meaning generation tasks (verbs but also cross-categorical).	Legal nonwords	300ms	Onset of ambiguity. (maybe a typo?)	Y (At the end of experiment)	Priming for both dominant/subordinate meanings in contexts biasing subordinate meanings.

Ahrens (2006)	(Roughly unbalanced) ambiguous nouns (involving metaphors and idioms; uncertain whether primary/secondary meaning is more metaphorical). Contexts biased toward the primary meaning.	Associative targets based on meaning generation tasks (mostly nouns, repetitive characters found, polysemous.) Matched-targets design.	(Probably—legal nonwords)	a. 300ms b. 750ms c. 1500ms	Offset	Y (At the end of experiment)	a. Priming for both primary/secondary meanings. b. P Priming for both primary/secondary meanings. c. Priming only for primary meanings.
Blasko & Connie (1993) Exp 1-4	Metaphorical primes presented in metaphorical sentences. Metaphors selected based on norms/aptness/ familiarity ratings.	Metaphorical/literal targets based on participant answers.	Legal nonwords	250ms	a. Offset b. 300ms c. Offset d. 750ms	Y (At the end of 30% of the trials)	a. High familiar metaphor: Priming for both literal and metaphorical targets. Low familiar metaphor: Priming only for literal targets. b. Similar to a. c. Priming for highly apt metaphors among lowly familiar metaphors but not among moderately apt metaphors. d. Priming for metaphorical meanings in "most LF [(lowly familiar)] and moderate-apt metaphors".

Klepousniotou (2002)	Using sentences as primes (cross-modal sentence-priming lexical decision task; contextual bias is not measured; associates of ambiguous words are avoided).	Ambiguous words (homonymy, metaphor, metonymy, names; presented after the sentences). Two groups of control targets, matched either for printed frequency or meaning frequency and familiarity (meaning frequency were obtained not by meaning generation tasks but by ratings of a word in appropriate contexts). (Cross-categorical & polysemous.	Legal nonwords. (Derived from the critical words in the exp.s)	Not mentioned	Offset	N	Greater priming effects for metonymy than for metaphor and for homonymy. Sig. differences between homonymy/metonymy. (Noticing corpus frequency does not reflect real frequencies of ambiguous words' meanings.)

Several timing issues in a cross-modal priming paradigm are necessary to be considered. First of all, the temporal point at which the visual target word is presented is important. In speech recognition studies (usually using a single word prime), researchers may present the target at exactly the isolation point (IP; the position where the word becomes unique in the language), offset, or sometime later. In ambiguity studies usually it is at prime offset. However, in a zoomed-in sound spectrum window in Praat, even at the offset there may be a 100~200 ms zone for the researcher to decide an actual cut-off point. In the current study (experiments 2 and 3) I define offsets of experimental items as the end of formants (as suggested in Praat). Particularly, the offsets are the nearest zero-crossing points, since sounds not starting or ending at zero-cross points may lead to perception differences.[36]

Secondly, inter-stimuli interval (ISI) is another issue. Usually a 0 ms ISI taps into initial stage of processing, and a later ISI, a later stage. (Also see discussion on Ahrens' (2006) study.) Since using a more typical ISI in ambiguity studies, i.e., 0 ms, will allow a comparison with most other studies, in the study this setting is used in the three online experiments.

Thirdly, target presentation duration needs to be considered. As Ahrens (2006) suggested that most studies supporting exhaustive access used a target presentation duration less than 1000 ms, and most studies supporting selective access used a target presentation duration longer than 1500 ms, in formal experiments the current study adopts a 1000 ms duration, which is considered appropriate due to the types of target words used in the study (see discussion above on associative and semantic priming).

[36] I appreciate Professor Janice Fon and her students' comments on this point.

2.5.4 Visual Target Word Collection, Criteria, & Tools

The earlier review on Ahrens (2006) suggests that controlling visual target words is a crucial methodological issue in priming studies. Previous priming studies do not adequately deal with issues such as serious semantic overlappings, repeated characters in primes and targets, undistinguished lexical category, different nature of semantic relationships, varied degree of concreteness, etc., and at most distinguished associative and semantic priming. Researchers including Swinney (1979) may determine visual targets based on intuition without any other criteria or relatedness ratings, thus leaving their target words uncontrolled. Other studies that collect visual target words based on association tasks (Tabossi, 1987) or meaning generation tasks (Ahrens, 2006) risk losing good control of targets over the above factors, because production data tend to be chaotic and uncontrolled. For association tasks, participants tend to firstly and only think of associates of (polarized) ambiguities' primary meanings and not the secondary. Tabossi (1987) hence explicitly asked the participants to "produce other words associated to the subordinate meanings of the ambiguities", which but rendered the whole task unnatural. Meaning generation tasks solve this problem but on the other hand may ignore serious semantic overlappings between the selected targets. Ahrens (2006), for example, took frequently occurring words in meaning generation tasks as her visual targets. But as polysemous meanings are related, frequently occurring words in different meaning definitions are likely to be related too. Consequently, a visual target chosen for the secondary meaning may in fact relate to the first meaning (see the earlier review on Ahrens (2006) for examples). A further potential problem in a word association task is that nouns usually get nominal associates, while verbs may obtain more nominal than verbal associates, thus leaving the targets uncontrolled for lexical category. Given these concerns, I hope to eliminate the problems by deliberately

selecting visual targets based on a set of restrictive criteria, and check the results in relatedness ratings.[37]

In what follows I discuss the criteria for target word collection in the study and their motivating reasons in sequence. Then, I present the possible trade-offs of the criteria, and the corpus tools or lexical resources used in search for the target words.

The criteria for the determination of visual target words in the study include: (1) Use monosemous words as visual targets; (2) avoid homophones; (3) avoid repeated characters between the prime and the target; (4) avoid repetition of visual targets and words in sentential contexts before the ambiguous primes; (5) use disyllabic words; (6) use words in Chinese Wordnet or in the Revised Mandarin Chinese Dictionary; and (7) they should be significantly more related in the related condition than in the unrelated condition:

(1) *Use monosemous words as visual targets*. The reason for this criterion lie in the fact that it is virtually impossible to find out (for each of the prime words) a target word related to the first meaning but unrelated to the second meaning, given the permeating polysemous phenomenon. For ambiguity studies on homonym this is easier (e.g. the two meanings of *bank* can either relate to *river* or money), but for ambiguity studies on any kind of polysemy this is difficult due to semantic overlappings between related senses or even related meaning facets. Moreover, in many cases, the most related words for the primes are their synonyms (e.g. the prime word 廢物 *fei4 wu4* 'waste' has a closes related word 垃圾 *le4 se4* 'garbage'), which may have developed their meanings in a similar direction (e.g. 廢物 and 垃圾 are both metaphorically extended to refer to people). In this case, the most direct associate cannot be used, since it is related to both literal and metaphorical meanings of the prime, while in the current study, I plan to test

[37] I still rely on association data to enhance the searching of good target words that meet the criteria, but still they are required to be checked in relatedness ratings finally.

the targets (literal or metaphorical) in contexts biased either to literal or metaphorical meanings.

This criterion is observed by checking all the candidate target words primarily in Chinese Wordnet. Since Chinese Wordnet is still under construction, if Chinese Wordnet has not yet included the word, I further check it in the Revised Dictionary of Mandarin Chinese (National Language Committee, 1997; access dates: From Nov. 2008 to Dec. 2008). In doing so, I expect the words to have clearly only one sense (and involve no facet-level meanings for words in Chinese Wordnet). There are several advantages:

(a) Using monosemous visual targets makes it more likely to reduce semantic overlappings between polysemous meanings, thus enhancing the observation of meaning activation.

(b) Particularly, because I examine meaning frequency issues in the study, using monosemous words avoids the possibility that the target words, like the prime words, vary in meaning frequency. For example, the prime "sun" may be paired to a visual target "light", which has both a nominal *radiation* meaning and an adjectival *weight* meaning. In this case, the two meanings may have different meaning frequencies. Although further study is required, it is not unlikely that a high-frequency unrelated meaning (suppose it is the *weight* meaing in this case) affects the priming results. Indeed, the polysemous nature of visual target words and their meaning frequencies have not received much attention in previous studies, and it is the current study's hope to control for this issue.

(c) Using monosemous words also means that I adopt words as visual targets only if they are defined strictly as nouns or verbs with no cross-categorical meanings. In this case, nominal primes are assigned with nominal visual targets, and verbal primes, verbal targets. In this way I avoid any meaningful V-O sequence in the experiments.

Besides the use of monosemous words, there are other criteria:

(2) *Avoid homophones.* The reason is very similar to that for monosemy. I try to avoid visual targets having different meanings in the same orthographic form or the same phonological form due to concern for meaning frequency.

(3) *Avoid repeated characters between the prime and the target.* Repeated characters may result in priming effects that are not purely semantic (i.e., orthographic or phonological priming) and thus should be avoided (see the earlier review on Ahrens' (2006) study).

(4) *Avoid repetition of visual targets and words in sentential contexts before the ambiguous primes.* Using visual targets that repeat exactly the same words in their previous contexts leads to biased priming effects, which also should be avoided.

(5) *Use disyllabic words.* In this study I strictly use disyllabic words, since word length affects word recognition times. Although researchers can match the conditions for word length and so let word length vary (e.g. Ahrens, 2006), the current study attempts to strictly control word length. This means an improved accuracy in later RT analyses, and equally importantly prevents visual targets from appearing (i.e., its beginning position) at different positions on the computer screen.

(6) *Use words in Chinese Wordnet or in the Revised Mandarin Chinese Dictionary*. While I searched for visual targets, different lexical resources and corpus tools were employed (*infra*). However whether a character string (e.g. one that is automatically segmented as a "word" in corpus) constitutes a word in Chinese is occasionally uncertain (also, see Cheng, 2002). Therefore, I only adopt words from Chinese Wordnet or the Revised Mandarin Chinese Dictionary, two standard lexical resources for Mandarin Chinese. This criterion then ensures the words are conventionally recognized as "words" in Chinese. Words absent from these two databases are not used.

(7) The final criterion to determine the final list of visual targets is based on results in prime-target relatedness ratings in and out of context (reported in Chapter Three). I expect to have a relatively high mean relatedness ratings in related condition and low mean relatedness ratings in unrelated condition, and significant differences for the same group of target words between related and unrelated conditions.

Trade-offs of the Criteria

While the restrictive criteria are established to solve the aforementioned problems, there are trade-offs. However, because the advantages of the criteria are considered greater than disadvantages, I currently accept the trade-offs and discuss them below:

(1) *Contrast between literal and metaphorical visual targets*. Strictly using monosemous words as visual targets make it possible that they are either related to the literal or metaphorical meanings of the primes. However, an inherent difference between literal and metaphorical meanings is that literal meanings tend to be more concrete and metaphorical meanings, more abstract (Lakoff, 1993). In other words, the monosemous visual targets for literal/metaphorical meanings expectedly may differ in concreteness, provided they are well selected (in one sense). Using polysemous words as targets on the other hand may help balance concreteness between literal targets and metaphorical ones. But that just exposes the fault of doing so—such a balance comes from a mixture of multiple different meanings.

There is also a likely trade-off between relatedness and better control of concreteness, if the monosemous criterion is to be held. In informal, preliminary relatedness ratings for candidate visual targets (see footnote 47 in Chapter Three) it is found that using more concrete monosemous words as visual targets for metaphorical meanings tend to lower the relatedness degree between the primes and the targets. This

is natural. Because metaphorical meanings are more abstract, using concrete monosemous words as related targets just makes the word pairs less related.

Between polysemy and monosemy and between relatedness and concreteness, then, I decide to stick to related monosemous words in order to avoid the previous problems. Still, because for the study's purpose and in the current experimental design (a matched-primes design, see earlier discussion) it it not the main purpose to directly compare literal and metaphorical visual targets; instead, I mainly compare RTs of exactly the same group of literal visual targets under different contextual conditions (literal, metaphorical, or unrelated contexts), and likewise for metaphorical visual targets, varied degree of concreteness between target groups does not affect the major comparisons, and hence it is considered acceptable to maintain the current criterion.

(2) *Less usage of the most directly related words*. For priming studies it is the safest to use the most directly related words as visual targets. The current criteria however limits the possibility to find for each of the primes two most directly related visual targets. Often, those most directly related words, as typically used in priming studies (e.g., locksmith-key, skier-snow, writer-novel, used in McKoon et al., 1994), do not fulfill the current criteria due to having polysemous or homophonic meanings, etc. Hence in such cases, I follow the criteria and select words that best meet the requirements, although then they may not appear that directly related, thus likely to affect the priming effects.

However, given the earlier review on semantic and associative priming, I suggest that what appears to be "the most directly related words" tend to be associatively-related words. While purely semantically-related words may also produce priming effects (see earlier discussions), what is important for the current study is to check the prime-target pairs are sufficiently related in relatedness ratings and find out an appropriate timing

(e.g., ISI, target presentation duration) in order to observe priming effects.[38] For these reasons, I decide to stick to the current criteria for target word selection.

Materials, Corpus Tools, & Lexical Resources Used in Search for Visual Target Words

In practice many corpus tools and lexical resources are used to enhance the preparation of visual target words, as introduced below:

(1) Chinese Word Sketch (http://wordsketch.ling.sinica.edu.tw/) is an online corpus tool incorporating Sketch Engine, a corpus query system developed by Kilgarriff et al. (2004) and Chinese Gigaword Corpus, which collects data from Central News Agency in Taiwan, Xinhua News Agency in PRC, and Singapore Zaobao. Results from the Thesaurus and the Word Sketch functions are particularly considered in search of visual target words. The thesaurus provides possible synonyms based on corpus data, and the Word Sketch provides collocates of a prime in different argument role positions.[39]

(2) Chinese Wordnet (http://cwn.ling.sinica.edu.tw/) is also used in search for visual target words. Much like Princeton Wordnet, a lexical resource constructed based on semantic relationships between words, Chinese Wordnet is an online lexical resource that compiles meaning definitions based on corpus data, etc., and respects Ahrens et al.'s (1998) and Ahrens, Huang, and Chuang's (2003) criteria for sense and meaning facet distinction. I use this database to search for related words and other words fulfilling the study's criteria. This database is also used to check if a word is monosemous. However, because Chinese Wordnet is still under construction, many words have not been included, and thus often a query word does not exist in the database. In this case, I take the Revised Mandarin Chinese Dictionary as a supplementary resource (*infra*).

[38] For this reason, I conducted many preliminary informal pretests for online cross-modal tasks, and tried to adopt a timing setting that most probably allows the detection of priming effects. The current setting (0 ISI, 1000 ms) is appropriate at the current stage. However, other settings may be tested in future studies.
[39] The Chinese Word Sketch thus is also used to enhance the creation of sentential stimuli. See below.

(3) National Language Combinatory Search System (國家語文綜合聯結檢索系統; http://www.nlcsearch.moe.gov.tw/EDMS/index.html) is also used to search for appropriate targets. This website incorporates Mandarin language resources produced by Ministry of Education in Taiwan, and in particular allows one to consult the Revised Mandarin Chinese Dictionary, a standard Mandarin dictionary long used in the Chinese world. I also search for potentially related visual targets words in this resource. All visual targets are checked primarily in Chinese Wordnet to see if they fulfill the requirements, and when Chinese Wordnet does not have enough data, I check the words in the Revised Mandarin Chinese Dictionary. Only words appearing in either databases are used.

(4) *Souwenjiezi* (搜文解字, http://words.sinica.edu.tw/), and in particular its subsystem, *Soucixunzi* was also used. This online lexical resource allows one to search for disyllabic words (in corpus) that contain, start with, or end with, a certain character, which enhances the searching process.[40]

2.5.5 Effects of Nonwords

The types of nonwords affect lexical decision results. In lexical decisions different types of nonwords can be used, e.g., illegal nonwords (comprising meaningless combination of graphemes, violating phonological rules), legal nonwords (usually pronounceable) and pseudohomophones (pronounced like real words but orthographically different from them). It is held by certain researchers that pseudohomophones deepen semantic processing and thus are apt for semantic studies (Azuma & VanOrden, 1997; Lin & Ahrens, forthcoming), because number of meaning effects become stronger when the nonwords become more and more "word-like" in simple lexical decisions.

[40] It is also possible to use other resources or tools, such as HowNet or ConceptNet.

However, pseudohomophones may not be necessarily a good candidate for priming studies. For one, to date how phonological and orthographical representations are interconnected (as in the case of pseudohomophones, which correspond to correct phonological information but wrong orthographical information,) remains unclear (Gomes et al., 1997; Klepousniotou & Baum, 2007). Moreover, Ahrens (1998) claims that pseudohomophone tasks should be best described as interference tasks in nature (cf. Besner & Davelaar, 1983; Glucksberg et al., 1986; Vanhoy & Van Orden, 2001). She argues that whether such an interference task used in priming studies (and not in pure lexical decision studies) could "[measure] processing relating to ambiguity resolution" is questionable. Indeed, the core task in pseudohomophone experiments is an orthographic verification process (Ziegler, Jacobs & Kluppel, 2001) that differs from other tasks in nature. This task demands participants to check orthographic forms before answering, thus forcing the mind to be a spell-checker, either in word trials or in nonword trials. Hence it is likely that such an interference creates noises and masks priming effects. Pseudohomophones thus may not be appropriate for priming studies.

Given these concerns (whether pseudohomophones benefit observation of semantic processing, or interfere priming effects), the current study prepares two kinds of nonword trials—pseudohomophones and legal nonwords—and seeks to use an appropriate type of nonwords in formal experiments.[41] See Tables 3A and 3B for types of nonwords used in previous cross-modal priming studies.

2.5.6 Lexical Category

Accompanying with the permeating polysemy phenomenon, many words are cross-categorical (e.g., *light* has both a nominal and adjectival meaning). Although it is

[41] Because pseudohomophones retain the phonological forms of the base words, in creating them I manipulated their relatedness with the filler prime words. In this way, the filler prime words and base words of pseudohomophones can also be used in offline relatedness ratings as filler trials, thus serving for the study's general purpose too.

uncertain whether this factor has significant impact on priming studies, it will still be attended to in this study. On the one hand, previous studies on lexical ambiguity generally did not control for this factor (cf. Lin & Ahrens, forthcoming; Tsai, 2005). Moreover minimal differences between nouns and verbs in terms of their neural representation were also reported (Gomes et al., 1997; Tyler et al., 2001), hinting at little distinction in their processing. On the other hand, researchers still noted differences between nouns and verbs in terms of difficulty in learning (Kauschke, Lee & Pae, 2007), naming latency (Kauschke & von Frankenberg, 2008), mutability (Ahrens, 1999), anomia (Crepaldi et al., 2006), their different focus (cf. Ahrens, 1995; nouns denote objects, and verbs are relational, involving all their relevant thematic roles; Vigliocco & Vinson, 2007), etc. In particular, a faster response for nouns than for verbs were often found (Gomes et al., 1997). In cognitive terms, nouns and verbs also involve different construal operations, such as summary scanning and sequential scanning; the former refers to a construal of the object as a whole (i.e. nouns), while the latter involves conceptualizing the scene in on-going time (i.e. verbs; Croft & Cruse, 2004). Because the effect of lexical category is uncertain (and is not considered in any of the lexical access models discussed here), the current study will stick to the primary focus, i.e., a contrast between salient/nonsalient literal or metaphorical meanings in biased contexts. However, I will attend to the issue by avoiding cross-categorical lexical items either for prime words or target words. Half of the stimuli will be purely nouns, and half, purely verbs.

2.5.7 Creation of Contexts & Criteria

Besides the lexical items, the creation of sentential stimuli may also affect the results. Giora (2003) points out that "weighted contextual information, polar ambiguities, and location in the sentence context" will require further study. The

following criteria therefore apply for factors relevant to the creation of sentential stimuli:

(1) *Strongly biased contexts*. Since previous studies distinguish strongly biased contexts from weakly biased contexts (Rayner et al., 1994; Vu et al., 2000; Vu et al., 1998; Wiley & Rayner, 2000), I decide to bias the sentential contexts strongly, since a major claim in Giora (2003) is activation of salient meanings occurs regardless of contextual influence. The strongly biased contexts thus enhance a critical examination of the hypothesis.

(2) *Sentence-medial position*. The positioning of ambiguous words in sentences is an issue. Placing ambiguous words in the beginning of sentences reduces contextual effects and enhances activation of multiple meanings. On the other hand, placing ambiguous words in a sentence-final position results in stronger contextual effects, although it is argued salient meanings still will not be put down there (Giora, Peleg & Fein, 2001; cf. Vu et al., 2000). Given the hypothesis and the present goal of study, I locate the ambiguous words in the middle of the sentences, where the contextual effects are strong enough but is less likely for participants to anticipate the appearance of visual targets.

(3) *Single sentential contexts, moderately long*. The number and length of sentences (two or more short or long sentences or single sentences) vary in previous studies. To simplify the whole setting to a sentential context without having to consider potential more global, discourse level information, I use one single sentence for each trial. The length of sentences is controlled as such that length of every sentence is roughly 30 characters (see Chapter Three for specific details).

2.5.8 Memory Tests

A final issue in a cross-modal lexical priming study is how memory tests are conducted and analyzed. Memory tests are important in a dual task like a cross-modal priming task, since a trade-off between response accuracy and comprehension is likely to occur while participants listen to the auditory stimuli and respond to the visual stimuli. How often memory tests are conducted or what accuracy level the participants are required to attain may affect the results. A high accuracy threshold as well as a long memory test interval (or only once after the whole experiment) means a selection of high memory-span participants, and vice versa. And it is suggested that high memory-span participants employ a different processing strategy when presented with ambiguous words from low memory-span participants (Ahrens, 2006). The former group retains both meanings of ambiguous words, while the latter group holds on to only the dominant meanings. Ahrens (2006) adopted a high accuracy threshold (0.8) for a memory test of ten trials after an experiment of 42 trials. Due the difficult to attain the standard, roughly 60 out of 180 participants' data had to be removed. Hence, the design and accuracy threshold in memory tests affects the results, interpretation and the necessary number of participants (see Tables 3A & 3B for memory tests in other studies). In the current study, memory tests are conducted during the experiments, and a medium accuracy level is required (see Chapter Three for details).

Chapter 3 Methodology

3.1 Overview of Chapter and Experimental Design

Chapter three reports the methodology for material preparation. The materials include **(1)** ambiguous prime words, that is, metaphorical polysemy with frequent/infrequent literal/metaphorical meanings in corpus, **(2)** sentential stimuli that contain them, **(3)** visual target words, **(4)** unrelated prime words and their sentential stimuli, **(5)** filler trials and memory test trials, and **(6)** the auditory files for the prime words and sentential stimuli. The sentential stimuli will be pretested for their bias and the prime-target pairs will be pretested for their relatedness either out of context or in context according to the criteria established in the previous chapter.

This section will firstly introduce the experiment and then present an overview of the experimental design, sample stimuli, and research procedure.

The cross-modal lexical priming task is adopted in order to detect activation of meanings of metaphorical polysemy embedded in literally- or metaphorically-biased contexts. This dual task requires participants to listen to auditory stimuli, and at critical time points (here at prime offsets) visual targets are presented on the screen for participants to decide whether they constitute real words or not. Experimental trials may contain real word targets that are related to either meanings of primes. Facilitated reaction times to such targets then suggest activation of a certain meaning in the prime. This paradigm thus allows an observation of how literal and metaphorical meanings of the primes may be activated in on-going context.

In the main experiment, three major variables were manipulated, namely prime types, target types, and sentence types. Metaphorical polysemies that contrast in corpus sense frequencies (either having a highly frequent literal or metaphorical meaning) served as primes, as contrasted to their matched monosemous unrelated prime words.

These words were embedded in different types of contexts (literally-biased, metaphorically-biased, or unrelated contexts). And literally-related or metaphorically-related visual targets rotated in different sentential conditions and were visually presented at prime offsets when the auditory sentential stimuli were being played.

The stimuli prepared in this chapter will be used in Chapter Four for the evaluation of three measures of salience, namely corpus sense frequency, offline word association task (experiment 1), and online cross-modal lexical priming task for isolated words (experiment 2), and in Chapter Five for the major experiment, cross-modal lexical priming task for words in context (experiment 3), which examines the research hypothesis in the study.

Sample stimuli prepared in this chapter are as following:

Sample Stimuli:

1. **Experiment 1: Off-line Measure of Salience: Word Association Task**

   Metaphorical Polysemy: **廢物** ***fei4 wu4*** (Highly Literal Word)

   (Literal Sense: 'Waste'; Metaphorical Sense: 'A good-for-nothing')

2. **Experiment 2: Online Measure of Salience: Cross-modal Priming Task for Isolated Words**

   Related Prime: 廢物 *fei4 wu4* 'waste[1]; a good-for-nothing[2]'

   Unrelated Prime: 門禁 *men2 jin4* 'entrance control'

   Visual Target 1 (Literal): 殘渣 *can2 za1* 'residue'

   Visual Target 2 (Metaphorical): 累贅 *lei2 zui4* 'a nuisance'

3. **Experiment 3: Cross-modal Priming Task for Words in Context**

   Literally-biased Sentence:

   化學肥料工廠依規定須妥善處理加工過程中產生的**廢物**ˆ，不可隨便。

   'According to the law chemical fertilizer factories have to deal with ***wastes***ˆ generated during production with great care and should not be heedless of them.'

   Metaphorically-biased Sentence:

   從小祖母就諄諄告誡他：不要做個混吃等死的**廢物**ˆ，要做有用的人。

   'Ever since childhood his grandmother admonished him: Don't be ***a good-for-nothing***ˆ who knows nothing but eating till death; be someone useful.'

   Unrelated Sentence:

   某些大學的宿舍爲了確保同學安全設有**門禁**ˆ，限制深夜同學的出入。

   'Some college dormitories have an ***entrance controller***ˆ that limits entrance and exit at night to ensure safety.'

   Visual Target 1 (Literal): 殘渣 *can2 za1* 'residue'

   Visual Target 2 (Metaphorical): 累贅 *lei2 zui4* 'a nuisance'

Overview of Research Procedure

The basic methodological steps were as following (see Figure 5):

(1) I started from collecting candidate ambiguous primes from Chinese Wordnet.

(2) Sense taggings based on Chinese Wordnet definitions and Sinica Corpus 4.0 were done for many of the stimuli in order to determine the final lists of prime words that had either highly frequent literal meanings or highly frequent metaphorical meanings in corpus.

(3) Two subsequent steps were carried out simultaneously:

a) Creating sentential stimuli (biased to either meanings of ambiguous words) based on the ambiguous primes and pretesting them for their bias;

b) Looking for words related to ambiguous primes so as to prepare appropriate visual target words. Meanwhile, a word association task on the ambiguous primes was done, both for general purpose of the study and to enhance the preparation of visual target words.

In these steps, informal pretests, including pilot relatedness ratings and pilot sentence completion tasks, were done to determine the final items used in formal pretests and in online experiments.

(4) Unrelated sentences, unrelated prime words, filler sentences/words, nonwords, and words/sentences for memory tests were created or determined.

(5) Prime words and sentential stimuli were recorded.

(6) E-Prime scripts and other minor tasks (creating short introduction video, measuring critical time point of the recordings, testing machines, etc.) were for preparation for online experiments.

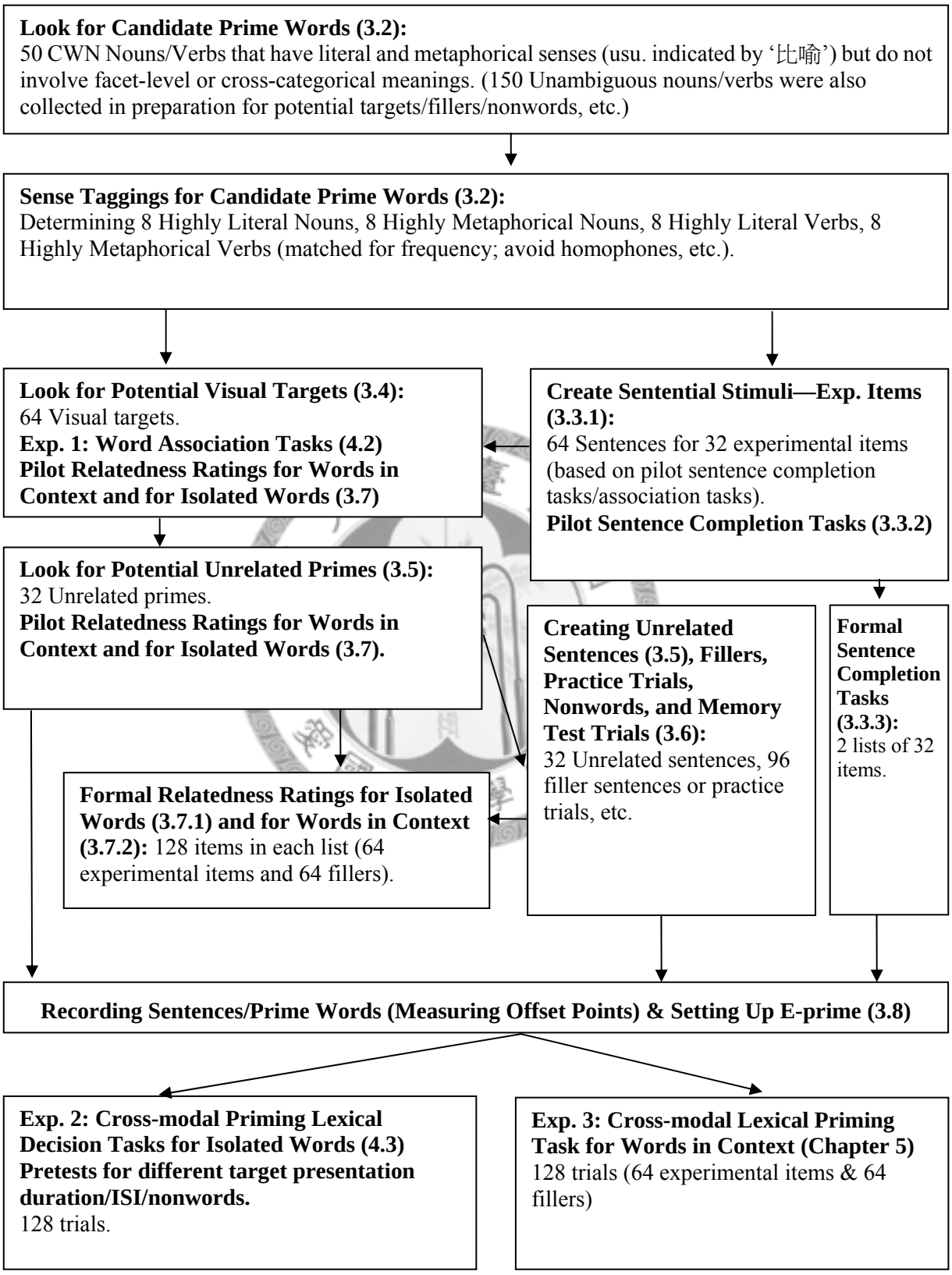

Figure 3. Overview of Research Procedure

3.2 Preparation of Ambiguous Words and Sense Taggings

One hundred disyllabic verbs and nouns (fifty verbs and fifty nouns) from Chinese Wordnet were gathered. These nouns/verbs all involved sense-level metaphorical meanings but not facet-level meanings or cross-categorical meanings; in other words, they were purely nouns and verbs. In addition, they did not involve any homographic meanings, as indicated by different lemma entries in Chinese Wordnet (see Chapter Two for introduction). Because metaphorical meanings were clearly recognized and indicated (usually by adding 比喻 *bi3 yu4* 'metaphorical' in the sense definitions) in Chinese Wordnet, it was adopted as the operational criterion for the determination of metaphorical senses.[42] Besides these words, 150 disyllabic, monosemous nouns and 150 disyllabic, monosemous verbs were also selected from the database for later use.

Sense taggings based on Chinese Wordnet definitions and Sinica Corpus 4.0 data for these polysemous words were done by the author for most of the candidate prime words[43], since Chinese Wordnet definitions were largely written based on Sinica Corpus 4.0 data. Firstly, KWIC (Key Words in Context) data for candidate prime words were downloaded from Sinica Corpus 4.0 into an excel file, with the word window[44] set at 119 characters per concordance line (i.e. maximum length allowed in Sinica Corpus 4.0). Secondly, each datum was manually coded for the Chinese Wordnet definition it corresponded to. Thirdly, proportions of each Chinese Wordnet sense's frequency as compared to the total frequency were obtained for candidate prime words' Chinese

[42] Namely I did not determine metaphorical meanings by myself. In a few cases, '比喻' was not clearly indicated in the definitions though the meaning seems metaphorical. For these words, two CWN members must further agree that the meaning was metaphorical for the words to be included in candidate stimuli. As Chinese Wordnet is still under construction, and the definitions may be constantly modified, one word, 湧起 *yong3 qi3* 'flow up' was found to have more related metaphorical senses after I finished the sense tagging work. In this case, I follow the original definitions obtained before sense taggings started.

[43] Except for words whose frequencies are too high or inappropriate to be experimental items. These words may serve as fillers in the experiment.

[44] See Svanlund (2008) for a discussion on length of word window for the determination of word meanings.

Wordnet senses. Since Chinese Wordnet analyzed word meanings based on corpus data and further supplemented meaning definitions based on other dictionaries, internet data, etc., the definitions were sufficient for the sense tagging work. In this study, results of sense taggings were taken as the primary criterion for the measuring the relative sense frequency of experimental items.

After sense-taggings were done for many candidate primes, eight nouns and eight verbs with primary, highly frequent literal meanings in corpus, and eight nouns and eight verbs with primary, highly frequent metaphorical meanings in corpus were chosen. For either highly literal words or highly metaphorical words, sense frequencies for high-frequency senses were never less than 65%, and sense frequencies for the other selected low-frequency senses were never more than 35 % (mean sense frequency: (1) literal senses for highly literal nouns/verbs/words as a whole: 77.70%/90.50%/84.10%, (2) metaphorical senses for highly literal nouns/verbs/words as a whole: 17.25%/5.64%/ 11.45%, (3) literal senses for highly metaphorical nouns/verbs/words as a whole: 15.07%/5.78%/10.42%, (4) metaphorical senses for highly metaphorical nouns/verbs/ words as a whole: 81.68%/90.49%/86.08%). These words did not differ in frequency [Mean=209.16, SD=265.52, $F(3, 28)=2.06$, $p>.12$; if only distinguishing highly literal words from highly metaphorical words, $t(30)=-1.19$, $p>.24$], word length (all are disyllabic), number of senses [Mean=2.69, SD=0.92, $F(3, 28)=1.34$, $p>.28$; if only distinguishing highly literal words from highly metaphorical words, $t(30)=1.69$, $p>.26$], or number of facets (none of them involve facet-level meanings). Sense frequencies for literal meanings of highly literal words and metaphorical meanings of highly metaphorical words, and sense frequencies for metaphorical meanings of highly literal words and literal meanings of highly metaphorical words, also did not differ [$t(15)=-0.51$, $p>.61$; $t(15)=0.40$, $p>.69$]. Sample stimuli and details for the stimuli's

relative sense frequencies are provided in Tables 4~6 below. See Appendix I for further information about selected senses of the words.

Table 4. Sample stimuli for nouns and verbs with highly frequent literal meanings (廢物 *fei4 wu3* 'waste'; 吞下 *tun1 xia4* 'swallow').

Noun	POS		WN Sense	Sense Freq.	NOS	Freq.
廢物 'waste'	Na	L	普通名詞。失去原有使用價值的東西。 'Noun. Sth. that lost its original usage or value.'	87.50 %	2	40
		M	普通名詞。沒有用的人。 'Noun. A good-for-nothing.'	12.50 %		
吞下 'swallow'	VC	L	將物體不經細嚼進入食道。 'To have sth. enter into oesophagus without chewing.'	72.73 %	4	11
		M	比喻壓抑住情感或言辭。 '(Metaphorical) To suppress emotion or words.'	18.18 %		

Table 5. Sample stimuli for nouns and verbs with highly frequent metaphorical meanings (角度 *jiao3 du4* 'angle'; 打斷 *da3 duan4* 'to break').

Noun	POS		WN Sense	Sense Freq.	NOS	Freq.
角度 'angle'	Na	L	普通名詞。兩直線或平面相交所形成的空間。 'Noun. The space formed two intersecting lines or planes.'	15.61 %	2	538
		M	普通名詞。比喻觀察特定事件的觀點。 'Noun. (Metaphorical) The viewpoint in observing sth.'	84.39 %		
打斷 'break'	VC	L	打擊物體，使其斷裂。 'To strike sth. that it breaks.'	11.32 %	2	53
		M	中斷正在進行的事件。 'To interrupt an ongoing event.'	88.68 %		

Table 6. Relative Sense frequencies of highly literal nouns (HLN), highly literal verbs (HLV), highly metaphorical nouns (HMN), and highly metaphorical verbs (HMV).

HLN	Lit.	Meta.	HMN	Lit.	Meta.
廢物	87.50%	12.50%	角度	15.61%	84.39%
櫥窗	71.11%	28.89%	觸角	32.56%	67.44%
孤兒	67.50%	25.00%	本錢	21.43%	71.43%
成本	85.90%	14.10%	戰術	34.09%	65.91%
跑道	65.12%	4.65%	焦點	0.00%	100.00%
主角	69.35%	30.65%	角色	12.69%	87.31%
生態	86.52%	10.87%	壓力	4.15%	77.66%
輪廓	88.64%	11.36%	階級	0.00%	99.26%
Mean	**77.70%**	**17.25%**	**Mean**	**15.07%**	**81.68%**
HLV	**Lit.**	**Meta.**	**HMV**	**Lit.**	**Meta.**
說出	89.23%	3.85%	站穩	5.56%	72.22%
毀容	85.71%	14.29%	帶動	5.07%	94.93%
動工	86.84%	0.00%	喚起	2.08%	95.83%
走路	96.55%	2.76%	看成	4.92%	95.08%
散去	94.74%	5.26%	浸淫	5.56%	94.44%
上臺	100.00%	0.00%[45]	打斷	11.32%	88.68%
長大	98.16%	0.79%	湧起	11.11%	83.33%
吞下	72.73%	18.18%	面臨	0.63%	99.37%
Mean	**90.50%**	**5.64%**	**Mean**	**5.78%**	**90.49%**
Mean(HL)	**84.10%**	**11.45%**	**Mean(HM)**	**10.42%**	**86.08%**

3.3 Preparation of Sentential Stimuli for Ambiguous Words

3.3.1 Creating Sentential Stimuli

Based on the criteria established in 2.5.7, 64 sentences were created for the 32 ambiguous primes, two for each word. For each pair of sentences, one was biased to the ambiguous word's literal meaning and the other to its metaphorical meaning. The prime words were embedded at sentence-medial position and the length of the sentences were

[45] Note that although some infrequent meanings get a sense frequency as low as zero in corpus, that does not mean they are totally obsolete. In fact, if one searches for the word in Google as some scholars do, one might find the infrequent sense still constitutes a portion of total sense frequency. The idea here is that since corpus is believed to be a sample of the language as a whole, corpus sense frequency should reflect a general tendency—and suggest whether a word is an unbalanced ambiguity. And that is my main purpose. In the study, I take sense frequencies more as a tendency than exact proportions. This being said, on the other hand I also think this might already be more accurate than other measures (see Chapter Two for a review). Also, this is relevant to a fundamental issue, that is, choice or establishment of corpus. See Chapter Six for a more detailed discussion.

controlled as such that each of them was 30-character long (i.e., using the MS-Office Word Count function, including punctuations), except for one.[46] Mean length including punctuation marks (but quotation marks)=30.03, SD=0.17; mean length excluding punctuation marks=27.36, SD=0.65; mean distance from the offsets of ambiguous words to the end of sentence (including punctuation marks)=7.55, SD=1.67; mean distance from the offset of ambiguous words to the end of sentence (excluding punctuation marks)=5.72, SD=1.64 (see Appendix III for the whole set of stimuli).

3.3.2 Pretest 1: Sentence Completion Task[47]

A sentence completion task (Ahrens, 2001; Ahrens, 2006; Tabossi et al., 1987) cuts off the sentential stimuli to right before the ambiguous words and requires participants to read the sentence fragments and to complete the sentences based on intuition in order for the researcher to verify the sentences bias the intended meanings.

Participants

52 undergraduate students from National Taiwan University and National Taiwan Normal University participated in the Internet-based sentence completion tasks (40 from NTU and 12 from NTNU). Participants were screened for experience of dwelling abroad, brain injury, and visual, auditory, or speech impairment. 10 participants' data were removed due to failure to meet the language background requirements.[48] Two participants filled out more than one questionnaire or other questionnaires related to the study, and thus only data from the first finished questionnaire were included. One

[46] One sentence was 31-character long based on the calculating method.

[47] Given the limited number of qualified ambiguous words, I did informal pretests before the sentence completion task and relatedness ratings in order that the stimuli were modified until they satisfied the criteria and could be used in the study. In this case, pretests were done by using Web Survey Toolbox (BETA 2006.08.30), a free online survey package tool that established a survey website and gathered data to a database, and then by using Google Docs.

[48] The overall criterion for dwelling abroad was that data from those who lived abroad for more than one year before the age of seven cannot be used. Although in the questionnaire I asked the participants to indicate for how long, when and where they lived if they answered yes to the question "Did you live abroad?", six participants did not leave necessary information and thus the data were removed. Another one participant clearly indicated she only lived abroad for two months; thus her data were retained.

participant did not leave real Chinese name or student ID and thus the data were excluded. The remaining 39 participants all spoke Mandarin Chinese at home and had a mean age of 19.38 (SD=0.89 years).

Materials & Design

The modified 64 sentences were divided into two lists, each containing 32 sentences. Types of sentences (literally biased or metaphorically biased, for highly literal nouns/verbs and highly metaphorical nouns/verbs) were counterbalanced in the two lists. Each list was further randomized into two versions to avoid any potential ordering effects. Sentences were cut off from right before the ambiguous word prime, and were embedded in a Google Docs questionnaire webpage. Before the completion questions, there was an introductory paragraph explaining the task to the participants (see Appendix VIII for the instruction), which was followed by a section for participants to fill out their language background. After these two sections, 32 sentence fragments were listed, each followed by a blank for participants to fill in their answers.

Procedure

It was explained in the introductory paragraph that participants should read the sentence fragments and try to finish the sentence by writing down the first answer they think of based on intuition. The questionnaires were configured as such that all required questions must be answered before data can be submitted. Immediately after participants submitted their answers, the data were imported into a Google Docs spreadsheet for later use.

Results & Discussion

The results consistently showed that the sentential stimuli biased to the intended aspect of meanings (see Appendix VI for the data). Particularly, in many cases,

participants consistently thought of exactly the missing ambiguous words.[49] This meant: (1) Strong bias was created for the sentences, which met the study's purpose (see discussions in 2.5.7. (2) The fact that many participants thought of the exact prime words suggested that on the one hand, the correct aspect of meaning was established, while on the other hand, it was possible that the intended aspect of meaning might be activated before the appearance of prime words. Some priming studies examined this issue by relocating the visual targets before the occurrence of prime words. While it is arguable that this phenomenon accompanies all studies that used a strongly biased one-sentence context, this issue however is out of the current scope and could be further explored in a future study. In general still, the sentential stimuli met the study's criteria and are appropriate for the current purpose to examine the graded salience hypothesis, which states that salient meanings will always be activated regardless of contextual bias.

3.4 Preparation of Visual Targets

Based on the review and criteria established in 2.5.4 and the lexical tools introduced in 2.5.4.2, 64 visual target words from Chinese Wordnet/the Revised Mandarin Chinese Dictionary were collected for literal and metaphorical meanings of the 32 metaphorical primes. These words were all monosemous based on the aforementioned criteria, and involved no cross-categorical meanings or facet-level meanings (for words obtained from Chinese Wordnet). Nominal primes were assigned with nominal visual targets, and verbal primes, verbal targets. Homophones, repeated characters in corresponding primes, and repeated words in sentential contexts before the primes, were avoided. Although this study mainly compares reaction times of the same set of target words (e.g., literal targets for highly literal prime words) under different contextual conditions (literal, metaphorical, or unrelated), the four groups of visual

[49] Although I did not yet have the data checked by more judges, but the author, it is believed that due to the rather consistent results these stimuli are 'safe' enough to be experimental items.

targets, i.e., literal targets for highly literal words and for highly metaphorical words, and metaphorical targets for highly literal words and for highly metaphorical words, did not differ in frequency [$F(3, 60)=0.61$, $p>0.61$][50], number of meanings (all are monosemous), word length (disyllabic words) or lexical category (nominal related primes for nominal unrelated primes, and verbs for verbs).[51]

3.5 Preparation of Unrelated Primes and Sentences

For the 32 ambiguous primes 32 matched unrelated primes were collected from the 150 disyllabic, monosemous nouns and 150 disyllabic, monosemous verbs obtained from Chinese Wordnet in the beginning. They were chosen for being weakly related to the prime words and the corresponding visual targets and were to be rendered into later relatedness rating tasks. The related-unrelated prime pairs did not differ in frequency (for highly literal word group, $t(15)=0.69$, $p>0.50$; for highly metaphorical word group, $t(15)=0.48$, $p>0.63$), word length (all are disyllabic), or lexical category (nominal related primes for nominal unrelated primes, and verbs for verbs).[52]

For these 32 unrelated prime words, 32 unrelated sentential stimuli were created in a manner similar to how sentential stimuli were created for the 32 metaphorical primes. The length of sentences was controlled as such that length of every sentence is equal to 30 characters (including punctuations; mean length excluding punctuation marks=27.72, SD=0.52; mean distance from the offset of unrelated prime words to the end of sentence (including punctuation marks)=9.03, SD=2.28; mean distance from the offset of unrelated prime words to the end of sentence (excluding punctuation marks)=7.38,

[50] Because some target words did not appear in Sinica Corpus 4.0, in this case the frequency counts were based on Sinica Corpus 5.0, which was still unpublished then and could be found in Chinese Word Sketch. Elsewhere I used Sinica Corpus 4.0 frequency counts.

[51] See Chapter Two for further discussion and reasons for comparing exactly the same group of targets under different contextual conditions.

[52] Informal familiarity/concreteness ratings were also done. Hence I attempted to roughly match these factors too.

SD=2.16; see Appendices II~III for the whole set of stimuli). These sentences will be rendered into later relatedness rating tasks.

3.6 Preparation of Fillers, Practice Trials, Nonwords, and Memory Test Trials

3.6.1 Filler/Practice Prime Words and Sentences

In the current experimental design, all experimental prime words were paired to real word visual targets, and hence for lexical decisions an equal amount of nonword trials containing filler prime words and nonword visual target words were created. Since each list contained 64 experimental trials, 64 filler (nonword) trials were added. Additional 32 items were prepared in a similar way for practice trials (20 trials) or for later use.[53]

Filler trials were created as following: From the remaining 68 candidate prime words that were collected from Chinese Wordnet, 24 nouns and 24 verbs were selected. Like the experimental prime items, they all involved sense-level metaphorical meanings and not facet-level meanings or cross-categorical meanings in Chinese Wordnet. From the remaining 118 disyllabic, monosemous nouns that were collected from Chinese Wordnet, another 24 nouns and 24 verbs were selected. Like the experimental unrelated prime items, each of them involved only one sense-level meaning and not facet-level meanings or cross-categorical meanings in Chinese Wordnet. These words were similar to the experimental prime words, and thus were appropriate to serve as fillers or practice trials.

For these 96 filler prime words, 96 sentences were further created. The filler prime words varied in their position of appearance in the sentence so as to eliminate potential response strategy. For the 48 filler metaphorical prime words, half of the sentences were roughly biased the literal meanings, and half of the sentences roughly biased the

[53] More fillers than needed were created in the beginning for later use, e.g., sample stimuli in experimental instruction, or necessary substitution of unsatisfactory trials.

metaphorical meanings. The length of sentences was controlled as such that each sentence was exactly 30 characters long (including punctuations; see Appendix IV for the whole set of stimuli).

3.6.2 Two Types of Nonword Visual Targets

Two types of nonword visual targets for the filler primes were created: pseudohomophones and legal nonwords.[54] Because pseudohomophones maintain phonological information of real words (e.g., the nonword 壩吧 *ba4 ba5* for 爸爸 *ba4 ba5* 'father'), and merely differ from real words in orthographic forms, I manipulated relatedness between the filler primes and their corresponding pseudohomophones' base words. For example, the filler prime 家庭 *jia1 ting2* 'family' was paired with 壩吧 *ba4 ba5* (爸爸 *ba4 ba5* 'father') to (roughly) form a related pair. In contrast, the filler prime 種子 *zhong3 zi3* 'seed' was paired with 髮另 *fa3 ling4* (法令 *fa3 ling4* 'law') to (roughly) form an unrelated pair. These filler prime-target pairs were also used in later offline relatedness ratings as fillers, with pseudohomophones changed back to their base words.

For the 96 filler prime words, 96 pseudohomophones were created by replacing characters of real words with their homophones. There were an equal amount of related and unrelated pseudohomophones for each group of filler primes (24 metaphorical nouns/verbs, 24 monosemous nouns/verbs). The 48 related base words were chosen by intuition and were roughly controlled for lexical category (nouns for nominal fillers, and verbs for verbal fillers); they were further checked for not repeating any other words in the experiments. And the 48 unrelated base words were selected from the remaining candidate monosemous words and were controlled for lexical category and paired to the remaining filler prime words in a similar way.

[54] See 2.5.5 for details and reasons for creating two types of nonwords.

64 out of the 96 fillers used in formal experiments were counterbalanced for metaphoricity, lexical category, and relatedness. For another 20 fillers used in practice trials, half of the pseudohomophones were changed back to the base words to form real word trials.

Besides pseudohomophones, 74 legal nonwords for formal experiments and practice trials were also created by randomly exchanging the second characters of the 74 pseudohomophones used in formal experimental and practice trials. Results of randomization were further checked to prevent if any new string of characters formed a meaningful word or a pseudohomophone.

3.6.3 Memory Test Words and Sentences

The general design of memory tests (for pretest 4 and experiments 2 and 3) was as following: Since the 128 lexical decision trials in each experiment were divided into eight randomized blocks of 16 trials, after every block followed a memory test of ten trials, and hence there were 80 memory test trials in each formal experiment. There were an equal amount of positive and negative trials in each memory test block.

For pretest 4 and experiment 2, which tested words presented in isolation, additional 24 multiple-sense nouns and 24 multiple-sense verbs from Chinese Wordnet were chosen, which did not involve any facet-level or cross-categorical meanings and were purely nouns and verbs. These words were selected as negative trials in memory tests because they resembled the experimental items in having polysemous meanings. Among these 48 nouns and verbs, 20 nouns and 20 verbs were used in formal memory tests, and four nouns and four verbs were used in practice sessions. The 20 nouns and 20 verbs were then divided into eight groups of five words (five nouns or verbs). Each group of words were combined with another five words that did appear in a lexical decision block to form a memory test of ten trials; the five positive trials included 2

experimental primes and 3 filler primes. In addition, the eight remaining multiple-sense words (four nouns and four verbs) were combined with four nominal primes and four verbal primes selected from the practice lexical decision block to form a practice memory test for the practice session (see Appendix V for the whole set of stimuli).

In experiment 3, which tested words presented in context, the 128 trials were divided into eight blocks of 16 trials, and ten sentences from each block were selected (eight fillers and two experimental items) for memory tests. Half of the sentences remained exactly the same in memory tests, while the other half were slightly adjusted so that they were only similar to original sentences. For experimental items that were selected, because they had both literally-biased or metaphorically-biased contexts which were counterbalanced between lists, memory test sentences were created according to their conditions in each memory test in their appropriate lists. In addition, ten practice memory test items were designed in a similar way for the practice session.

3.7 Off-line Pretests: Relatedness Ratings for Isolated Words and Words in Context

Pretests for relatedness between the prime (out of context and in context) and the selected visual target words were the final steps to check the stimuli met the criteria established in 2.5.4.

3.7.1 Relatedness Ratings for Isolated Words

Participants

40 undergraduate students from National Taiwan University participated in the Internet-based relatedness rating task. These participants were mainly recruited by randomly emailing a request to 408 NTU undergraduate students of different colleges (roughly 1 per 40 NTU undergraduate students). Participants were screened for experience of dwelling abroad, brain injury, and visual, auditory, or speech impairment.

Nine participants' data were removed due to failure to meet the language background requirements. One participant's data were removed because of obvious inadvertence.[55] The remaining 30 participants all spoke Mandarin Chinese at home and had a mean age of 20.37 (SD=1.52 years).

Materials & Design

The design of this offline rating task simulated the design in online experiments (which used a matched-primes design), albeit slightly differently. The experimental lists were designed as such that in one list, an ambiguous prime was paired to its literal target and the unrelated prime to the metaphorical target; in a second list, the prime-target pairings were switched, i.e., the ambiguous prime was paired to its metaphorical target and the unrelated prime was paired to the literal target. Four lists were created, two for nouns and two for verbs. Nouns and verbs were separated into different lists to avoid any potential meaningful V-O sequence. Hence list 1 and list 2 both contained 32 experimental prime-target pairs for highly literal nouns and highly metaphorical nouns and just differ in prime-target pairings; and likewise for list 3 and list 4 for highly literal verbs and highly metaphorical verbs.[56] Types of targets (literal and metaphorical) and prime-target relatedness conditions (related and unrelated) were counterbalanced between lists.

32 filler prime-target pairs prepared in the earlier sections were added into each list. Half of the word pairs consisted of the filler metaphorical primes (prepared in the earlier section), and their corresponding targets (base words of pseudohomophones; see the earlier section). The other half consisted of filler monosemous primes and their corresponding targets. There were an equal amount of related and unrelated filler trials.

[55] Mean ratings/SDs respectively are 3.78/1.05, which is the lowest SD among the remaining 31 participants (i.e., not including those who failed to meet the language background requirement).

[56] The design is described here in detail for the first time, and hereafter details are only repeated where necessary.

The 64 word pairs in each list were randomized and were embedded in four different Google Docs questionnaire webpages. The webpages began with an introductory paragraph explaining the task to the participants, which was followed by a language background section. After these two sections, the 64 randomized word pairs were listed, each followed by a 1-to-7 likert scale for participants to rate the relatedness of the word pairs, with 1 meaning "very unrelated" and 7 meaning "very related".

Procedure

It was explained in the introductory paragraph that participants should judge the degree of relatedness between meanings of the paired two words based on their intuition. The questionnaires were configured as such that all required questions must be answered before data could be submitted. Immediately after participants submitted their answers, the data were imported into a Google Docs spreadsheet for later use (for the whole set of stimuli, instruction, and screeshots of webpages, see Appendices II, IV, and VIII.B).

Results & Discussion

The results suggested that the prime-target pairs were sufficiently related for later online experiments, which was indicated by significant differences in relatedness ratings for the same sets of targets between the related and unrelated conditions.

Mean ratings for each prime-target pair were submitted to a three-way ANOVA with Prime Group (highly literal group and highly metaphorical group), Target Type (literal target and metaphorical target), and Prime Relatedness (related and unrelated) as fixed factors. Overall, significant main effects were found for Prime Relatedness [$F(1, 120)=354.05$, $p<.001$] and for Prime Group [$F(1, 120)=5.85$, $p<.02$]. A significant

two-way interaction was found for Prime Group×Target Type [F(1, 120)=9.53, p<.004]. There were no other interactions.[57]

Separate independent t-tests showed significant differences for each group of prime-target pairs under the related and unrelated conditions: For literal targets of highly literal words, t(30)=13.10, p<.001, for metaphorical targets of highly literal words, t(30)=8.23, p<.001, for literal targets of highly metaphorical words, t(22.70)=8.11, p<.001, and for metaphorical targets of highly metaphorical words, t(23.27)=9.10, p<.001. Mean relatedness ratings for each group of prime-target pairs are summarized in Table 7 and Figure 4:

Table 7. Mean Relatedness for Highly Literal/Metaphorical Words in Isolation.

	Literal Meaning		Metaphorical Meaning	
	Relatedness	D	Relatedness	D
Highly Literal Words				
Related Prime	5.29	+3.69***	4.37	+2.62***
Unrelated Prime	1.60		1.75	
Highly Metaphorical Words				
Related Prime	4.85	+3.04***	5.54	+3.14***
Unrelated Prime	1.81		2.40	

***p<.001

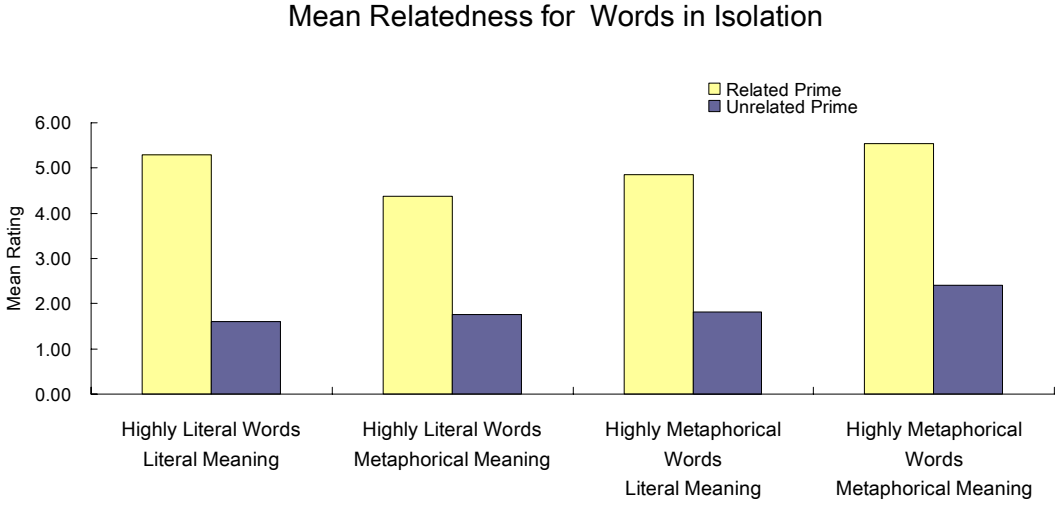

Figure 4. Mean Relatedness for Highly Literal/Metaphorical Words in Isolation.

[57] Equal variances not assumed.

Note that the current study mainly compared the same set of targets (e.g. literal targets for highly literal words) under different conditions, and thus the target words, when presented in isolation, already satisfied the relatedness criterion established in 2.5.4. However, the interaction between Prime Group and Target Type is worth noticing: It may result from the fact that for highly literal words, ratings were slightly higher for their literal targets (mean=3.44) than for their metaphorical targets (mean=3.06), while for highly metaphorical words, ratings were slightly higher for their metaphorical targets (mean=3.98) than for their literal targets (mean=3.33). This may reflect the contrastive sense frequencies of literal and metaphorical meanings in the two groups of primes (highly literal words and highly metaphorical words). Also, the main effect for Prime Group resulted from the fact that relatedness ratings for the highly metaphorical word group (3.65) was slightly higher than the highly literal word group (3.25). Although it was not the main purpose of the study to compare reaction times of different groups of visual targets, this suggested that lack of priming effects for highly metaphorical word group but not for highly literal word group cannot be attributed to differences in their relatedness ratings.

3.7.2 Relatedness Ratings for Words in Context

Participants

38 undergraduate students from National Taiwan University participated in the Internet-based relatedness rating task. Participants were screened for experience of dwelling abroad, brain injury, and visual, auditory, or speech impairment. Nine participants' data were removed due to failure to meet the language background requirements. The remaining 29 participants all spoke Mandarin Chinese at home and had a mean age of 19.93 (SD=1.41 years).

Materials & Design

Four basic lists were created, each containing 128 trials, including fillers. Exactly the same prime-target pairs used in the previous experiment were used, except that the primes were in sentences, and sentential stimuli for nominal primes and verbal primes were not separated because there were not possible meaningful V-O sequence between the prime words. Based on the prime-target pairings in the previous rating task, unrelated prime words were replaced by their unrelated sentential stimuli, and half of the related prime words were replaced by literally-biased sentences and half by metaphorically-biased sentences. Hence, the Prime Relatedness factor was replaced by the Sentence Type factor in this task. Types of related sentential stimuli and visual target words for metaphorical primes were counterbalanced between lists.

Each list were further randomized into two versions, and were embedded in eight different Google Docs questionnaire webpages similar to those in the previous experiment. After the introductory paragraph and the language background sections, the 128 randomized sentence-target pairs were listed, each followed by a 1-to-7 likert scale for participants to rate the meaning relatedness between the primes (embedded in sentences) and the corresponding visual target words, with 1 meaning "very unrelated" and 7 meaning "very related". The prime words were marked out by adding two asterisks ("**") before and after it. After the sentence, a dash and visual target word were listed (for the whole set of stimuli, instruction, and screeshots of webpages, see Appendices III, IV, and VIII.C).

Procedure

The procedure was identical to that in the previous task, except that participants should carefully read the sentences and judge the degree of relatedness between

meanings of words marked out by "**" in sentences and meanings of words listed after the sentences, based on their intuition.

Results & Discussion

The results suggested that stimuli satisfied the criteria for the study. This was indicated by significant differences in relatedness ratings for the same sets of targets under different sentential conditions (literally-biased, metaphorically-biased, or unrelated).

Mean ratings for each sentence-target pair were submitted to a three-way ANOVA with Prime Group (highly literal group and highly metaphorical group), Target Type (literal target and metaphorical target), and Sentence Type (literally-biased, metaphorically-biased, and unrelated contexts) as fixed factors. An overall significant main effect was found for Sentence Type [$F(2, 180)=175.77$, $p<.001$]. The effect of Prime Group was only barely significant [$F(1, 180)=4.04$, $p=.046$]. A significant two-way interaction was found between Sentence Type and Target Type [$F(2, 180)=40.14$, $p<.001$]. Post hoc Tukey HSD tests showed significant differences between literal context and unrelated context conditions ($p<.001$), and between metaphorical context and unrelated context conditions ($p<.001$). The data are summarized in Table 8 and Figure 5:

Table 8. Mean Relatedness Ratings for Words in Context.

	Literal Meaning			Metaphorical Meaning		
	Relatedness	D		Relatedness	D	
Highly Literal Words						
Literal Context	5.35	+4.02	+1.13	3.60	+2.20	-2.09
Metaphorical Context	4.22	+2.89		5.69	+4.29	
Unrelated Context	1.33			1.40		
Mean	3.63	-	-	3.60	-	-
Highly Metaphorical Words						
Literal Context	4.92	+3.67	+1.55	3.26	+1.80	-2.17
Metaphorical Context	3.37	+2.12		5.43	+3.97	
Unrelated Context	1.25			1.46		
Mean	3.18	-	-	3.38	-	-

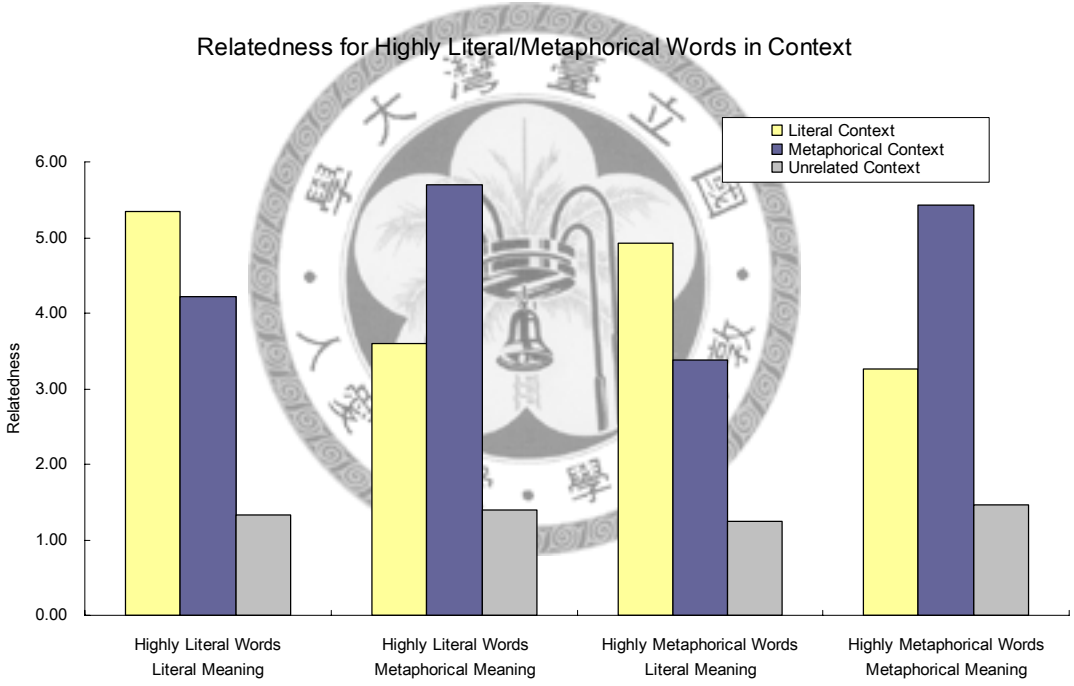

Figure 5. Relatedness for Highly Literal/Metaphorical Words in Context.

Further separate one-way ANOVAs were conducted to observe effects for each group of targets (e.g., literal targets for highly literal words) under different sentential conditions. One-way ANOVAs showed significant differences for each group of target words between different types of sentential context conditions (for literal targets of highly literal words, $F(2, 45)=51.83$, $p<.001$; for metaphorical targets of highly literal words, $F(2, 45)=81.91$, $p<.001$; for literal targets of highly metaphorical words, F(2,

45)=38.86, p<.001; for metaphorical targets of highly metaphorical words, for metaphorical targets of highly metaphorical words, F(2, 445)=54.19, p<.001). Moreover, post hoc Tukey HSD tests showed significant differences in ratings for literal targets of highly literal words between each sentence type (literal vs. unrelated or metaphorical vs. unrelated context, *p*s<.001; literal vs. metaphorical context, p<.03), for literal targets of highly metaphorical words between each sentence type (literal vs. unrelated or metaphorical vs. unrelated, *p*s<.001; literal vs. metaphorical, p<.003), and for metaphorical targets of highly literal/metaphorical words between each sentence type (all *p*s<.001).[58]

Note, again, that the current study mainly compared the same set of targets (e.g. literal targets for highly literal words) under different contextual conditions, and hence the target words, when presented in context, already satisfied the relatedness criterion established in 2.5.4. However, the interaction between Sentence Type and Target Type is also worth noticing: It may result from the fact that literal targets obtained higher ratings than metaphorical targets in literally-biased contexts (5.13 vs. 3.80), while metaphorical targets obtained higher ratings than literal targets in metaphorically-biased contexts (3.43 vs. 5.56). This was reasonable and suggested that the contexts were correctly biased to the intended meanings and that the selected target words correctly related to the literal or metaphorical meanings of the primes. In all, the stimuli prepared in this chapter are appropriate for later online experiments.

3.8 Preparation of Auditory Stimuli

3.8.1 Sound Recordings & Apparatus

All sounds were recorded by a male native speaker of Taiwanese Mandarin in a sound-attenuated room. These items were recorded in a single channel to the hard disk

[58] Equal variances not assumed in this series of ANOVAs.

of an Intel Pentium 4 (2.40 GHz) computer at a sampling rate of 22050 Hz and in bit-depths of 16, with the aid of Computerized Speech Lab audio processing package (Model 4400, version 2.7.0).

3.8.2 Measuring Critical Time Points

For pretest 4, the sounds of individual words were cut off to their offsets by using Goldwave v.5.06. For experiment 2 and 3, the sounds of experimental items were re-processed by using Praat v.5.0.46 for a better accuracy. The criteria for measuring offset points of experimental items were as following: (1) Offsets of primes and end of sentential stimuli were defined as the end of formants. (2) The sounds should be trimmed to the nearest zero crossing points and exact prime offset positions (both for isolated words and for words in context), because whether sounds start or end at zero crossing points affects perception. And the total duration for each sentence were thus measured. (3) Because prime words were embedded at a sentence-medial position, when primes were immediately followed by another word and no apparent ending of formants was observed between the words, a cut-off point was further determined (usually judged by examining the formants/spectrum).

Because length of prime words (all were disyllabic) and length of sentences (mean= 27.36, SD=0.65 characters, excluding punctuation marks) were controlled, the duration of individual word sounds were around 1s and duration of experimental sentential stimuli had a mean of 6063.84 ms (SD=320.55 ms); the duration from the onset of sentential stimuli to the offset of prime words had a mean of 4356.05 ms (SD=504.40 ms).

Chapter 4 Comparing Salience Measures to Determine Salient Meanings

This chapter compares results from three measures of salience reviewed in Chapter Two in order to properly determine "salient meanings" in the current stimuli. While corpus-based sense frequency is adopted as the primary measure (see Chapter Two for reasons), based on which all the stimuli in the study are organized, the three measures and their results will be discussed and compared. In particular, the current study conservatively defines meanings as salient only if the three measures produce consistent results. Defining salient meanings will then provide a basis for discussion of the study's major issue in Chapter Five, i.e., how salient/nonsalient literal/metaphorical meanings are accessed in context.

4.1 Corpus-based Sense Frequency

Though corpus-based sense frequency is potentially a more accurate, objective, operationalizable, and economical measure of salience than others (see Chapter Two for discussion), how it actually works for the current issue remains yet uncertain. Hence while it is taken as the main measure in the study, it needs evaluation before it serves as the basis for the exploration of the major issue of study. For methodology and results of calculating the items' corpus-based sense frequencies, see 3.2. The relevant items will be used in the following measures for the evaluation.

4.2 Offline Measure: Word Association Task (Experiment 1)

This section presents a word association task (though a small-scale one) that investigates the major associates of the ambiguous primes to find out which meanings are salient based on this measure (see Chapter Two for a review).

Participants

39 students from National Taiwan University participated in the Internet-based word association task. Four participants were found graduate-level students, and thus in

order to maintain homogeneity within the participants their data were removed. One participant filled out other questionnaires related to this study, and thus her data were not included. Another 14 participants' data were excluded because they did not strictly follow the instruction and provided less or more than three responses, or because they did not leave valid background data or failed to meet the language background requirements (dwelling abroad before or having visual impairment). The remaining 20 participants (Mean age=20.50, SD=1.36 years; 7 males and 13 females) all spoke Mandarin[59] at home and were screened for experience of dwelling abroad for a long period, brain injury, and visual, auditory, or speech impairment. In order to ensure that association data were not biased by participants' educational background, the participants' profile by college was further analyzed (Fig. 6). As suggested in Figure 6, slightly more than half of the participants came from colleges of management, liberal arts, and social sciences (closer to social science), and 40 % of the participants came from colleges of science, engineering, etc. This indicated that their educational background was relatively balanced and not a potential source of bias.

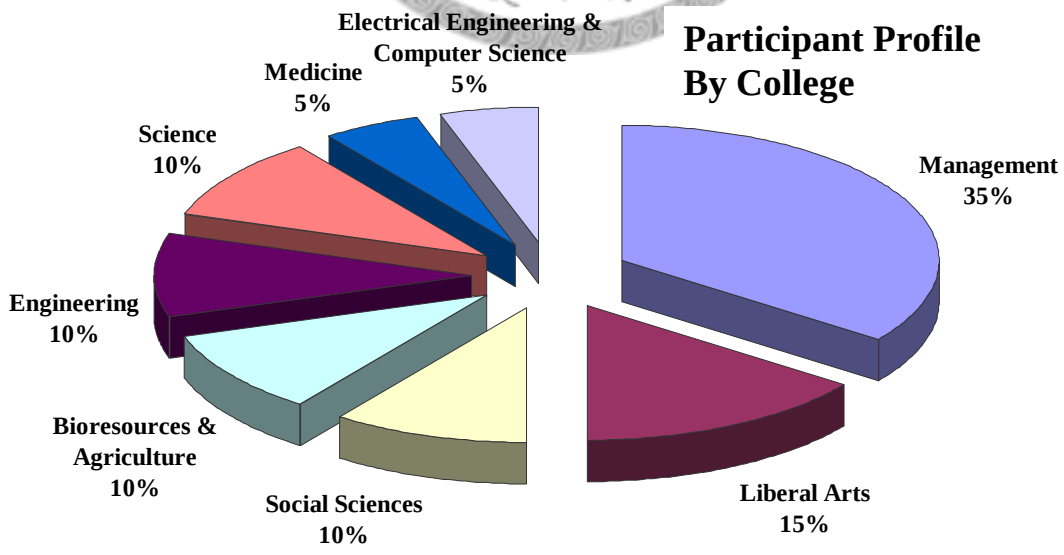

Figure 6. Participant Profile by College.

[59] One participant indicated she spoke Peking Mandarin at home.

Materials & Design

The 32 ambiguous primes prepared in Chapter Three were used in this task. In order to avoid any potential meaningful V-O sequence, nouns and verbs were separated into two lists, each containing 16 items. Then each list was randomized into two versions (thus four lists were created) so as to avoid potential ordering effects. The items were then embedded in a Google Docs questionnaire webpage. Before the completion questions, there was an introductory paragraph explaining the task to the participants (see Appendix I for the whole set of stimuli, and Appendix VIII.D for instruction and screenshots), which was followed by a section for participants to fill out their language background. After these two sections, 16 experimental items were listed, each followed by a blank for participants to fill in their answers.

Procedure

It was explained in the introductory paragraph that participants should fill in the first word that comes to their mind based on intuition when they see the experimental item, and then the second word, and then the third word, namely this was a continuous association task (see 2.3.3.3 for further discussion; De Deyne & Storms, 2008). Immediately after participants submitted their answers, the data were imported into a Google Docs spreadsheet for later use.

Data Analysis

The data were analyzed in the following way: Since it was of interest which meaning would be measured as salient based on this task, I focused on the first associates, and determined whether these associates were related to the words' frequent literal or metaphorical senses (i.e., the words' dominant usages in corpus). Because the sequence of the production results were usually meaningful and could enhance the judgment, all associates produced by a participant for a single lexical item must be

examined together before a decision was made based on intuition. For example, a metaphorical associate may be followed by a metaphorical associate too (as in the case of 湧起 *yong3 qi3* 'flow up'－ 1 水泉 *shui3 quan2* 'spring' － 2 思緒 *si1 xu4* 'thought' － 3 意識 *yi4 shi4* 'consciousness'). Then, the associates of the lexical items were sorted according to the order in which they were produced. First associates for each group of items were then analyzed in order to examine which meanings were salient based on the measure. Correlation analyses were run to analyze the relationship between corpus sense frequency and the proportion of first associates that corresponded to the word's dominant usage in corpus (see Appendix VII for all the data gathered in word association task).[60]

Results

Highly Literal Words

The results of the first associates of highly literal words are presented in Tables 9 and 10. The second row indicates the sense frequencies of the words' primary literal senses in Sinica Corpus 4.0, and the words in white cells are categorized as associates related the primary literal senses, while words in shaded cells are categorized as associates related to the metaphorical senses of the items. The row labeled "proportion" indicates the proportions of the first associates that are related to the items' primary meanings in corpus (likewise for Tables 11 and 12).

[60] Note that it may be also meaningful to analyze the other associates and examine whether the second or the third associates may relate to the infrequent senses of the word (e.g., 觸角 *chu4 jiao3* 'antenna'－1 昆蟲 *kun1 chong2* 'insect'－2 伸展 *shen1 zhan3* 'to extend'－3 企業 *qi4 ye4* 'enterprise' (metaphorically referring to the sphere or types of business an enterprise is engaged in). This was not done since the validity of second associates is still doubted by certain researchers (De Deyne & Storms, 2008).

Table 9. First Associates of Highly Literal Nouns.

HLN	孤兒	跑道	生態	主角	櫥窗	輪廓	廢物	成本
1st Sense Freq.	**67.50%**	**65.12%**	**86.52%**	**69.35%**	**71.11%**	**88.64%**	**87.50%**	**85.90%**
First Associates	無依	操場	環境	男	商業	模糊	垃圾	控制
	遺憾	石灰	保育	電影	精品	剪影	垃圾	估計
	冷漠	比賽	生物	死亡	展示	臉	利用	利潤
	孤兒院	運動會	鴨子	搶眼	商品	臉孔	垃圾	效益
	堅強	範圍	環境	演戲	熊	鮮明	垃圾	價錢
	移居	賽車	變遷	舞台	觀賞	少女	利用	老闆娘
	伶仃	比賽	保育	白癡	古董	素描	垃圾	效益
	院	飛機	保育	聚光燈	花車	朦朧	臭	經濟
Lit.	長腳叔叔	pu	保育	聚焦	展示	顏面	利用	機會
Meta.	眼睛	選手	綠	男生	專櫃	印象	底層	機會
Proportion	**1**	**1**	**1**	**1**	**1**	**0.9**	**0.9**	**0.8**

Table 10. First Associates of Highly Literal Verbs.

HLV	說出	毀容	走路	散去	上臺	動工	吞下	長大
1st Sense Freq.	**89.23%**	**85.71%**	**96.55%**	**94.74%**	**100.00%**	**86.84%**	**72.73%**	**98.16%**
First Associates	事實	王水	跌倒	鳥獸散	表演	破土	彈珠	小孩
	很好	鹽酸	駝背	霧	說話	土木	藥	大樹
	心裡話	王水	交通	人潮	表演	土堆	口水	8 歲
	坦白	王水	很近	烏雲	發表意見	建築工地	囫圇吞棗	成熟
	表達	情殺	健康	雲霧	演說	破土	喉嚨	結婚
	理念	硫酸	逛街	雲霧	演講	開始	筆	成人
	話語	硫酸	跑	離開	演講	開始	囫圇吞棗	成熟
	讓別人了解	絕望	雙腳	霧	緊張	工程	雞蛋	成熟
	口	引人注意	沒看路	人群	表演	破土	藥丸	得到
	事實	台大毀容院	專心	人潮	報告	開挖	藥丸	承擔
Lit.	話	硫酸	散步	雲霧	演講	開始	委屈	責任
Meta.	膽量	硫酸	跌倒	雲霧	緊張	軟開	苦水	責任
Proportion	**1**	**1**	**1**	**1**	**1**	**0.8**	**0.8**	**0.7**

Overall, lexical items grouped as highly literal words according to corpus sense frequencies consistently had first associates related to their primary meanings in corpus. In most cases, participants consistently thought of words associating with the words' literal usage in corpus.[61] For example, 廢物 *fei4 wu4* 'waste[1] literal; a

[61] In the case of 跑道 *pao3 dao4* 'track[1]; work[2]', one associate in fact is related to the *air lane* sense in

good-for-nothing[2] (metaphorical)' obtained most of its first associates related to 垃圾 *le4 se4* 'garbage' or 利用 *li4 yong4* 'make use of (related to recycling)'. This indicated that, at least for primary literal meanings, corpus sense frequencies and word association tasks as measures of salience produced similar results. Further Pearson correlation tests showed a near-significant correlation between corpus sense frequencies and proportions of first associates related to the primary literal senses in corpus for highly literal nouns (r=-.68, p>.06), whose mean relative literal sense frequency was 77.70%, and the total proportion of literal associates was 95%. Although no significance was found for highly literal verbs (r=.26, p>.54), their mean literal sense frequency was 90.50% and the total proportion of literal associates was 91.25%, which were close and indicated that the lack of significance might be due to the fact that the frequencies and the proportions were both high. This may partly lead to the result that no significant correlation was found for highly literal words as a whole (r=-.21, p>.43), whose mean sense frequency was 84.10% and total proportion of literal associates was 93.13%. Nevertheless, in all a generally consistent pattern was suggested.

Highly Metaphorical Words

The results of the first associates of the highly metaphorical words are presented in Tables 11 and 12. Overall, unlike results for highly literal words, however, roughly only half of the associates were related to the items' primary metaphorical usages in corpus. For example, in the case of 角度 *jiao3 du4* 'angle[1] (literal); viewpoint[2] (metaphorical)', the first associates, such as 三角形 *san1 jiao3 xing2* 'triangle', 數學 *shu4 xue2* 'mathematics', and 照相 *zhao4 xiang4* 'to photograph', tended to relate to its infrequent literal sense, rather than the frequent metaphorical sense in corpus:

Chinese Wordnet; however, as it still refers to a literal meaning, I currently do not distinguish them.

Table 11. First Associates of Highly Metaphorical Nouns.

HMN	本錢	階級	壓力	焦點	角度	戰術	觸角	角色
1st Sense Freq.	**71.43%**	**99.26%**	**77.66%**	**100.00%**	**84.39%**	**65.91%**	**67.44%**	**87.31%**
First Associates	年輕	鬥爭	緊張	注目	眼光	團體	廣度	身分
	特色	權力	真實	新聞	立場	線上遊戲	廣闊	扮演
	未來	分化	沈重	目光	觀點	比賽	獨角仙	勇士
	年輕	公司	很大	新聞	三角形	戰爭	蟲	影視
	年齡	鬥爭	崩潰	新聞	撞球	攻防	昆蟲	戲劇
	利用	勞工	鞭策	鎂光燈	數學	孫子兵法	昆蟲	戲劇
	吃	鬥爭	焦灼	人物	鏡頭	策略	蝸牛	扮演
	美色	印度	課業	鏡頭	弧線	計謀	獨角仙	男女
Lit.	健康	貧富	鍋	光芒	眼鏡	指南	昆蟲	主角
Meta.	貪	劃分	鍋子	透鏡	照相	軍營	昆蟲	扮演
Proportion	**1**	**1**	**0.8**	**0.7**	**0.3**	**0.3**	**0.2**	**0.1**

Table 12. First Associates of Highly Metaphorical Verbs.

HMV	喚起	面臨	打斷	浸淫	帶動	湧起	站穩	看成
1st Sense Freq.	**95.83%**	**99.37%**	**88.68%**	**94.44%**	**94.93%**	**83.33%**	**72.22%**	**95.08%**
First Associates	不好的記憶	困難	別人說話	文學	士氣	思緒	商場	誤認
	記憶	難關	賤	這是什麼	工作	流露	腳步	豬
	回憶	危機	思緒	文字	促進	感想	台階	你
	記憶	即將來到	停下	田野	氣氛	睡意	立正	假裝
	記憶	困難	對話	性	氣氛	風起雲湧	腳步	眼花
	記憶	挫折	對話	培養	氣氛	風雲	腳跟	搞錯
	記憶	遭遇	談話	徜徉	風氣	水泉	獨木橋	誤解
	精神	難題	談話	遊戲	氣氛	海浪	雙腳	錯誤
	回憶	危機	插嘴	文學世界	鼓勵	海浪	安全	別人
	記憶	問題	無禮	回憶	唱歌	海浪	地震	眼花
Lit.	記憶	壓力	對話	沉醉	唱	海浪	腳	誤認
Meta.	記憶	難關	講話	癡狂	唱	淚水	腳步	誤認
Proportion	**1**	**1**	**1**	**1**	**0.7**	**0.4**	**0.1**	**0**

Further Pearson correlation tests showed no significant correlation between corpus sense frequencies and proportions of first associates related to the primary metaphorical senses in corpus, either for highly metaphorical nouns ($r=.31$, $p>.45$), whose mean relative literal sense frequency was 81.68% and the total proportion of literal associates was 55%, for highly metaphorical verbs ($r=.56$, $p>.15$), whose mean relative literal

sense frequency was 90.49% and the total proportion of literal associates was 65%, or for highly metaphorical words as a whole (r=.42, p>.10), whose mean relative literal sense frequency was 86.08% and the total proportion of literal associates was 60%. This indicated that, for primary metaphorical meanings in corpus, corpus sense frequencies and word association tasks as measures of salience did not produce consistent results.

Discussion

For an overall comparison (see Fig. 7), while the mean relative sense frequencies for highly literal words' literal meanings and for highly metaphorical words' metaphorical meanings were similarly high in corpus (both around 85%), only highly literal words' first associates were consistently related to the primary literal meanings in corpus. In contrast, only 60% of highly metaphorical words' first associates were related to their primary metaphorical meanings in corpus. This hinted at the possibility that in terms of measuring meaning salience, word association results corresponded to corpus sense frequency results when the meaning was literal, but not when the meaning was metaphorical.[62]

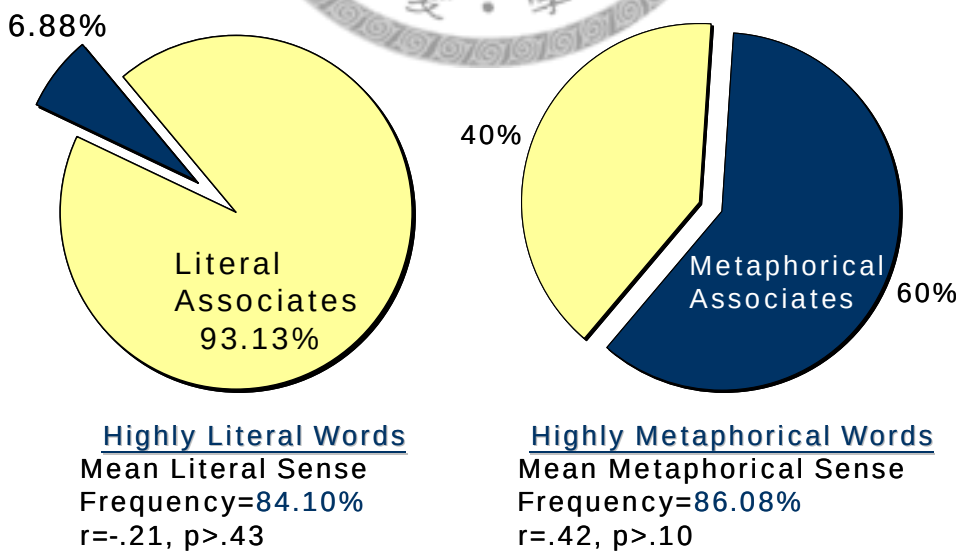

Figure 7. Overall comparison of first associates for highly literal words and highly metaphorical words.

[62] Given the limited number of participants in this experiment, the results were considered as merely reflecting a rough pattern. However, future studies can further pursue this issue. See discussions on limitations of study in Chapter Six.

Hence, for now based on the two measures, frequency and association, highly literal words' literal meanings can be conservatively regarded as salient meanings.

In what follows, I compare the results with those based on still another salience measure, i.e., online priming experiments for isolated words. While focusing the primary goal of this chapter, that is, to determine what counts as salient meanings for the study's purpose, I provide possible explanations for the consistencies and inconsistencies between the three measures in the final section of this chapter and present them only as minor issues in the thesis.

4.3 On-line Measure: Cross-Modal Lexical Priming Tasks for Isolated Words (Pretest 4 & Experiment 2)

The online cross-modal lexical priming tasks for isolated words is taken as a third measure of salience in the thesis. Since the earlier review on methodological issues suggests the importance to choose an appropriate type of nonword and timing setting in a cross-modal priming experiment, two experiments were conducted with (1) pseudohomophones as nonwords and a 300 ms target presentation duration, and (2) legal nonwords and a 1000 ms target presentation duration (see Chapter Two for detailed discussion on the issues). The former experiment (settings of which were proved inappropriate for the current study) was taken as a pretest and the latter as a formal experiment in the study, the type of nonword and timing settings of which were considered appropriate and will still be used in experiment 3 to maintain a consistency between the formal online experiments in the thesis.[63]

[63] In this sense, the experiment also prepared for the later context experiment. Due to limitation of time and cost, I could not test more combinations. But the current one is considered representative and adequate for the current purpose.

4.3.1 Pretest 4: Pseudohomophones

Participants

12 undergraduate students from National Taiwan University (mean age=20.92 years, SD=1.04 years; three males and nine females) participated in pretest 4, online cross-modal priming task for words in isolation (with pseudohomophones as nonwords, 0 ISI, target presentation duration=300 ms). These participants were mainly recruited after announcement was made on BBS for students to register on an online registration system.[64] All participants were native speakers of Mandarin Chinese, right-handed, and had normal or corrected-to-normal eyesight or hearing. They were also screened for experience of dwelling abroad, brain injury, and auditory or speech impairment. All participants were paid NT$100 for participation.

Materials & Design

Four lists were created using the same prime-target pairs as those in relatedness ratings for isolated words (see 3.7.1 for the materials and design). The original nominal and verbal lists were combined as two separate sessions in one list and the filler target words were returned from real words to their pseudohomophones.[65] The related/unrelated primes in list 1a were switched with their corresponding unrelated/related primes in list 2a. Lists 1a and 2a both ordered the noun session before the verb session. List 1b and 2b had prime-target pairings identical to lists 1a and 2a except that they ordered the verbal session before the nominal session. Hence each list contained 128 trials, with an equal amount of nominal and verbal, experimental (word) and filler (nonword) trials, and related and unrelated trials (see 3.7.1 and 3.6 for details). In each list half of the experimental trials contained highly literal primes (and corresponding unrelated matched primes), and half with highly metaphorical primes

[64] Designed by using Web Survey Toolbox as mentioned in Chapter Three.
[65] This was done also to avoid any potential meaningful V-O sequence.

(and corresponding unrelated matched primes). Experimental items were counterbalanced for Target Type (literal and metaphorical targets) and Prime Relatedness between lists 1a/1b and 2a/2b. Notice that in this experiment relatedness was also manipulated for filler pseudohomophone trials; hence in the whole experiment contained a balanced proportion of related and unrelated trials (see 3.6 for details; see Appendix II and Appendix IV.A for the whole set of stimuli).

The 128 trials (2 sessions of 64 trials) in each list were then evenly divided into eight blocks of 16 trials according to their conditions. After each lexical decision block followed a memory test of ten trials, using the materials prepared in 3.6.3; hence there were totally 80 memory test trials in each formal experiment (see Appendix V for the whole set of memory test stimuli). Each list then contained two formal sessions, each containing four blocks of lexical decisions and their following memory tests. In addition, a practice session of 20 lexical decision trials and 16 memory test trials was prepared using materials prepared in 3.6 (see the section for details; for stimuli, see Appendices IV.B and V). This session did not separate nominal and verbal trials since it was for practice. Auditory stimuli were recorded as described in 3.8.

Procedure

Participants sat in a sound-attenuated room in front of the experimental computer and a button box. An introductory video was prepared before the experiment began to standardize the experimental procedure. The (roughly) 3-minute video was played to each participant in the beginning of experiments, which explained the task with real auditory stimulus example taken from the remaining fillers prepared in 3.6. Screenshots similar to what appeared in formal experiments, examples of visual targets and memory tests, and photos of response box, etc., were also visually presented to illustrate the experimental procedure (for instructions, sample trials in instructions, and screenshots

of video, see Appendices IV.C and VIII). Participants were told to listen to the sound played over the headphone and stare at the fixation point on the center of screen, and when characters appeared and replaced the fixation point, they should decide whether the two characters made up a word or not and make responses on the button box. Since the PST serial response box had five buttons, they were specifically instructed that the right-most button meant "word" and the left-most button meant "non-word" during lexical decision tasks, and in memory tests that followed lexical decision tasks (when a word was visually presented on the screen), the right-most button meant "Yes, I heard the word just now" and the left-most button meant "No, I did not hear the word"; this was also indicated on the screen by a "Yes" on the right and a "No" on the left. They were told to keep their right index finger and left index finger on the two buttons at all times during experiment and to make responses as quickly and accurately as possible during lexical decisions, although they could take time to finish memory tests. The participants were foretold that the experiment would be conducted in an enclosed space with only one lamp turned on, and they had the right to halt the experiment at any time.

Twenty practice lexical decision trials and sixteen practice memory tests were given before formal experiments began. After participants understood the whole experimental procedure, two sessions of experiments consequently started, with nouns in one session and verbs in the other, and with an interval of five minutes between the sessions. This was done to avoid any potential meaningful V-O sequence occurring as a result of stimuli randomization. The order of stimuli within each block and the order of blocks within each session were randomized each time for each participant. For lexical decisions, sounds were played with a fixation point displaying on the center of the screen; E-Prime was configured as such that at prime offset the fixation point should disappear and a string of characters should appear on that position for 300 ms, and

E-Prime measured the time from the appearance of target words to the time responses were made in milliseconds. For memory tests, on top of screen displayed a line saying "Did you just hear:", with a memory test item displaying on the center of screen. On bottom right and bottom left of the screen a "Yes" and a "No" were also displayed to indicate that the right-hand button meant a positive answer and the left-hand button meant a negative answer. The memory tests were designed to ensure that participants did not merely focus on lexical decisions without listening to the auditory stimuli. There was no inter-trial intervals set up in the experiment. Instructions were presented on the screen and/or over the headphone to indicate the beginning and end of lexical decisions, memory tests, and the five-minute interval. The whole experiment lasted for about twenty minutes.

Apparatus

For pretest 4, four scripts were compiled using E-Prime 2.0.1.19 and the experiment was run on a TOSHIBA TECRA M5 PTM51 laptop (equipped with Genuine Intel CPU T2400@1.83GHz/987MHz, 1GB RAM, and NVIDIA Quadro NVS 110M graphics card) with a PST serial response box. Positive responses were always placed on the right since the participants are all right-handed, and the sounds were played out through a closed-ear headphone throughout the experiment. The participants sat in front of the laptop and the response box at a distance of about 86 cm from the computer screen to their eyes.

Results & Discussion

All participants' lexical decision accuracy rates were above or equal to .83, and memory test accuracy rates were above .76, and no data were removed for this reason. Incorrect responses, outliers (RTs more than 1000 ms) and data of visual targets whose

presentation delayed for more than 30 ms were removed, which accounted for 12.11% of the experimental trials (Mean RT= 624.82 ms, SD=124.70 ms).[66]

A four-way ANOVA was run on individual participants' raw RT data with Lists as a random factor and Prime Group (highly literal group and highly metaphorical group), Target Type (literal target and metaphorical target), and Prime Relatedness (related and unrelated) as fixed factors. Due to multiple levels of factors, a full-factorial analysis was not always allowed in SPSS, either in this experiment or in later experiments. Therefore, only main effects and interactions for the fixed factors were examined in order to maintain a consistent statistical analysis method in the series of online experiments. No significant main effect was found for Prime Relatedness [$F(1, 664)=.49$, $p>.48$], Prime Group [$F(1, 664)=.42$, $p>.51$], or Target Type [$F(1, 664)=1.02$, $p>.31$], though a main effect for Lists [$F(3, 664)=15.51$, $p<.001$]. No interaction effects were found.[67] It should noted that technical errors might have occurred during the experiment and created noises, because serious target presentation delays or missing primes were later found in approximately three to five trials within an experiment (randomly occurring in filler or experimental trials), which may be due to incorrect software settings or the apparatus's failure to meet E-Prime's machine requirements. This experiment hence did not meet the current purpose to measure meaning salience in the items. Still, while taking the technical errors as one explanation for the lack of significant effects, I discuss the results based on the assumption that three to five randomly occurring erroneous trials (fillers or experimental items) in the total 128 trials did not completely turn around

[66] An ideal situation is nothing delays in the experiment. However, in reality it sometimes may take a few milliseconds from the time computers start loading a image, etc. to memory and to the time it is displayed on the screen. While various reasons, including hardware limitations (e.g., shared resources in laptops), background running softwares, screen refresh rates, could lead to actual delays, E-Prime records all critical timestamps in case of need. This is however considered a general problem that occurs in experimental computers and not limited to the current computers. I have modified the settings to minimize potential target onset delays in later experiments.

[67] Equal variances not assumed.

the data and a general pattern could still be observed. The data are summarized in Table 13 and Figure 8:

Table 13. Mean RTs for Highly Literal/Metaphorical Words in Isolation (Pseudohomophone).

	Literal Meaning		Metaphorical Meaning	
	RT	Priming	RT	Priming
Highly Literal Words				
Related Prime	616.22	+2.33	640.99	-7.22
Unrelated Prime	618.55		633.77	
Highly Metaphorical Words				
Related Prime	629.70	-17.40	623.65	-1.31
Unrelated Prime	612.30		622.34	

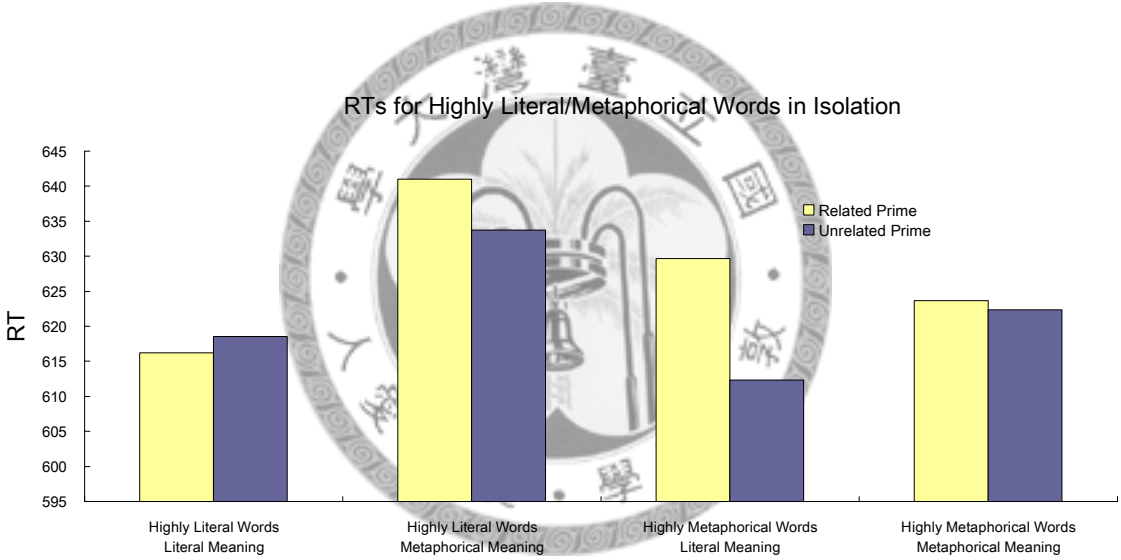

Figure 8. Mean RTs for Highly Literal/Metaphorical Words in Isolation (Pseudohomophone).

When related/unrelated pseudohomophones and a target presentation of 300 ms at 0 ISI were adopted, no effect was found for any group of targets or primes. Moreover, the situation seemed to be reversed: For three out of the four types of visual target words, reaction times were longer in the related than in the unrelated condition, exactly the opposite of what priming effects should be like.

Besides the technical errors, I propose two important reasons to explain the results: Pseudohomophones and the target presentation duration. It is suggested in the earlier review (see 2.5.5) that pseudohomophone tasks are interference tasks by nature. Since

relatedness between the nonwords' phonological forms (their base words) and the prime words was manipulated in this experiment, the interference effects might be even stronger than otherwise. Particularly, in related nonword trials, the pseudohomophones' phonological forms could have been correctly primed while the orthographic forms had to be denied, which lengthened the reaction times and masked the priming effects. This is supported by participants' reported sensible interference during lexical decisions.[68] A second possible reason is that a 300 ms target presentation was inappropriate for priming effects to occur for the items in the study. Based on the review on semantic and associative priming issues in 2.5.3, priming may occur early for associatively related words, while most items in the study were semantically related (as suggested by significant results in relatedness ratings; see 3.7), but not necessarily direct associates (see 2.5.4 for the current study's criteria for visual target word selection and reasons). Hence, it is suggested that these two major variables may need adjusting for later online experiments.

In what follows, I change the type of nonwords to legal nonwords, which are meaningless and do not cause interference, and the target presentation duration to 1000 ms,[69] and meanwhile refine necessary details in software settings and replace the computer with an improved one, and re-run the experiment in order for the current purpose to properly measure meaning salience.

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[68] Among the study's three online experiments, the pseudohomophone experiment was considered very difficult to participants, and thus the mean RT was the longest among the three experiments. The legal nonword experiments were easier, while the isolated word experiment had a faster mean RT than the context experiment.

[69] Before experiment 2 formally began, pilot experiments testing different combinations of ISIs and target presentation duration were run. Although I learned from literature that semantic priming could occur later, it is not certain what exact timing would be the most appropriate for the items in the study. And so 17 volunteer participants helped with pilot experiments which used (1) ISI=0 ms, duration=300 ms; (2) ISI=750 ms, duration=300 ms; (3) ISI=0 ms, duration=1000 ms; (4) ISI=750 ms, duration=0 ms. Finally, a 0 ISI and a duration of 1000 ms seemed appropriate. Later the 3 participants' data were taken as part of formal experimental data (and they were paid thus). I deeply appreciate all the volunteer helpers' support.

4.3.2 Experiment 2: Legal Nonwords

Participants

16 undergraduate students from National Taiwan University (mean age=19.81 years, SD=1.33 years; eight males and eight females) participated in experiment 2, online cross-modal priming task for words in isolation (using legal nonwords, 0 ISI, target presentation duration=1000 ms). All participants were native speakers of Mandarin Chinese, right-handed, and had normal or corrected-to-normal eyesight or hearing, and none dwelt abroad for more than one year before the age of seven. They were also screened for brain injury and auditory or speech impairment. All participants were paid NT$100 for participation.

Materials & Design

The materials and design were similar to those in pretest 4,[70] while the nonwords were changed to legal nonwords (the proportion of related/unrelated trials hence was balanced in experimental trials only) prepared in 3.6.2 and target presentation duration to 1000 ms. The experimental auditory stimuli were more accurately cut off to a zero crossing point at the ending of formants by using Praat v.5.0.46 (see 3.8 for further details).

Procedure

Participants sat in the same sound-attenuated room in front of the experimental computer and a button box. An introductory video was prepared before the experiment began, which was similar to the one used before, except that this time the example for pseudohomophone was changed to a legal nonword. Since in earlier experiments or

[70] There were four lists created in the beginning. After the first three subjects were run for list 1a, however, I further modified the script and created another new four lists. The remaining 13 participants were run using these new lists. The major design was the same, that legal nonwords are used and target presentation duration is 1000 ms at prime offset. Minor differences (e.g., PreRelease settings in E-Prime objects, sound loading factor, or ITI settings (2000 ms or 3000 ms), not recorded in detail) may exist but were considered to have only minute influences, if any.

informal pretests some participants thought memory tests were the most important parts in the experiment or mentioned they developed a strategy to memorize the auditory primes during lexical decisions, it was further emphasized that reaction times to lexical decisions were the most important to the study and that they did not need to consciously memorize anything during lexical decisions because it was not hard to pass the memory tests. E-Prime measured the time from the appearance of target words to the time responses were made in milliseconds until the time limit for response passed, and recorded time stamps for necessary information such as target presentation time or target onset delays. An inter-trial interval was also added.[71] The remaining procedure was similar to that in the previous experiment. The whole experiment lasted for roughly 35 minutes.

Apparatus

For experiment 2, scripts were compiled using E-Prime 2.0.8.22 and the experiment was run on a Intel Pentium 4 (1.70GHz) desktop computer (with 1 GB RAM, NVIDIA GeForce FX 5200 graphics card, and Intel ICH 4 sound card) with a PST serial response box, and a ViewSonic E773 CRT monitor. The experiment was configured as such that prime words were played while a fixation point appeared on the center of screen. At the offset of the auditory prime word a visual target appeared on the position of fixation point for 1000 ms or until a response was made. E-Prime measured the response time in milliseconds. Positive responses were always placed on the right since the participants were all right-handed. The sounds were played out through a closed-ear headphone. The participants sat in front of the computer and the response box at a distance of about 60 cm from the computer screen to their eyes.

[71] An ITI of 2000 ms was generally adopted. As mentioned earlier, however, I modified list 1a after the first three participants finished the experiment and created new lists based on it. The new lists (which were run for the remaining 13 participants) all had their ITI set as 2000 ms, though it was not documented whether list 1a adopted a 2000 ms or 3000 ms ITI. However the influences seemed minute for the current purpose.

Results & Discussion

All participants' lexical decision accuracy rates were above or equal to .82, and memory test accuracy rates were above .79, and no data were removed for this reason. Incorrect responses, outliers (RTs more than 1000 ms) and data for visual targets whose presentation delayed for more than 30 ms were removed, which meant 12.50% of the experimental trials (Mean RT= 550.64 ms, SD=124.07 ms).

A four-way ANOVA was run on individual participants' raw RT data with Lists as a random factor and Prime Group (highly literal group and highly metaphorical group), Target Type (literal target and metaphorical target), and Prime Relatedness (related and unrelated) as fixed factors. There was no significant main effect found for Prime Group [$F(1, 885)=.06$, $p>.80$] or Target Type [$F(1, 885)=1.11$, $p>.29$], but a main effect for Lists [$F(3, 885)=12.39$, $p<.001$]. There was a near-significant effect found for Prime Relatedness [$F(1, 885)=2.72$, $p=.10$]. There were no interactions.[72] Further examination of the data revealed that the near-significant effect for Prime Relatedness may be due to the low power (.38) of the analysis (given relatively small number of participants), and due to the fact that although in the highly literal word group, literal targets in the related condition were faster responded to than metaphorical targets, in the highly metaphorical word group, there was virtually no difference between related and unrelated conditions, thus slightly weakening the effect.

Given the near-significant effect and the fact that the main purpose of study was to compare the same group of target words under different conditions (see 2.5.2 for details), further separate independent t-tests were done for RTs of each group of visual targets under the related and unrelated conditions. The results showed a significant difference between the related and unrelated conditions for highly literal words' literal targets

[72] Equal variances not assumed.

[t(212)=-2.04, p<.05]. There was no significant effect found for highly literal words' metaphorical targets [t(219)=-0.20, p=.84], for highly metaphorical words' literal targets [t(222)=-0.54, p>.58], or for highly metaphorical words' metaphorical targets [t(235)=-0.49, p>.62]. The data are summarized in Table 14 and Figure 9:

Table 14. Mean RTs for Highly Literal/Metaphorical Words in Isolation (Legal Nonword).

	Literal Meaning		Metaphorical Meaning	
	RT	Priming	RT	Priming
Highly Literal Words				
Related Prime	526.40	+35.67*	557.03	+3.31
Unrelated Prime	562.07		560.34	
Highly Metaphorical Words				
Related Prime	544.65	+9.60	546.57	+7.38
Unrelated Prime	554.25		553.95	

*p<.05

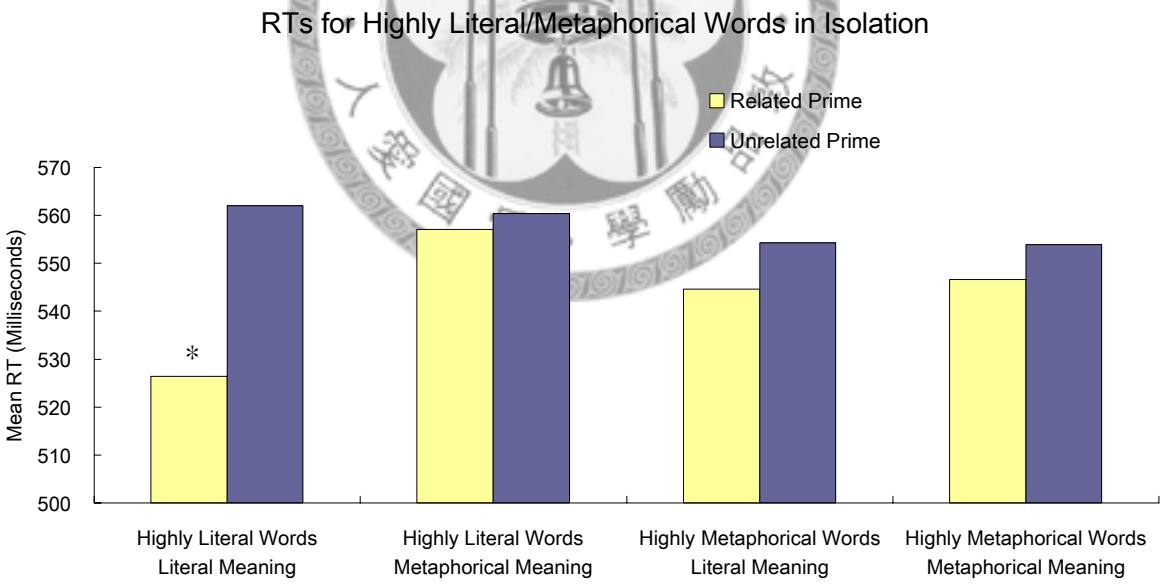

Figure 9. Mean RTs for Highly Literal/Metaphorical Words in Isolation (Legal Nonword).

When literal visual targets were presented for 1000 ms immediately after isolated words that had highly frequent literal senses in corpus, a significant priming effect was found. However, no effect was found for infrequent metaphorical senses of highly literal words, or for literal or metaphorical senses of highly metaphorical words. This indicated

that, based on the categorization of corpus sense frequency, highly literal words' literal meanings may be regarded as salient meanings based on the current online priming measure, which corresponded to the results in the earlier word association task.

It was of interest whether frequent metaphorical meanings could still be primed when frequency and association consistently suggested that these meanings were salient, since words with highly frequent metaphorical meanings did not always obtain first associates related to such meanings. If they were primed, then based on the criterion proposed in the beginning of this chapter, these meanings could be defined as salient meanings in the study.

Further second-order analyses were done on nine groups of items selected from the previously defined highly metaphorical word groups. The experimental primes in these groups all had frequent metaphorical meanings in corpus as well as 70%[73] or more first associates related to their metaphorical meanings in the association task. A two-way ANOVA was run on the items' raw RT data with Target Type (literal target and metaphorical target), and Prime Relatedness (related and unrelated) as fixed factors. There was no significant main effect found for Prime Relatedness [$F(1, 254)=.006$, $p=.94$] or Target Type [$F(1, 254)=.003$, $p>.95$]. There was no interaction effect. Hence, even when the frequency measure and the association measure consistently suggested the words' metaphorical meanings were salient, these meanings were not primed. Although the results could also be due to the limited number of items and participants, in all, there was not adequate support for the current study to define these metaphorical meanings as salient, based on the previously established criterion.

[73] Due to the current criteria for frequency threshold (65%) and concern for the limited number of items, this threshold was considered appropriate for the association measure.

4.4 Summary & Discussion

Because Giora (2003) does not provide clear operational criteria for the determination of salient meanings, in this chapter I compare three important salience measures, namely frequency, association, and priming, and define what salient meanings are in the study, before the major issue is explored in the next chapter. Since these measures may produce inconsistent results (Gibbs & Colston, 2006), and since the number of items, participants, etc., are limited in the current analysis, I follow a conservative criterion to define meanings as salient, i.e., meanings are defined as salient in this study only when they obtain consistent results in the three measures. Based on this criterion, literal meanings of highly literal words are defined as salient and their metaphorical meanings, nonsalient.[74]

Though taken as minor issues in the study, comparing and evaluating results from these salience measures has a number of implications. Given the limitations of the study, I regard the following discussion not as conclusive but merely as preliminary, and the accompanying issues are worth pursuing in future studies:

Consistencies & Inconsistencies Between Salience Measures & Possible Reasons

The current results suggested only literal meanings could be consistently defined as salient by the three measures but not metaphorical meanings. In addition, inconsistencies were only found where (1) the frequency measure suggested the words' metaphorical meanings were salient, while the association measure instead suggested the words' literal meanings were salient, and there was no priming for either the words' literal or metaphorical meanings;[75] and (2) the frequency measure and the association

[74] Opposite to frequent literal meanings, infrequent metaphorical meanings obtained a low proportion of metaphorical first associates and were not primed either.

[75] Apart from those presented in the earlier section, I did other second-order analyses including this one. But because this analysis was not of the current major interest in determining salient meanings (these items already failed to meet the study's criterion for salient meanings) and because of the even more limited number of items (only 7 items), it was not presented in the earlier section. (For Target Type, F(1,

measure both suggested the words' metaphorical meanings were salient, but there was no priming for the words' metaphorical meanings (nor for the literal meanings).

I propose two possible reasons for the results: the literal vs. metaphorical differences, and inherent differences in these measures. It has been suggested in 2.2.2 and 2.3.1 that literal meanings differ from metaphorical meanings in concreteness and a graded nature (i.e., varied degree of lexicalization of meanings). It is possible that metaphorical meanings are less concrete (Lakoff, 1993), thus difficult to access. Moreover, since metaphorical meanings, though already conventional, can be lexicalized to different degree and vary "in their conventionalized ability to activate concepts from the source domain" (Svanlund, 2007), they may vary in their degree of salience, which hints at an asymmetric salience between literal and metaphorical meanings. Hence, when tested in different measures, these meanings did not obtain consistent results. Partly based on Marzo et al. (2007), I assume corpus data denote general (and deliberate) language use, association data denote conscious language production, and priming experiments denote unconscious language processing. From frequency to association to priming, these inherently different measures require the data to be more and more spontaneous. Hence conventional metaphorical meanings are the most frequently observed in corpus but less frequent in an association task for isolated words, and are the hardest to detect in a priming experiment (especially when there is no contextual support), if priming (in its current settings) is assumed to reflect an automatic processing, for which to occur the metaphorical meanings must be lexicalized and encoded in the lexicon to a considerable extent. I illustrate this speculation on the relationship between the salience measures and real degree of salience in Figure 10.

199)=.01, p>.93; for Prime Relatedness, F(1, 199)=.93, p>.33; there was no interaction effect.)

With higher and higher frequency of usage, the metaphorical meanings may become more and more salient[76]:

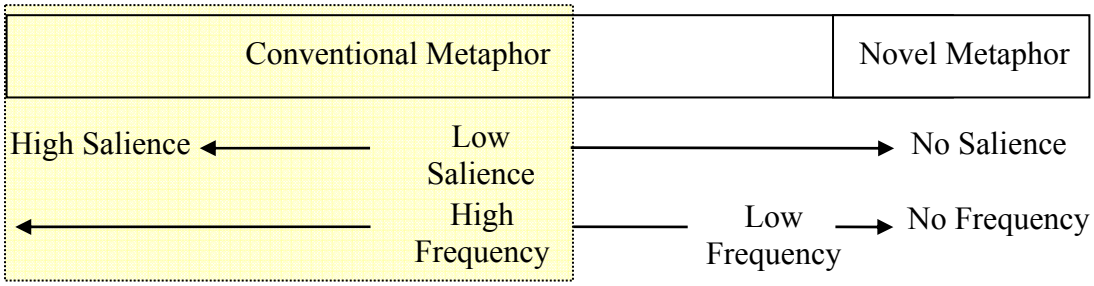

Figure 10. Frequency and Degree of Salience in Conventional Lexical Metaphor.

This speculation has the following implications:

(1) The three salience measures may differ especially in their sensibility to salience of metaphorical meanings, which in turn may be one source of the inconsistencies. Hence a reconsideration of the inherent differences and potential inconsistencies between the measures may be necessary for Giora's (2003) study and for lexical access studies in general to determine salience for abstract meanings, since most lexical memory studies tend to address concrete concepts (as indicated in 2.2.2.1).

(2) Although I currently do not define salient metaphorical meanings and specifically contrast them to salient literal meanings to address the main issue in the study (which is one of the study's limitations), differences between conventional metaphorical meanings and literal meanings in term of their accessibility are suggested, which implicates that literal meanings could not be fully equated to conventionalized metaphorical meanings in metaphor comprehension studies.

Limitations of Salience Measures

The limitations of the salience measures compared in the current study are noted as below. The frequency measure is possibly the most limited in measuring salience of

[76] Notice that *salience* is defined in the thesis based on comparison of different measures and not according to a particular measure, because *salience* in Giora (2003) in rather an idealized concept than anything operationalized based on a sole measure.

metaphorical meanings. And since to date corpora are usually based on written data, it may not much reveal spontaneous language use. The association measure is limited particularly in estimating salience for unbalanced ambiguities and for polysemous/facet-level meanings (see 2.3.3 for details), and possibly also limited in measuring salience of metaphorical meanings. The priming measure is particularly limited for its accompanying complicated timing and prime-target relationship issues, which consequently leads to the difficulty in generalizing or comparing the results.

The above issues are only presented as subordinate issues in this study. Having defined what salient meanings are, in the next Chapter I address the major issue in this thesis, i.e., how salient/nonsalient literal/metaphorical meanings are accessed in literally- or metaphorically-biased contexts. Despite the current definition of salient meanings, which is considered the most reliable, other possibilities based on the salience measures will also be discussed. The highly metaphorical words will still be included in the experiment too for a complete discussion on the issue.[77]

[77] This was done for many reasons, e.g., to further verify whether such meanings can be primed with contextual support and to obtain further evidence for the current claims.

Chapter 5 Online Cross-Modal Lexical Priming Task for Words In Context (Experiment 3)

In this chapter I address the major issue in this thesis, the interaction of meaning salience and contextual effects in the processing of metaphorical polysemy. I have defined what salient meanings are in the study in Chapter Four, and will explore the study's major issue based on this definition while also discussing other possibilities. I hypothesize that salient or nonsalient sense-level literal and metaphorical meanings can only be activated in compatible contexts and not in incompatible contexts.

Participants

34 undergraduate students from National Taiwan University participated in experiment 3, online cross-modal priming task for words in context (using legal nonwords, 0 ISI, target presentation duration=1000 ms). All participants were native speakers of Mandarin Chinese, right-handed, and had normal hearing and normal or corrected-to-normal eyesight, or an eyesight that did not affect the experimental purpose[78]. None dwelt abroad for more than one year before the age of seven. They were also screened for brain injury and auditory or speech impairment. All participants were paid NT$100 for participation. After the experiment was run, 25 participants' data were valid; these participants had a mean age of 20.68 years (SD=1.29 years; 13 males and12 females).

Materials & Design

Four lists were created using exactly the same prime-target pairs in relatedness ratings for words in context (see 3.7.2 for the materials and design), except that the fillers' corresponding real visual targets words were changed to the legal nonword counterparts used in experiment 2. All primes and targets occurred in every list and just

[78] One participant has pseudomyopia but the doctor told him that does not need correcting.

rotated in different sentential context conditions (see Appendices III and IV for the whole set of stimuli).

The 128 trials within each list were divided into eight blocks of 16 trials, each block having an equal amount of experimental and filler nonword trials and nominal and verbal primes overall. In each block, there were an equal amount of highly literal and highly metaphorical primes for experimental trials, and an equal amount of metaphorical polysemy and unambiguous filler primes. There were also an equal amount of related and unrelated experimental trials, and for the related trials half had literally-biased sentences and half had metaphorically-biased sentences. After each lexical decision block followed a memory test of ten trials, using the materials prepared in 3.6.3; hence there were totally 80 memory test trials in each formal experiment. For metaphorical experimental items that were chosen for memory tests, because they had two kinds of contexts, literally-biased or metaphorically-biased, which occurred in different lists, memory test sentences were created according to their conditions in their respective memory test, and were inserted in the appropriate lists (see 3.6.3 for details and Appendix V for the whole set of memory test stimuli). In addition, a practice session of 20 lexical decision trials and 10 memory test trials was prepared using materials prepared in 3.6 (for stimuli, see Appendices IV.B and V.B). Auditory stimuli were recorded as described in 3.8.

Procedure

Participants sat in the same sound-attenuated room in front of the experimental computer and a button box. An introductory video was prepared before the experiment began, which was similar to those used before, although this time the sample auditory stimulus and memory test stimulus were changed to a corresponding filler sentence, and necessary modification was done to make the instruction adapted to the current

experiment. Participants were told to listen to the sentence played over the headphone and stare at the fixation point on the center of screen, and when characters appeared at an unknown time and replaced the fixation point, they should decide whether the two characters made up a word or not and make responses on the button box. In memory tests, they should decide whether the sentence displayed on the screen was exactly the same as the one they heard before. They were told to keep their right index finger and left index finger on the two buttons at all times during experiment and to make responses as quickly and accurately as possible during lexical decisions, although they could take time to finish memory tests. There was an inter-trial interval of 1500 ms. The whole experiment lasted for about 40 minutes. The remaining procedures were similar to those in experiment 2.

Apparatus

For experiment 3, scripts were also compiled using E-Prime 2.0.8.22[79] and the experiment was run on the same hardware as that in experiment 2. The experiment was configured as such that in lexical decisions prime sentences were played while a fixation point appeared on the center of screen, and at prime offsets the fixation point disappeared and a string of characters appeared on that position for 1000 ms, while the auditory sentence went on playing till the end. E-Prime measured the response time in milliseconds or until the time limit (2000 ms) for response passed. Positive responses were always placed on the right since the participants were all right-handed. The sounds were played out through a closed-ear headphone. The participants sat in front of the computer and the response box at a distance of about 60 cm from the computer screen to their eyes.

[79] I sincerely appreciate Tu-yuan Cheng for her instruction on the experimental design and provision of her previous scripts.

Results & Discussion

5 out of the total 34 participants failed to reach the lowest criterion .69 accuracy for memory tests, and thus their data were removed. Unexpected interruptions occurred during another two participants' experiments, and thus the data were not used. One participant admitted that she nodded off during the experiment, the thus her data were excluded. At the end of another participant's experiment, E-Prime reported a significant clock system timing problem, and thus the participant's data were not used. After the first six participants (who were among the remaining 25 participants) finished the experiment, two memory test items were further modified to correct errors or to make the trial clearer, and thus relevant data were excluded for the six participants. Also, three among the six participants reported occasional technical problems during the experiment, and therefore potentially unreliable data were removed.[80] In addition, the scripts were further modified to fix the problems and to minimize target onset delays. In the end, all the remaining participants had a lexical decision accuracy above or equal to .87, and a memory test accuracy above or equal to .69.

Incorrect responses, outliers (RTs more than 1000 ms) and data of visual targets whose presentation delayed for more than 30 ms were removed, which meant 13.31% of the experimental trials (Mean RT= 582.58 ms, SD=141.54 ms).

A four-way ANOVA was run on individual participants' raw RT data with Lists as a random factor and Prime Group (highly literal group and highly metaphorical group), Target Type (literal target and metaphorical target), and Sentence Type (literally-biased, metaphorically-biased, and unrelated contexts) as fixed factors. An overall significant

[80] The problem was an occasional missing of prime sound. One participant clearly remembered the specific trial where the auditory prime was not played, and thus the data point was removed. Another participant remembered the problematic trial occurred in the last block, and thus data from the block and its following memory test were removed. The other participant only remembered the problematic trial occurred roughly in the first several blocks, and thus the first half of the experimental blocks, including their memory tests, were removed.

main effect was found for Sentence Type [F(2, 1372)=6.49, p<.003]. There was no main effect found for Prime Group [F(1, 1372)=.09, p>.76], Target Type [F(1, 1372)=1.60, p>.20], though a main effect for Lists [F(3, 1372)=3.17, p<.03]. No interaction effects were found. Post hoc Tukey HSD tests revealed significant differences between literally-biased context and unrelated context conditions (p<.04), and between metaphorically-biased context and unrelated context conditions (p<.004). The data are summarized in Table 15 and Figures 11 and 12:

Table 15. Mean RTs for Words in Context.

	Literal Meaning		Metaphorical Meaning	
	RT	Priming	RT	Priming
Highly Literal Words				
Literal Context	546.62	+50.17*	581.12	+30.22
Metaphorical Context	564.82	+31.97	562.73	+48.61*
Unrelated Context	596.79		611.34	
Highly Metaphorical Words				
Literal Context	574.51	+17.26	591.7	-6.58
Metaphorical Context	564.62	+27.15	570.26	+14.86
Unrelated Context	591.77		585.12	

*p<.05

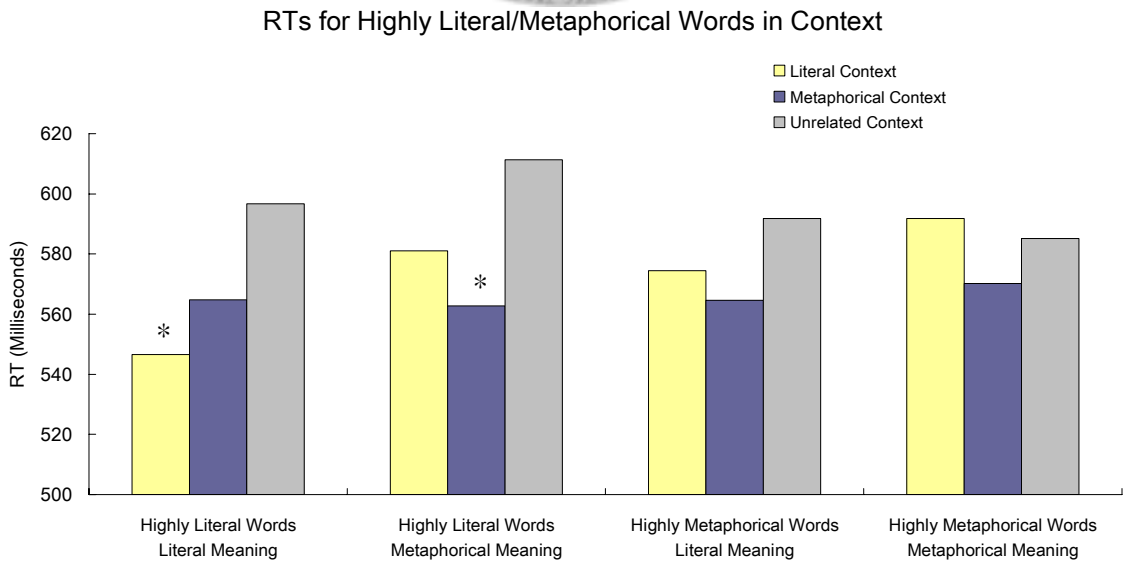

Figure 11. Mean RTs for Highly Literal/Metaphorical Words in Context.

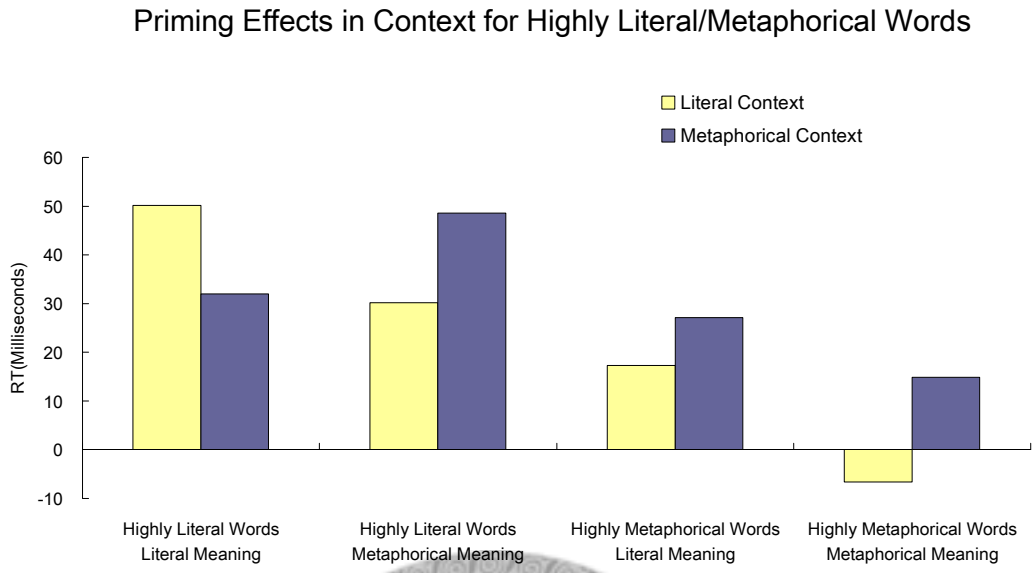

Figure 12. Priming Effects for Highly Literal/Metaphorical Words in Context.

Further separate one-way ANOVAs were conducted to observe effects for each group of targets (e.g., literal targets for highly literal words) under different sentential conditions. One-way ANOVAs showed significant differences for RTs of highly literal words' literal targets under different contextual conditions [$F(2, 351)=4.58$, $p<.02$], and for RTs of highly literal words' metaphorical targets under different contextual conditions [$F(2, 344)=3.43$, $p<.04$]. No significant effects were found for highly metaphorical words' literal targets under different contextual conditions [$F(2, 322)=1.07$, $p>.34$], or for highly metaphorical words' metaphorical targets under different contextual conditions [$F(2, 358)=0.59$, $p>.55$]. Post hoc Tukey HSD tests revealed significant differences in RTs for highly literal words' literal targets between the literal context condition and the unrelated context condition ($p<.02$), and for highly literal words' metaphorical targets between the metaphorical context condition and the unrelated context condition ($p<.04$).

The results supported the study's hypothesis in that salient or nonsalient sense-level literal or metaphorical meanings were only primed in their compatible

contexts, and not in incompatible contexts. This contradicted Giora's (2003) graded salience hypothesis, which states that salient meanings will always be activated regardless of contextual bias. I suggest the main reason is that I focus on words with only sense-level lexical meanings, which cannot coexist in the same context. The results thus also suggested a need to reconsider Giora's (2003) hypothesis.

The fact that highly metaphorical words were not primed with contextual support further led me to reconsider the possibility that highly metaphorical words' frequent metaphorical meanings could still be primed in contexts when frequency and association both suggested these meanings were salient. Had I defined such meanings as salient in Chapter Five, the results of the analysis (whether priming effects had been found or not) would be used to suggest the processing of metaphorical polysemy that had "salient metaphorical meanings" and "nonsalient literal meanings" in biased contexts. Further, suppose the meanings in turn were primed in this analysis, then this would indicate a need to reconsider the previous criterion to define salient meanings, because metaphorical meanings were not primed in that experiment, probably due to lack of contextual support and hence the priming measure was not appropriate for these metaphorical meanings in isolated words, which were frequent in corpus and obtained a high proportion of metaphorical first associates.

Further second-order analyses similar to those presented in 4.3.2 were done on the identical items chosen in the previous reanalyses. A two-way ANOVA was run on the items' raw RT data with Target Type (literal target and metaphorical target), and Sentence Type (literally-biased sentences, metaphorically-biased sentences, and unrelated sentences) as fixed factors. There was no significant main effect found for Sentence Type [$F(2, 368)=.70$, $p>.49$] or Target Type [$F(1, 368)=.001$, $p=.97$]. There was no interaction effect. Hence, on the one hand, if I had defined these meanings as

salient in Chapter Four, the interpretation of the processing of metaphorical polysemy that had salient metaphorical meanings would be: Lack of priming effects for either meanings in either literal or metaphorical contexts, although the analyses were limited by number of items, etc. On the other hand, the lack of priming effects for these meanings did not support the possibility that the previous priming measure was inappropriate for these metaphorical meanings due to lack of contextual support. Hence this also suggested that the previous criterion for the determination of salient meanings was reasonable for the current study, and consequently I will maintain the earlier interpretation of results based on the previously proposed criterion.

Note that lack of priming effects for highly metaphorical words could not be attributed to a lesser degree of relatedness, because relatedness ratings for the words in context showed virtually no difference between the highly literal word group and the highly metaphorical word group, and moreover relatedness ratings for the words in isolation showed even higher degree of relatedness for the highly metaphorical word group than the highly literal word group (see 3.7).

The fact that highly literal words' nonsalient metaphorical meanings were primed in context and that highly metaphorical words' metaphorical meanings were not primed in context again did not evidence the possibility that conventional metaphorical meanings needed contextual support for them to be fully activated, because while both were presented in compatible contexts, the nonsalient metaphorical meanings were primed but not the frequent metaphorical meanings. Hence the current lack of priming for highly metaphorical words' metaphorical meanings might result from an internally varied degree of lexicalization or salience.

Also note that in incompatible contexts, salient literal meanings and nonsalient metaphorical meanings both obtained roughly the same amount (50 ms and 49 ms) of

nonsignificant numerically faster response than in the unrelated contexts. This was suspected to result from a general relatedness between the polysemous meanings, and did not provide support for Giora's claim that salient meanings will always be activated regardless of contextual bias.[81]

In all, the current results lent support to the study's hypothesis that sense-level lexical meanings are not able to be activated in incompatible contexts.

[81] It should also be noted that the results do not support direct access model either, because highly metaphorical words' meanings were not primed in strongly biased contexts.

Chapter 6 General Discussion

6.1 Summary of Results & Response to Research Question & Hypothesis

In this study, I investigated the interaction of meaning salience and contextual effects in the processing of metaphorical polysemy, and asked the following question:

- **How can meaning salience interact with contextual effects in the processing of metaphorical polysemy?**

In exploring the issue, I focused on Giora's (2003) graded salience hypothesis, which claims that salient meanings will always be initially activated regardless of contextual biases. Giora's model however lacks clear differentiation of lexical- and phrasal-level meanings, and sense- and facet- level meanings, which recent cognitive semantic theories promote. In addition, methodologically, this model lacks clear operational criteria for the determination of salient meanings. Hence, I focused on sense-level lexical meanings in metaphorical polysemy, and defined salient meanings by comparing results from three measures, i.e., frequency, association, and priming. Based on the comparison, I defined highly frequent literal meanings as salient meanings and infrequent metaphorical meanings as nonsalient meanings. Because sense-level meanings cannot coexist in the same context, I hypothesize, contrary to Giora's claim:

- **Salient or nonsalient sense-level literal and metaphorical meanings can only be activated in compatible contexts and not in incompatible contexts.**

The results from a cross-modal lexical priming experiment for words in context supported the hypothesis and suggest thated salient literal meanings and nonsalient metaphorical meanings could only be activated in compatible contexts. This implicated a need to reconsider the graded salience hypothesis as well as lexical access models in general based on cognitive semantic theories (see 2.4.3 for further implications).

6.2 Back to Big Issues

A basic concern in this study is the possibility to incorporate fundamental lexical semantic issues proposed in cognitive linguistics into psycholinguistic experiments, in order to improve researchers' understanding of human cognition.

Cognitive linguists do not emphasize an "innateness of cognitive abilities", but propose that general cognitive abilities govern language use. As Croft and Cruse (2004) states:

> "…the cognitive processes that govern language use, in particular the construction and communication of meanings by language, are in principle the same as other cognitive abilities."

In this way, the construal of lexical meanings involves the operation of basic human cognitive abilities. Croft and Cruse (2004) state that the distinction of senses and facets involves the operation of the basic cognitive ability *attention*. Sense boundaries are not miraculously established in context, but are established because context directs *attention* to a particular part of meaning's natural properties which differs from the other parts of meaning potentials during the conceptualization process going on in a certain context, thus forming the so-called *attentional autonomy* for sense-level meanings. It is named so because in such a context one cannot attend to two sense-level word meanings at the same time, if an interpretation is to be achieved.

Based on such a dynamic view of lexical meanings, the differences between sense- and facet- level meanings are worth considering in language processing studies.

As Croft and Cruse (2004) state in their last chapter: "…there is considerable scope for further interaction between cognitive psychology and cognitive linguistics, in particular for critical experimental testing of cognitive linguistic hypotheses, and a refinement of the linguistic assumptions behind the experimental designs of cognitive

psychologists." Truly, it is hoped that by starting from cognitive semantic theories and corpus data, and test them in psycholinguistic experiments, the study might contribute even a little bit to the exploration of the universe of human cognition. Again, citing their final words (ibid.) in the book: "…cognitive linguistics has the potential to make a contribution to a theory of language that goes beyond cognition, as well as a theory of cognition that goes beyond language." We expect to see that.

6.3 Limitations of Study

The current study has the following limitations:

(1) Number of Participants & Statistical Issues:

The experiments in this study had only a limited number of participants. Particularly, in experiment 1 and pretest 4 there were respectively only 20 and 12 participants, which may render the results less stable (e.g., the proportion of the first associates). Besides, there were not an equal number of participants in each experiment, and generally not in each list (except for pretest 4); hence, homogeneity among the experiments was not strictly preserved. In addition, there were strong list effects in the online experiments; and equal variances were not assumed in the statistical analyses in offline ratings, pretest 4, and experiment 2, due to which strong claims were disallowed. (Equal variances in the last experiment held, and t-tests' results were adjusted when necessary, which still lent support to the current study.)

(2) Material Preparation:

The restrictive criteria for item collection also limited the amount of good items. This was particularly so since Chinese Wordnet was still under construction and there were only a limited number of lexical items which had metaphorical senses but involved no facet-level meanings, etc. Thus investigation of the effects was limited. In addition, since only part of highly metaphorical words obtained a high proportion of first

metaphorical associates, it is suggested that more items of this type may be prepared to further examine the effects.

Also, although Chinese Wordnet and Sinica Corpus 4.0 as recognized resources were taken as the primary basis for the sake of clear operational criteria for material preparation, these two resources themselves were not perfect. For example, Chinese Wordnet did not always define metonymically-extended meanings as facet-level meanings, which suggested a discrepancy between theory and practice (see 2.2 for a review). Sinica Corpus 4.0 on the other hand was established roughly a decade ago, and hence may not capture the language change in Chinese during these years.[82]

Further, the visual target words used in the series of experiments were selected based on a set of restrictive operational criteria, which had trade-offs in terms of concreteness of meanings and direct associates (see 2.5.4 for concerns and reasons to maintain them in the current study). This may affect the timing of priming effects (see 2.5.3) and the results. Hence, visual target words selected based on other criteria (such as using corpus tools like HowNet and CiLin for synonymous words) could still be tested for an improvement of visual target selection and for further investigation into the issue.

In addition, the lexical items were only controlled as such that they did not involve cross-categorical meanings and there were a balanced amount of nouns and verbs. However, because lexical category was not a main issue in this study, the frequencies of the nominal visual targets were significantly higher than verbal visual targets [$t(62)=3.00$, $p<.002$][83], which disallowed a further observation on the possible effects of lexical category. For example, in a reanalysis of experiment 3 with category added in as a fixed factor, nominal trials were found to be significantly faster responded to than

[82] A more recently established corpus is Chinese Gigaword. Or, adopting a web-as-corpus approach and using Google data may compensate for this insufficiency.
[83] Assuming equal variances.

verbal trials [F(1, 1361)=12.77, p<.001], which however may be due to the higher frequencies of nominal targets and thus was not of interest.[84]

Finally, further concreteness and familiarity ratings on the individual word meanings may be done in order for a bettered matching of visual targets between groups and a further observation of the effects. Still, because I mainly focus on comparisons of the same visual targets under different conditions, the general claim holds.

(3) Timing Settings, E-Prime Settings, and Apparatus:

While in the current study I focused on a single timing setting, that is, a 0 ISI and a 1000 ms target presentation duration, which was believed to tap into an initial processing stage, other timing settings could be tested to further examine the effects. Particularly, since Ahrens' (2006) study suggests the importance of visual target presentation duration, other shorter or longer durations could be examined.

Besides, E-Prime scripts were modified to improve details in the experiments after several participants finished experiments 2 and 3, which may cause differences between the different versions, though the influences were considered minute. Also, because technical errors occurred during pretest 4, the nonword effects could be re-examined with an improved apparatus.

6.4 Future Study

Besides the potential improvements stated above, the future extensions of the study could done in the following ways:

[84] In all the reanalyses I did, generally no effects of interest were found. Only when I selected 4 nominal items from highly metaphorical words which had metaphorical meanings consistently suggested as salient based on frequency and association did I find a likely instance. In that case, the four items' literal meanings were activated in metaphorical contexts (p<.02). However, due to the limited amount of items, participants, and data, the results might be of peculiar cases and it was hard to make any claim based on this.

(1) Using Other Paradigms:

Further experiments could be done testing the stimuli in an eye-tracking paradigm to investigate whether salient meanings in incompatible contexts will lead to longer fixation times. Also, simple lexical decision tasks could be done on the metaphorical prime words and monosemous words to investigate issues concerning ambiguity advantage or disadvantage.

(2) Using Other Methods to Estimate Corpus Sense Frequency:

Calculation of corpus sense frequency can be done using Chinese Word Sketch, which can be a more time-saving method than coding all corpus data. It can be hypothesized that word meanings are determined by their collocates.[85] And thus with the collocational information provided by Chinese Word Sketch, it might be possible to roughly estimate a lexical item's dominant meaning in corpus.

(3) A Modified Model:

Based on the current hypothesis, it may be possible to postulate a modified lexical access model by incorporating the sense-facet differences into the graded salience hypothesis and conduct further experiments.

[85] This idea was obtained from Professor Siaw-Fong Chung during a meeting at NCCU.

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APPENDICES

APPENDIX I. Experimental Items: Metaphorical Prime Words and Meanings

*POS=Part of Speech, WN Sense= Sense definition in Chinese Wordnet, NOS= Number of sense in Chinese Wordnet. Number in the parentheses means amount of actually tagged data. (Some ambiguous cases were not tagged)

APPENDIX I.A Highly Literal Nouns

Noun	POS		WN Sense	Sense Freq.	NOS	Freq.
廢物	Na	L	普通名詞。失去原有使用價值的東西。 Noun. Sth. that lost its original usage or value.	87.50%	2	40
		M	普通名詞。沒有用的人。 Noun. A good-for-nothing.	12.50%		
櫥窗	Na	L	普通名詞。用來陳列物體或公佈訊息的透明展示空間。Noun. A transparent space for exhibition (of sth.) or for announcements.	71.11%	2	45
		M	普通名詞。比喻展示訊息的管道。 Noun. Metaphorically referring to the channel through which messages are distributed.	28.89%		
孤兒	Na	L	普通名詞。死了父親的孩子。 Noun. A child who lost his/her father.	67.50%	3	41 (40)
		M	普通名詞。比喻缺乏應得的支持與援助的人或物。 Noun. Metaphorically referring to sb. or sth. that lacks necessary support or help.	25.00%		
成本	Na	L	普通名詞。貨物的生產運輸過程中所花費的金錢。 Noun. Money spent in the process of producing and transporting goods.	85.90%	2	702
		M	普通名詞。比喻進行前述事件時所需的全部付出。 Noun. Metaphorically referring to the total necessary cost to carry out sth. previously mentioned.	14.10%		
跑道	Na	L	普通名詞。一種特別的行道，人們用來競速的場地。 Noun. A special sort of path for people to race.	65.12%	3	43
		M	普通名詞。比喻人生或職業的路徑。 Noun. Metaphorically referring to the path of life or vocation.	4.65%		
主角	Na	L	普通名詞。有情節的故事作品中的主要角色。 Noun. The main character in a story with plot.	69.35%	2	258 (248)
		M	普通名詞。比喻在特定事件中具有主要地位的特定對象。Noun. Metaphorically referring to sb. who plays a major role in an event.	30.65%		
生態	Na	L	普通名詞。生物與環境相互作用所產生的各種現象。 Noun. Phenomena resulting from interaction between living creatures and environment.	86.52%	4	467 (460)
		M	普通名詞。比喻特定對象與特定環境相互作用所產生的各種現象。 Noun. Metaphorically referring to phenomena resulting from interaction between sth. and a certain environment.	10.87%		
輪廓	Na	L	普通名詞。物體外觀的形狀，由它的外緣線條所界定。Noun. The outward shape of sth., delineated by its figure.	88.64%	2	44
		M	普通名詞。所描述事物的概況。* Noun. The general situation of sth.	11.36%		

APPENDIX I.B Highly Metaphorical Nouns

Noun	POS		WN Sense	Sense Freq.	NOS	Freq.
角度	Na	L	普通名詞。兩直線或平面相交所形成的空間。 Noun. The space formed by two intersecting lines or planes.	15.61%	2	538
		M	普通名詞。比喻觀察特定事件的觀點。 Noun. Metaphorically referring to the viewpoint in observing sth.	84.39%		
觸角	Na	L	普通名詞。昆蟲、節足或軟體動物頭部突出的感覺器官之一。 Noun. One of the sensory organs of insects, arthropods, mollusks, which thrust out from the head.	32.56%	2	43
		M	普通名詞。比喻從本體延伸，用來探索較不熟悉的部份。Noun. Metaphorically referring to an extension of the subject that aims to explore an unfamiliar realm.	67.44%		
本錢	Na	L	普通名詞。可以用於營利或其他事業的資金。 Noun. Capital that can be used to run business or other enterprise.	21.43%	4	44 (42)
		M	普通名詞。比喻達成前述事件可以憑藉的條件。 Noun. Metaphorically referring to the condition by which sth. mentioned before can be achieved.	71.43%		
戰術	Na	L	普通名詞。在戰場上用來達成作戰目標的方法。 Noun. The strategy used on war field to achieve a military goal.	34.09%	2	44
		M	普通名詞。在競爭中爲達成目標所採取的方法。 Noun. The strategy adopted in competition to achieve the goal.	65.91%		
焦點	Na	L	普通名詞。平行光線射於球面鏡或透鏡上，被反射或折射後所集聚的一點。 Noun. The point on which parallel rays converge after being reflected or refracted by a spherical mirror or lens.	0.00%	3	364
		M	普通名詞。比喻吸引眾人注意力的對象。 Noun. Metaphorically referring to sb. that attracts people's attention.	100.0%		
角色	Na	L	普通名詞。戲劇中演員扮演的人物。 Noun. The role an actor plays in drama.	12.69%	2	903 (875)
		M	普通名詞。比喻在團體中，依所擔負的責任而具有的身份。 Noun. Metaphorically referring to the role sb. plays in a group of people according to his/her responsibility.	87.31%		
壓力	Na	L	普通名詞。物體表面所承受的力量。 Noun. The force the surface of sth. bears.	4.15%	3	943 (940)
		M	普通名詞。比喻特定對象所承受的負擔。 Noun. Metaphorically referring to the burden sb. bears.	77.66%		
階級	Na	L	普通名詞。供人上下的階梯中層級的部份。 Noun. The steps of a stairway for people to ascend or descend.	0.00%	2	270 (269)
		M	普通名詞。比喻社會組織結構中處於不同地位的社會族群。 Noun. Metaphorically referring to social classes of different ranks in the societal hierarchy.	99.26%		

APPENDIX I.C Highly Literal Verbs

Verb	POS		WN Sense	Sense Freq.	NOS	Freq.
說出	VE	L	以口語媒介表達出後述訊息。 To express the following message in spoken language.	89.23%	4	141 (130)
		M	比喻由前述對象得到後述訊息。 Metaphorical. To infer the following message from an sth. aforementioned.	3.85%		
毀容	VB	L	將動物原本的面貌毀壞。 To disfigure the original face of an animal,	85.71%	2	8 (7)
		M	比喻將大自然原本的面貌毀壞。 Metaphorical. To damage the original scenery of nature.	14.29%		
動工	VA	L	工程正式開始進行。 To formally start a construction.	86.84%	3	83 (76)
		M	比喻特定事件開始進行。 Metaphorical. To start a specific event.	0.00%		
走路	VA	L	以兩腿交互向前移動，雙腳不同時離開地面。 To move with legs interchangingly moving forward but not leaving the ground simultaneously.	96.55%	3	145
		M	委婉用語。比喻特定對象的職位被取消。 Hedge. Metaphorical. Sb.'s job is cancelled.	2.76%		
散去	VA	L	原本聚集在一起的前述對象彼此分開。 The aforementioned group of (objects, which originally gathered together,) depart from one another.	94.74%	2	20 (19)
		M	比喻原本聚集在一起的前述團體彼此分開。 Metaphorical. The aforementioned group of (organizations, which originally are together) disunite.	5.26%		
上臺	VA	L	進行表演或演講。 To perform or to lecture.	100%	2	19
		M	出任職務或掌權。 To take a job position or to reign.	0.00%		
長大	VH	L	生物體在發育過程中由小到大直到成熟。 Biological organisms grow in size till maturity in the process of development.	98.16%	6	381
		M	比喻心智發展成熟。 Metaphorical. The mind develops and matures.	0.79%		
吞下	VC	L	將物體不經細嚼進入食道。 To have sth. enter into oesophagus without chewing.	72.73%	4	11
		M	比喻壓抑住情感或言辭。 Metaphorical. To suppress emotion or words.	18.18%		

APPENDIX I.D Highly Metaphorical Verbs

Verb	POS		WN Sense	Sense Freq.	NOS	Freq.
站穩	VA	L	站立並保持重心穩定。 To stand and keep a balanced center of gravity.	5.56%	3	18
		M	比喻有穩定基礎。 Metaphorical. To have a stable basis.	72.22%		
帶動	VC	L	帶領後述對象做特定動作。 To lead sb. to make a certain gesture.	5.07%	3	231 (217)
		M	比喻進行事件以達到後述狀態。 Metaphorical. To proceed sth. in order to achieve the state mentioned in the following context.	94.93%		
喚起	VC	L	叫醒。 To wake up.	2.08%	3	57 (48)
		M	比喻引起後述情感或精神狀態。 Metaphorical. To arouse the emotional or spiritual state mentioned in the following context.	95.83%		
看成	VG	L	藉視覺把前述對象誤認爲後述對象。 To mistake sb./sth. aforementioned as sb./sth. mentioned in the following context.	4.92%	2	63 (61)
		M	比喻把前述對象認定爲後述的一類。常用於將字句、把字句和被字句。Metaphorical. To recognize sth. aforementioned as a member in the category mentioned in the following context. Usu. used in *jiang*-construction, *ba*-construction, or *bei*-construction.	95.08%		
浸淫	VI VC	L	液體滲入後述對象。 Liquid infiltrates sth. mentioned in the following context.	5.56%	2	18
		M	比喻情緒完全投入於後述境界中。 Metaphorical. One's mood totally absorbed into the following state.	94.44%		
打斷	VC	L	打擊物體，使其斷裂。 To strike sth. that it breaks.	11.32%	2	53
		M	中斷正在進行的事件。 To interrupt an ongoing event.	88.68%		
湧起	VA	L	流體快速大量地從下往上冒出。 Fluid rapidly and massively uprush.	11.11%	3	19 (18)
		M	大量地出現。 To appear massively.	83.33%		
面臨	VK	L	前述對象所在的位置正面面對後述對象。 The position of sb./sth. aforementioned faces directly to sb./sth. mentioned in the following context.	0.63%	2	637 (635)
		M	比喻正在經歷後述事件。 Metaphorical. Sb. is experiencing the event mentioned in the following context.	99.37%		

APPENDIX II. Experimental Items: Metaphorical Prime Words and their Corresponding Unrelated Primes and Target Words, and Relatedness Ratings for Words Presented in Isolation

*Freq.=Frequency, R=Ratings for targets and related primes, U=Ratings for targets and unrelated Primes.

APPENDIX II.A Highly Literal Nouns

Metaphorical Primes	Freq.	Unrelated Primes	Freq.	Literal Targets	Freq.	R	U	Metaphorical Targets	Freq.	R	U
廢物	40	門禁	42	殘渣	13	5.89	1.18	累贅	16	4.64	2.11
櫥窗	45	草坪	45	玻璃	547	5.78	1.82	訊息	900	4.27	1.89
孤兒	41	海鮮	43	苦楚	17	4.78	2.09	苦境	4	5.27	1.33
成本	702	特色	765	費用	966	6.11	2.36	心力	245	4.18	1.78
跑道	43	室友	43	場地	403	5.00	2.00	職務	320	3.67	2.45
主角	258	金額	258	要員	25	5.27	2.00	重點	1120	5.89	3.09
生態	467	特徵	423	資源	2367	6.00	2.00	體系	784	5.00	2.73
輪廓	44	教職	45	外形	63	6.55	2.00	概況	59	4.44	2.45

APPENDIX II.B Highly Metaphorical Nouns

Metaphorical Primes	Freq.	Unrelated Primes	Freq.	Literal Targets	Freq.	R	U	Metaphorical Targets	Freq.	R	U
角度	538	類型	291	數值	65	5.11	2.09	看法	1126	6.36	3.33
觸角	43	用具	43	昆蟲	265	5.89	2.64	範圍	1353	4.91	2.89
本錢	44	成見	44	資金	952	5.78	1.82	實力	521	6.00	2.56
戰術	44	良知	43	兵法	15	6.78	2.82	球賽	67	6.00	4.67
焦點	364	風格	528	熱能	24	2.82	1.33	話題	520	5.89	4.55
角色	903	現象	1162	演員	464	6.82	3.44	職責	89	6.11	2.00
壓力	943	階段	949	重量	234	6.00	1.89	重擔	61	6.56	4.09
階級	270	草案	261	樓梯	153	4.27	1.78	白領	25	5.67	2.82

APPENDIX II.C Highly Literal Verbs

Metaphorical Primes	Freq.	Unrelated Primes	Freq.	Literal Targets	Freq.	R	U	Metaphorical Targets	Freq.	R	U
說出	141	提早	123	傾訴	40	5.00	1.00	隱含	86	1.60	1.00
毀容	8	選派	10	壞死	50	2.40	1.40	破敗	15	2.40	1.00
動工	83	遺忘	80	營建	66	5.60	1.00	實行	240	5.40	1.80
走路	145	忽視	152	步行	92	6.00	1.00	離職	106	5.00	1.60
散去	20	附贈	24	告辭	35	5.20	1.00	拆夥	10	4.20	1.00
上臺	19	仿照	19	展現	723	4.60	2.20	掌權	30	4.60	1.00
長大	381	違反	259	茁壯	89	6.20	1.40	圓熟	16	4.80	1.80
吞下	11	對調	15	餵食	68	4.20	1.20	強忍	29	4.60	1.00

APPENDIX II.D Highly Metaphorical Verbs

Metaphorical Primes	Freq.	Unrelated Primes	Freq.	Literal Targets	Freq.	R	U	Metaphorical Targets	Freq.	R	U
站穩	18	打烊	18	恆定	7	3.00	1.00	奠定	139	4.40	1.20
帶動	231	享有	178	率同	16	4.80	1.40	提振	57	5.80	1.20
喚起	57	改用	55	叫醒	25	5.60	1.00	引發	800	4.40	1.60
看成	63	著想	54	誤認	30	6.00	1.00	猶如	187	5.00	1.60
浸淫	18	打拼	18	吸收	478	3.20	1.40	心醉	10	4.80	1.00
打斷	53	深信	49	摧折	3	4.00	1.40	阻止	242	5.80	1.40
湧起	19	待命	18	飛濺	10	3.60	1.80	萌生	35	5.40	1.80
面臨	637	委由	264	迎向	48	4.00	2.20	遭受	332	5.60	1.80

APPENDIX III. Experimental Items: Metaphorical Prime Words, Target Words, Sentential Stimuli, and Relatedness Ratings for Words in Context

* L=Literally-biased context or literal target, M=Metaphorically-biased context or metaphorical target, U (Row)=Unrelated context. R=Ratings for targets and related primes, LR=Ratings for relatedness between prime words in literally-biased context and target words, MR= Ratings for relatedness between prime words in metaphorically-biased context and target words, U (Column)= Ratings for relatedness between unrelated prime words in unrelated context and target words.

APPENDIX III.A Highly Literal Nouns

Prime		Sentential Stimuli	Target	LR	MR	U
廢物	L	化學肥料工廠依規定須妥善處理加工過程中產生的**廢物**，不可隨便。	殘渣	5.89	5.50	1.00
	M	從小祖母就諄諄告誡他：不要做個混吃等死的**廢物**，要做有用的人。	累贅	4.29	6.00	1.94
	U	某些大學的宿舍爲了確保同學安全設有**門禁**，限制深夜同學的出入。				
櫥窗	L	時裝店老闆經常會將最流行的衣飾展示在店門邊的**櫥窗**以吸引顧客。	玻璃	5.56	4.63	1.33
	M	經濟部官員表示，股市是展示一個國家經濟情形的**櫥窗**，十分重要。	訊息	2.00	5.20	1.19
	U	高山上的氣候濕潤，特別在清晨**草坪**上會沾滿露珠，一片青蔥翠綠。				
孤兒	L	高中時他的雙親因車禍不幸喪生，從此他成了**孤兒**，靠人接濟維生。	苦楚	4.88	4.11	1.08
	M	因爲長期缺乏邦交國，許多人認爲台灣是國際間的**孤兒**，情形爲難。	苦境	4.20	4.00	1.13
	U	前幾天去高雄，朋友招待我去旗津吃**海鮮**，然後去西子灣觀賞夕陽。				
成本	L	和空運相比，船運的速度雖慢卻能大幅減少營運的**成本**，值得考慮。	費用	6.50	6.00	1.00
	M	打工會佔用許多讀書時間，他考慮這樣做所需的**成本**太大，要謹慎。	心力	4.00	3.86	1.44
	U	深沉內斂、邏輯清晰或許可說是俄羅斯的民族**特色**，跟南美很不同。				
跑道	L	學校最近得到經費，在運動場上鋪設了一條新的**跑道**，同學很興奮。	場地	3.57	4.60	1.88
	M	在政府工作三十年的父親幾經考慮，決定改換**跑道**，投入教育事業。	職務	1.89	4.88	1.25
	U	升上大學到台北的第一天，我和剛認識的**室友**一見如故，相談甚歡。				
主角	L	韓劇「七年之夢」的導演看中資歷最淺的他擔任**主角**，令眾人錯愕不已。	要員	6.29	5.60	1.81
	M	三月間盛開的櫻花，是每年阿里山花季的**主角**，吸引許多遊客參觀。	重點	3.78	6.38	2.08
	U	國科會今年核准的輔助款還沒有確定**金額**有多少，但會在近期公佈。				
生態	L	雪霸國家公園完整保存了三千公尺以上的高山**生態**，適合從事研究。	資源	4.60	2.00	2.19
	M	立委呼籲大家遵守誠信原則，以改善台灣政治的**生態**，並減少誤會。	體系	5.25	6.00	1.42
	U	警察呼籲民眾遭遇飛車搶案時應該牢記搶匪的**特徵**，方便日後追查。				
輪廓	L	黑暗之中他只能勉強辨認遠方走來的人臉孔的**輪廓**，但不清楚是誰。	外形	6.20	5.43	1.50
	M	檢察官經過長期的偵訊，才漸漸了解整個案情的**輪廓**，希望能破案。	概況	4.88	6.22	1.08
	U	很多留學生的夢想是拿到博士學位後回台灣尋找**教職**，並成家立業。				

APPENDIX III.B Highly Metaphorical Nouns

Prime		Sentential Stimuli	Target	LR	MR	U
角度	**L**	專家測量的結果證實，比薩斜塔傾斜的**角度**近百年來有增加的趨勢。	數值	5.11	2.50	1.25
	M	人生在世挫折、痛苦經常在所難免；學習換一個**角度**想會有所幫助。	看法	1.00	6.40	2.81
	U	荷花和睡蓮雖然外表相似，但仍可細分成屬於兩種不同**類型**的植物。				
觸角	**L**	弟弟蹲在廚房角落觀察地上的蟑螂兩根竄動的**觸角**，心中充滿好奇。	昆蟲	5.33	3.88	1.00
	M	公司爲了進一步發展，決定往大陸市場伸出業務的**觸角**，擴大營業。	範圍	1.14	5.20	1.56
	U	警方追查後發現嫌犯擁有疑似用來吸食毒品的**用具**，以及數把利器。				
本錢	**L**	媽媽爲了經營路邊攤位，只好變賣自己的首飾作爲**本錢**，購買材料。	資金	6.63	4.89	1.00
	M	要做籃球選手，需要足夠的身高和充沛的體力作**本錢**，才能脫穎而出。	實力	4.80	5.00	1.31
	U	婆婆對小兒子剛娶入門的媳婦懷有很深的**成見**，因此對她處處刁難。				
戰術	**L**	我軍這次能夠獲勝，是因爲將領發展出變化多端的**戰術**，揣測不易。	兵法	6.50	5.44	1.33
	M	球隊這次能夠奪得冠軍是因爲教練運用的**戰術**得當，發揮隊員實力。	球賽	2.80	2.29	1.31
	U	人類雖然會犯錯，但深處也有與生俱來的**良知**，引導規律人的行爲。				
焦點	**L**	太陽光通過透鏡會聚集在另一側的**焦點**上，藉此可讓紙張起火燃燒。	熱能	2.57	1.40	1.19
	M	同學作弊被發現後支吾其詞，企圖轉移大家關切的**焦點**，規避責任。	話題	3.56	6.25	1.92
	U	剛回國的豎琴演奏家在演奏時展現出她獨特的**風格**，令人耳目一新。				
角色	**L**	初次進到演藝圈時，他在連續劇中扮演失業父親的**角色**，頗受好評。	演員	4.86	2.40	1.19
	M	在台灣現代文學發展的過程中，他擔任承先啓後的**角色**，貢獻良多。	職責	5.11	4.88	1.00
	U	餅乾在空氣中放久了會有潮濕的**現象**，因此吃剩的要小心密封起來。				
壓力	**L**	氣象學課上教授正介紹大氣在地面高度造成的**壓力**該如何準確測量。	重量	3.20	4.71	1.50
	M	繁重的課業和兼差的工作對他成爲巨大的**壓力**，使他不禁感覺茫然。	重擔	4.63	6.56	1.50
	U	三級古蹟的整修工程現在進入最後收尾的**階段**，預計不久後可完工。				
階級	**L**	聽說沒有人數得清楚通往這座山頂的石梯有多少**階級**，讓人很好奇。	樓梯	5.40	1.57	1.50
	M	經過多年的努力，他終於成爲社會上中上層**階級**的人士，小有名氣。	白領	3.13	5.56	1.08
	U	同學們經過熱烈討論後提出了期末聚餐的**草案**，希望邀請老師參加。				

APPENDIX III.C Highly Literal Verbs

Prime		Sentential Stimuli	Target	LR	MR	U
說出	L	輔導室的老師默默的坐在被記過的同學身旁，聽他**說出**心裡的想法。	傾訴	6.00	5.75	1.00
	M	許多人相信宇宙萬物的存在和運行**說出**背後有位造物主，並非偶然。	隱含	1.71	5.40	1.56
	U	畫展的主辦單位爲了紓解人潮，決定**提早**在上午七時開放民眾入場。				
毀容	L	無情的火災造成他全身高度灼傷，臉部將近**毀容**，也奪走他的親人。	壞死	3.78	5.00	1.00
	M	無限制開發山坡地的結果，使原本青翠的山崗**毀容**，生態遭受破壞。	破敗	3.00	5.60	1.00
	U	軟體業者最近舉辦一場研討會，公司決定**選派**有相關背景的人參加。				
動工	L	校長計畫要在校園內蓋造新大樓，預估將會在最近**動工**，令人期待。	營建	6.13	3.33	1.17
	M	他努力想論文題目，希望題目確定後論文就能準備**動工**，及早完成。	實行	5.60	6.29	2.06
	U	因車禍骨折的他至終體悟人生喜樂的秘訣在於能夠**遺忘**別人的過犯。				
走路	L	孩子剛出生幾個月時還只會在地上爬，不會**走路**，要注意地面雜物。	步行	6.75	2.00	1.00
	M	經濟蕭條使得許多企業財務吃緊，老闆只得請員工**走路**，情形淒涼。	離職	1.40	7.00	1.88
	U	物質社會滿足了人外在的需求，卻經常**忽視**了人類內在靈性的需要。				
散去	L	婚宴上賓客們盡情吃喝閒聊，結束後大家各自**散去**，回到自己家裡。	告辭	5.86	4.80	1.06
	M	這些國家原本彼此結盟，後來意見不合，紛紛**散去**，造成分裂局面。	拆夥	3.11	6.13	1.08
	U	購買筆記型電腦時，除了相關軟體，店家通常都會**附贈**滑鼠等配備。				
上臺	L	他從小個性內向，最怕公開表現或者被叫到要**上臺**，至今仍是如此。	展現	3.71	2.40	2.00
	M	總統大選結束以後，政權轉移，新的總統即將**上臺**，正式開始執政。	掌權	3.00	6.25	1.08
	U	學校這幾年來爲了和國際接軌，許多制度和做法都**仿照**國外的大學。				
長大	L	母親細心的照顧餵養孩子，看著孩子一天天**長大**，心裡感到很欣慰。	茁壯	6.60	5.14	1.25
	M	他外表看來像很有資歷的人，但其實內心尚未**長大**，考慮不夠週詳。	圓熟	5.25	5.78	1.17
	U	偵探勘查過竊案現場之後認爲窗戶破裂的位置**違反**常理，頗爲可疑。				
吞下	L	從小我就不喜歡吃藥，每到服藥時總將藥丸一口**吞下**，以免嚐到苦味。	餵食	3.20	1.29	1.06
	M	原本正要發言的他看見情況不對，將要說的話硬是**吞下**，以免闖禍。	強忍	4.25	6.11	1.00
	U	爲了妥善利用空間，爸爸將電腦桌和床鋪的位置**對調**，使動線流暢。				

APPENDIX III.D Highly Metaphorical Verbs

Prime		Sentential Stimuli	Target	LR	MR	U
站穩	L	搬家工人說，搬運重物時要把重心放低、腳步**站穩**，脊柱成一直線。	恆定	2.78	5.13	1.08
	M	現今創業艱難，老闆認爲要先讓公司在國內業界**站穩**，再向外發展。	奠定	3.43	4.80	1.31
	U	每年中國過年期間，街上許多店家都會提早**打烊**，讓員工回家團圓。				
帶動	L	小學時校長會固定利用朝會時間請體育老師在臺上**帶動**大家做體操。	率同	4.67	2.88	1.08
	M	政府積極發展此地的交通設施和觀光事業，盼能**帶動**當地經濟成長。	提振	4.14	6.60	1.75
	U	依照憲法規定，中華民國政府應當保障人民**享有**工作權等基本權利。				
喚起	L	每天早晨當我還在沉睡，媽媽總會輕聲將我**喚起**，準備帶我去學校。	叫醒	6.75	5.56	1.08
	M	社團同學在校內各處張貼非洲遊民的照片，希望能**喚起**同學的愛心。	引發	1.60	6.00	1.94
	U	他對電腦要求很高，如果使用得不滿意會考慮**改用**其他廠牌的產品。				
看成	L	這對兄弟長得很相像，人從遠方常常會把弟弟**看成**哥哥，彼此混淆。	誤認	6.38	2.11	1.08
	M	苦難是化妝的祝福，因此每當遇到困難時不妨把它**看成**學習的機會。	猶如	3.80	3.57	1.25
	U	老師經常教導：孝順的孩子應當學習爲父母親**著想**，不讓他們擔心。				
浸淫	L	他拿一塊海綿泡在實驗用的藥劑裡，讓藥水充分**浸淫**海綿的每部分。	吸收	5.29	2.40	1.56
	M	音樂廳中演奏著優美的鋼琴名曲，走進其中讓人**浸淫**在藝術的世界。	心醉	2.00	6.63	1.08
	U	行政首長在演說中勉勵同仁一起爲杜絕貪污**打拼**，以改善行政效率。				
打斷	L	昨晚牯嶺街發生少年圍毆事件，受害人腿骨被棍棒**打斷**，送醫急救。	摧折	2.57	2.20	1.31
	M	前天在廣場上舉辦的音樂會被一場突來的雷雨**打斷**，民眾敗興而歸。	阻止	2.33	5.50	1.08
	U	雖然所愛的人和他分隔千里之遙，但他心裡**深信**兩人必定終成眷屬。				
湧起	L	颱風來時海上颳起大風浪，一陣陣的波瀾從海面上**湧起**，非常壯觀。	飛濺	4.60	2.71	1.13
	M	每當兒女有所成就時，一種滿足感總會從父母心裡**湧起**，無法言喻。	萌生	5.38	5.44	1.08
	U	調查局官員在屋內搜證時吩咐部屬須在一旁**待命**，以防備緊急情況。				
面臨	L	輪船上的乘客走到護欄旁邊，讓自己**面臨**大海，好觀賞日落的景色。	迎向	6.00	4.14	1.75
	M	金融風暴以後公司營運越來越困難，危機重重，現在**面臨**倒閉邊緣。	遭受	3.38	6.22	1.33
	U	他不擅處理事務，所以出國時機票、簽證等事一概**委由**旅行社辦理。				

APPENDIX IV. Filler /Practice Primes, Targets (Nonwords), Sentential Stimuli

APPENDIX IV.A Fillers Used in Pretest 4, Experiment 2, and 3

*****In pretest 4, only filler primes and pseudohomophones were used in lexical decisions; in experiment 2, only filler primes and legal nonwords were used; in experiment 3, only sentential stimuli and legal nonwords were used. Type refers to the type of fillers, e.g., MN means this prime word is a metaphorical noun taken from Chinese Wordnet (See Chapter Three for details), and LR means the sentence is roughly biased to its literal meaning, and the pseudohomophone target is (phonologically) related to the prime. Likewise, UAN means the prime is an unambiguous (monosemous) word taken from Chinese Wordnet; R means the pseudohomophone target is (phonologically) related to the prime. In pretest 4 and experiment 2, nominal fillers and verbal fillers were separated into two sessions. Legal=Legal Nonwords, Pseudo.=Pseudohomophones, Base=Base words of pseudohomophones.

Filler Primes	Type	Sentential Stimuli	Target		
			Legal	Pseudo.	Base
家庭	MN_LR	這孩子來自一個破碎的家庭，而他行爲和觀念的偏差，也與此相關。	琶暗	壩吧	爸爸
長城	MN_LR	來到中國的遊客感嘆多少不爲人知的故事，與故人同埋於長城之下。	德危	專快	磚塊
廣場	MN_LR	歐洲有許多城市以廣場爲其中心，道路系統並由此向四面八方擴展。	生提	刁向	雕像
殿堂	MN_LR	故宮建築的外觀有如古代君王的殿堂，華麗之餘，也饒富中國風情。	理新	保作	寶座
種子	MN_LU	死而復活的例證，就如一粒種子之埋到地裡，至終結出豐美的果實。	耘尙	髮另	法令
地震	MN_LU	南亞地震的結果，造成數以萬計的人流離失所，也喪失摯愛的親人。	史崇	豐器	風氣
戰爭	MN_LU	根據聖經的預言，在末後的日子戰爭和饑荒會增加，帶走許多人命。	僅太	生旺	聲望
醫生	MN_LU	心臟病患應該聽從醫生建議，不要搭乘雲霄飛車等刺激性遊樂器材。	固企	僅芳	警方
中心	MN_MR	他雖然沉默寡言，但常能一眼看出問題的中心，並找到解決的方法。	摑潔	眾新	重心
跳板	MN_MR	這所補習班在廣告上宣傳它是通往美國大學的跳板，造育許多學生。	壩膠	奕畜	益處
工程	MN_MR	進行學術研究就像執行一項浩大的工程，需要花費許多的精神體力。	眾氣	基企	機器
界線	MN_MR	人權團體舉行了各樣宣傳活動，希望能打破種族的界線，消除仇恨。	芳佣	裡潔	禮節
色彩	MN_MU	桌上擺的武士玩偶具有日本的色彩，從衣著到配戴的飾品都很講究。	濃浮	髮閨	法規
財產	MN_MU	爲了維護智慧財產權，請勿購買盜版的唱片和電影，保障作者權益。	專尖	由課	遊客
背景	MN_MU	不清楚一個人的背景經常會導致誤會，多些關心則會促進彼此體諒。	奕另	理勿	禮物
障礙	MN_MU	音樂家在創作的過程中需克服許多障礙，才能完成令人感動的作品。	仙張	固克	顧客
政策	UAN_R	愛鳥人士批評政府今年初制定的自然保護政策太過浮濫，沒有重點。	箋颱	芳楨	方針
人士	UAN_R	對在此興建焚化爐持反對意見的人士今天到立法院前拉白布條抗議。	舀焉	仙升	先生
行爲	UAN_R	校長稱許學生奮不顧身搭救溺水孩童的行爲，並對此感到非常欣慰。	刁啓	丞菓	成果
價格	UAN_R	經濟學家預估最近幾年景氣不會好轉，股票的價格也將會持續偏低。	保線	只樹	指數
記者	UAN_R	新聞記者不斷追問醜聞的真相，讓接受訪問的被害人感到十分困窘。	基勿	欣紋	新聞

政見	UAN_R	競選期間各黨派的候選人無不利用各種機會發表政見，以得人支持。	裡最	益提	議題
程式	UAN_R	資工系畢業後，他進入一家軟體公司負責設計程式，一面準備深造。	丞旻	評颱	平台
獎狀	UAN_R	弟弟從小成績優異，月考完後經常拿到獎狀，令家人感到十分欣慰。	只浮	燻張	勳章
政府	UAN_U	政府機關首長最需要的是保持清廉的作風，愛護民眾，不結黨營私。	桃段	宮仁	工人
球員	UAN_U	民事案件的被告指控牽涉在內的法官是球員兼裁判，判決有失公平。	瞰躲	新太	心態
產品	UAN_U	買電子產品時需要注意保固條件和廠商的信用，以免日後後悔不及。	髮拜	室機	事蹟
朋友	UAN_U	父親待人和善、細心體貼，所以在許多地方都有朋友可以互相幫忙。	豐另	割潭	歌壇
作品	UAN_U	畫家為了創造出令人感動的作品，不辭風雨在海濱作畫達數天之久。	髮京	蹤較	宗教
警官	UAN_U	經過多年警校的訓練，他終於如願以償的當上警官，開始執行勤務。	由升	游焉	油煙
食物	UAN_U	物質的身體需要食物才得飽足，而人心裡的虛空也同樣的需要滿足。	欣髮	墊露	電路
河川	UAN_U	環保人士高聲疾呼國人應當保護現有的河川，好留給後人安居之所。	益流	涂劃	圖畫
露面	MV_LR	大批的記者在行政院外守候，準備行政院長一露面就衝上前去採訪。	評樹	初線	出現
變質	MV_LR	診所開的藥物放置過久未服用可能會變質，服用前需確認尚未過期。	墊淚	摔拜	衰敗
出嫁	MV_LR	明天就是女兒出嫁的日子，他回想孩子成長的過程，感到十分欣喜。	賈畜	曲七	娶妻
屬於	MV_LR	從小他的夢想就是擁有一片屬於自己的田野，可以過著閒適的生活。	又室	規淚	歸類
征服	MV_LU	二次世界大戰時曾有野心家夢想過要征服全亞洲，但至終沒有成功。	燻較	流唸	留念
進入	MV_LU	火車從車站出發不久後，進入一片廣漠的凍原地帶，四周杳無人跡。	涂碇	頌膠	送交
認領	MV_LU	百貨公司裡常會聽見櫃台小姐廣播，請客人到櫃台認領遺失的皮包。	豆向	賈莊	假裝
發亮	MV_LU	家中陳舊的銅器經過僕人仔細磨光，在燈光下發亮，彷彿新的一樣。	任器	豆流	逗留
跳出	MV_MR	正當他在打字時螢幕上忽然跳出一個視窗，提示電腦將要重新開機。	宮吧	險室	顯示
渡過	MV_MR	雖然實驗遭遇困難，但室友說他感謝有位天賜的朋友陪他渡過難關。	初魄	課浮	克服
認帳	MV_MR	隨意下載資料造成公用電腦中毒的同學並不認帳，推說是他人所為。	險校	成刃	承認
點燃	MV_MR	學長的勸勉像一劑定心丸，使原本挫敗的他又重新點燃了一絲希望。	池七	積啓	激起
作夢	MV_MU	他希冀能有月入百萬的工作，長輩認為這不啻是在作夢，不切實際。	新篡	住震	助陣
看齊	MV_MU	看完同儕的演出後，他心中暗自定意向他們看齊，盼望有日能發表。	摔課	違升	維生
下山	MV_MU	此地的習俗是太陽下山後，所有的人都留在家裡足不出戶以策安全。	課菓	又仁	誘人
止痛	MV_MU	這對夫妻經過意外喪女的創傷，決定移居國外療傷止痛，不再回國。	倍仁	任危	認為
遵循	UAV_R	勤儉持家的母親一向遵循傳統的教訓，認為要黎明即起、灑掃庭除。	室紋	池手	持守
違背	UAV_R	弟弟由於孝順不敢違背父親的旨意，因此幾經考慮後決定報考軍校。	割仁	倍氣	背棄
擅長	UAV_R	音樂課時老師請一位擅長吹笛子的同學上台吹奏，為同學先做示範。	曲震	磚京	專精
迫使	UAV_R	強烈颱風嚴重損壞他的房屋，迫使他必須暫時到朋友那裡另覓住處。	規前	牆魄	強迫
深思	UAV_R	當今社會上廣泛存在的家庭暴力問題值得我們深思並仔細推想原因。	成莊	炭救	探究
聽任	UAV_R	政府不該聽任貪汙的立委繼續胡作非為，必須設法制裁，杜絕賄賂。	積楨	作室	坐視
致力	UAV_R	醫生自從愛妻因癌症不幸喪生後，便致力研發可對抗這種病的藥劑。	磚救	舍髮	設法
提前	UAV_R	校務會議決定將本學期開學提前一週，以因應國定假日造成的影響。	牆快	郁碇	預定
舉例	UAV_U	教授考慮純粹講述經濟學理論也許對學生太過抽象，需要舉例說明。	蹤唸	夏另	下令

顯現	UAV_U	他往如鏡的湖面上端詳，水面上顯現出天際浮雲和湖畔柳樹的倒影。	游機	薪洞	心動
留意	UAV_U	出國旅行時，需要隨時留意護照、皮夾等貴重物品是否攜帶在身上。	流劃	初前	出錢
促成	UAV_U	政府制定的農業政策方向正確，因此間接促成經濟、社會快速進展。	頌冠	道暗	到案
吸毒	UAV_U	輔導青少年多年的老師在電視上想同學宣導切莫吸毒以免事後悔恨。	住升	句被	具備
跑船	UAV_U	父親常年在外跑船，歷盡風霜，留下母親和子女們在家裡相依爲命。	違作	驟校	奏效
回嘴	UAV_U	性情乖巧的妹妹從不跟父母回嘴，即使有時被誤解她也會默默承受。	炭岷	至浮	制伏
俾利	UAV_U	有人建議都市規劃局將夜市區域規劃爲行人徒步區，俾利民眾通行。	作芳	瞰冠	看慣

APPENDIX IV.B Practice Trials Used in Pretest 4, Experiment 2, and 3

*****In pretest 4, only practice primes, bolded pseudohomophones and bolded real words were used in lexical decisions (since in practice sessions word trials are also needed); in experiment 2, only practice primes, legal nonwords, and bolded real words were used (for similar reasons); in experiment 3, only sentential stimuli, legal nonwords, and bolded real words were used (for similar reasons) were used. Type refers to type of practice items, e.g., MN means this prime word is a metaphorical noun taken from Chinese Wordnet (See Chapter Three for details), and LR means the sentence is roughly biased to its literal meaning, and the pseudohomophone target is (phonologically) related to the prime. Likewise, UAN means the prime is an unambiguous (monosemous) word taken from Chinese Wordnet; R means the pseudohomophone target is (phonologically) related to the prime. Legal=Legal Nonwords, Pseudo.=Pseudohomophones, Base=Base words of pseudohomophones.

Practice Primes	Type	Sentential Stimuli	Target		
			Legal	Pseudo.	Base
烏龜	MN_LR	茶几上的小水盆裡養著一隻烏龜，時常試著爬出水盆，卻很少成功。	舍刃	**琶崇**	爬蟲
天空	MN_LR	昂首仰望蔚藍的天空，一片雲也沒有的晴朗，他的街道上撒滿陽光。	郁克	**耘躲**	雲朵
功課	MN_LU	現在的孩子需要作的功課越來越多樣化，例如：參加某種社會活動。	夏室	**摑旻**	國民
朝廷	MN_LU	朝廷是舊時皇帝每天辦公的地方，清晨文武百官就要準備上朝議事。	薪閨	**濃岷**	農民
外界	MN_MR	同行間謠傳公司破產，但老闆受屬下矇騙，對外界的傳言混然不知。	初潭	**箋尖**	空間
網路	MN_MR	在網路上漫遊，例如瀏覽各式拍賣網站，經常可以讓人發現新事物。	-	蘋髖	**頻寬**
位置	MN_MU	經過多年奮鬥，他在公司裡得到了一個穩固的位置，受到多人尊敬。	-	供素	**公訴**
工具	MN_MU	天性純樸的朋友不願淪爲被人利用的工具，寧可辭職再找一分工作。	-	鰥元	**官員**
教師	UAN_R	一般人會期待小學教師在道德、學問、待人上都作學齡兒童的榜樣。	-	髽聲	**學生**
專家	UAN_R	郭教授是澎湖地質的專家，對當地海島之所以形成的原因十分了解。	-	髽赭	**學者**
吃掉	MV_LR	辛苦下廚的媽媽總是希望孩子把桌上的食物都吃掉，不要留下剩菜。	道旺	**舀段**	咬斷
溜走	MV_LR	生性害羞孤僻的他看到宴會上人來人往就想要溜走，卻被主人挽留。	句洞	**桃篡**	逃竄
送來	MV_LU	每天早上五點前後總有一位先生騎機車送來當天的報紙，供人閱讀。	驟手	**瞰尙**	看上
出去	MV_LU	蒙昧之中他彷彿聽見有人呼喚，於是他起身出去到庭院裡追尋來源。	至露	**德最**	得罪
採用	MV_MR	慈善團體發現在路邊募款效果不佳，決定變換方式，採用網路宣傳。	瞰被	**史佣**	使用
打破	MV_MR	這場學術會議打破傳統的型態，決定採用播放多媒體的方式作結束。	-	閱屆	**越界**
化爲	MV_MU	傳說中爲愛情殉難的情侶終不得廝守，只化爲一抹雲彩，漂泊天際。	-	抄齣	**超出**
跌落	MV_MU	聽見戀慕的對象將要搬往別地，他的心情跌落谷底，久久不能平復。	-	圭公	**歸功**
摔倒	UAV_R	路面雖然在施工卻沒有設立警告標示，造成行人摔倒，需儘速修理。	-	扮疊	**絆跌**
供認	UAV_R	二次大戰時，許多被俘的軍官禁不起納粹的拷問，將機密供認出來。	-	工任	**供出**

APPENDIX IV.C Remaining Fillers

*****One filler (with '*') was used in instructions in pretest 4, experiment 2, and 3. In order to illustrate the experimental procedure, both a word (the word in the parentheses) and a nonword trial were paired to it in the instruction. In pretest 4, only the instruction prime, the pseudohomophone, and the real word in parentheses were used; in experiment 2, only the instruction prime, the legal nonword, and the real word in parentheses were used; in experiment 3, only the instruction sentential stimuli, the legal nonword, and the real word in parentheses were used.

Filler Primes	Type	Sentential Stimuli	Target		
			Legal	Pseudo.	Base
階段	UAN_R	他的實驗現在正在最後收尾的階段，下一步則要準備開始分析資料。	-	斷洛	段落
鍋子	UAN_R	媽媽把生水餃放到燒著滾水的鍋子裡面，準備煮好後讓我們帶便當。	-	挽磐	碗盤
商業	UAN_U	不肖廠商在製造過程中偷工減料、利益掛帥的商業行爲爲人所不齒。	-	佬施	老師
*會議	UAN_U	他每次出國參加會議一定事先對當地的旅遊路線作一番清楚的調查。	酵乖	酵毅	效益 (藥物)
能力	UAN_U	公司的新進員工辦事很有能力，在很短的時間內就處理完許多資料。	-	拘岷	居民
名聲	UAN_U	剛上任的市長爲了顧及清廉的名聲，避免參加任何奢華浪費的晚宴。	-	寮嘯	療效
遺忘	UAV_R	有人說能夠遺忘別人的過犯是一種幸福，人生會因此過得更爲喜樂。	-	計德	記得
榮獲	UAV_R	剛學成歸國的年輕教授工作認真，榮獲國科會的傑出年輕學者獎項。	-	斑伐	頒發
致使	UAV_U	由於在餐廳工作的廚師忘記關瓦斯，致使大樓失火，財物付之一炬。	-	苞擴	包括
應邀	UAV_U	發明最新抗癌療法的醫生日前應邀在國際學術會議上發表研究成果。	-	球蟯	求饒
不惜	UAV_U	愛子心切的父母不惜花下大筆錢財幫孩子請美語家教訓練英語能力。	-	售憲	受限
誘使	UAV_U	室友在垃圾桶附近撒下剛買來的蟑螂特效藥，以誘使蟑螂接近吞食。	-	報翰	抱憾

APPENDIX V. Memory Test Items

APPENDIX V.A Memory Test Items Used in Pretest 4 & Experiment 2

*Response refers to whether the prime constitutes a positive trial or negative trial. Block ID refers to the block which the prime is grouped into in the experiment.

Block ID	Memory Primes	Type	Response	Block ID	Memory Primes	Type	Response
Practice	中間	Noun	N	Practice	以爲	Verb	N
Practice	少爺	Noun	N	Practice	叫作	Verb	N
Practice	巨星	Noun	N	Practice	出面	Verb	N
Practice	皮包	Noun	N	Practice	加壓	Verb	N
Practice	烏龜	Noun	Y	Practice	吃掉	Verb	Y
Practice	功課	Noun	Y	Practice	送來	Verb	Y
Practice	外界	Noun	Y	Practice	採用	Verb	Y
Practice	位置	Noun	Y	Practice	化爲	Verb	Y
1	伴侶	Noun	N	5	回家	Verb	N
1	呼聲	Noun	N	5	自認	Verb	N
1	姐妹	Noun	N	5	呈獻	Verb	N
1	版面	Noun	N	5	表明	Verb	N
1	空調	Noun	N	5	相愛	Verb	N
1	廢物	Noun	Y	5	說出	Verb	Y
1	良知	Noun	Y	5	著想	Verb	Y
1	種子	Noun	Y	5	征服	Verb	Y
1	中心	Noun	Y	5	跳出	Verb	Y
1	政府	Noun	Y	5	舉例	Verb	Y
2	前方	Noun	N	6	容許	Verb	N
2	胡琴	Noun	N	6	寄來	Verb	N
2	球迷	Noun	N	6	帶有	Verb	N
2	部分	Noun	N	6	淹沒	Verb	N
2	筆觸	Noun	N	6	連接	Verb	N
2	金額	Noun	Y	6	仿照	Verb	Y
2	本錢	Noun	Y	6	喚起	Verb	Y
2	長城	Noun	Y	6	變質	Verb	Y
2	財產	Noun	Y	6	看齊	Verb	Y
2	行爲	Noun	Y	6	擅長	Verb	Y
3	極限	Noun	N	7	揮手	Verb	N
3	電廠	Noun	N	7	傳教	Verb	N

3	對岸	Noun	N	7	意即	Verb	N
3	實況	Noun	N	7	感到	Verb	N
3	監獄	Noun	N	7	想要	Verb	N
3	跑道	Noun	Y	7	散去	Verb	Y
3	草案	Noun	Y	7	委由	Verb	Y
3	戰爭	Noun	Y	7	認領	Verb	Y
3	工程	Noun	Y	7	認帳	Verb	Y
3	作品	Noun	Y	7	吸毒	Verb	Y
4	課堂	Noun	N	8	遇見	Verb	N
4	營地	Noun	N	8	輕視	Verb	N
4	總部	Noun	N	8	歷經	Verb	N
4	螺絲	Noun	N	8	講究	Verb	N
4	罐頭	Noun	N	8	變爲	Verb	N
4	草坪	Noun	Y	8	選派	Verb	Y
4	壓力	Noun	Y	8	湧起	Verb	Y
4	殿堂	Noun	Y	8	屬於	Verb	Y
4	障礙	Noun	Y	8	止痛	Verb	Y
4	獎狀	Noun	Y	8	提前	Verb	Y

APPENDIX V.B Memory Test Items Used in Experiment 3

****** Type refers to type of memory test items, e.g., Filler means this item was taken from filler items in its previous lexical decision block; MN means this prime word is a metaphorical noun taken from Chinese Wordnet (See Chapter Three for details), and LR means the sentence is roughly biased to its literal meaning, and the pseudohomophone target is (phonologically) related to the prime. Likewise, UAN means the prime is an unambiguous (monosemous) word taken from Chinese Wordnet; R means the pseudohomophone target is (phonologically) related to the prime. Types not initiating with "Fillers" means this item is taken from an experimental item in its previous lexical decision block. For 'no' responses, the sentential stimuli were slightly adjusted to make them only similar to the original items. For block IDs followed by '(C1)' and '(C2)', that means the items are in different counterbalanced lists and thus do not appear in the same list.

Block ID	Memory Primes	Type	Response
Practice	茶几上的小水盆裡養著一隻烏龜，時常試著爬出水盆，卻很少成功。	Filler_MN_LR	Y
Practice	同行間謠傳公司破產，但老闆受屬下矇騙，對外界的傳言混然不知。	Filler_MN_MR	Y
Practice	每天早上五點前後總有一位先生騎機車送來當天的報紙，供人閱讀。	Filler_MV_LU	Y
Practice	傳說中爲愛情殉難的情侶終不得廝守，只化爲一抹雲彩，漂泊天際。	Filler_MV_MU	Y
Practice	一般人會期待小學教師在道德、學問、待人上都作學齡兒童的榜樣。	Filler_UAN_R	Y
Practice	現在的孩子打工的方式越來越多樣化，例如：晚間到麥當勞炸薯條。	Filler_MN_LU	N
Practice	經過多年奮鬥，他在政界獲得了極高的評價和聲望，受到多人尊敬。	Filler_MN_MU	N
Practice	辛苦下廚的媽媽總是希望孩子不要在外亂買零食，以免吃不下正餐。	Filler_MV_LR	N
Practice	慈善團體發現在超商募款效果不佳，決定變換方式，採用電視廣告。	Filler_MV_MR	N
Practice	路面雖然在施工卻沒有派人在旁監督，造成行人摔倒，需儘速改善。	Filler_UAV_R	N
1	桌上擺的武士玩偶具有日本的色彩，從衣著到配戴的飾品都很講究。	Filler_MN_MU	Y
1	二次世界大戰時曾有野心家夢想過要征服全亞洲，但至終沒有成功。	Filler_MV_LU	Y
1	政府機關首長最需要的是保持清廉的作風，愛護民眾，不結黨營私。	Filler_UAN_U	Y
1	勤儉持家的母親一向遵循傳統的教訓，認爲要黎明即起、灑掃庭除。	Filler_UAV_R	Y
1	前幾天去高雄，朋友招待我去旗津吃海鮮，然後去西子灣觀賞夕陽。	Unrelated	Y
1	這孩子來自一個奢侈的家庭，而他行爲和觀念的偏差，也與此相關。	Filler_MN_LR	N
1	正當他在打字時螢幕角落忽然跳出一行字，說明電腦中了木馬病毒。	Filler_MV_MR	N
1	環保人士批評立委今年初制定的垃圾回收政策太過浮濫，沒有重點。	Filler_UAN_R	N
1	教官考慮純粹講領導統御理論也許對學生太過抽象，需要舉例說明。	Filler_UAV_U	N

1(C1)	他外表看來像歷經世事的人，但其實經驗還不足夠，考慮不夠週詳。	HLV_M	N
1(C2)	母親獨自一人坐在客廳等待深夜未歸的孩子回家，心裡感到很擔心。	HLV_L	N
2	來到中國的遊客感嘆多少不爲人知的故事，與故人同埋於長城之下。	Filler_MN_LR	Y
2	雖然實驗遭遇困難，但室友說他感謝有位天賜的朋友陪他渡過難關。	Filler_MV_MR	Y
2	對在此興建焚化爐持反對意見的人士今天到立法院前拉白布條抗議。	Filler_UAN_R	Y
2	他往如鏡的湖面上端詳，水面上顯現出天際浮雲和湖畔柳樹的倒影。	Filler_UAV_U	Y
2(C1)	昨晚牯嶺街發生少年圍毆事件，受害人腿骨被棍棒打斷，送醫急救。	HMV_L	Y
2(C2)	前天在廣場上舉辦的音樂會被一場突來的雷雨打斷，民眾敗興而歸。	HMV_M	Y
2	爲了維護智慧財產權，請勿剽竊他人著作中的想法，保障作者權益。	Filler_MN_MU	N
2*	馬車從村莊出發後不久，進入一片蒼茫遼闊的原野，四周杳無人跡。	Filler_MV_LU	N
2	刑事案件的受害人指控法官收受賄賂，中飽私囊，因此判決不公正。	Filler_UAN_U	N
2	妹妹由於孝順不敢違背母親，因此幾經考慮決定聽命嫁到軍人世家。	Filler_UAV_R	N
2(C1)	球隊這次能夠奪得季軍是因爲球員合作得天衣無縫，發揮全部實力。	HMN_M	N
2(C2)	我軍這次所以失敗，主要是因爲將領策略擬定不佳，無法料敵機先。	HMN_L	N
3	不清楚一個人的背景經常會導致誤會，多些關心則會促進彼此體諒。	Filler_MN_MU	Y
3	百貨公司裡常會聽見櫃台小姐廣播，請客人到櫃台認領遺失的皮包。	Filler_MV_LU	Y
3	買電子產品時需要注意保固條件和廠商的信用，以免日後後悔不及。	Filler_UAN_U	Y
3	音樂課時老師請一位擅長吹笛子的同學上台吹奏，爲同學先做示範。	Filler_UAV_R	Y
3	警察呼籲民眾遭遇飛車搶案時應該牢記搶匪的特徵，方便日後追查。	Unrelated	Y
3	歐洲有許多城市的廣場交通四通八達，也常是人群集會的重要場所。	Filler_MN_LR	N
3	隨意安裝程式造成公用電腦當機的同學並不認帳，推說是他人所爲。	Filler_MV_MR	N
3	校長稱許學生奮不顧身搶救受困火場嬰孩的行爲，對此感到很欣慰。	Filler_UAN_R	N
3	出國旅行時要留意機票、簽證等文件是否都已攜帶，沒有遺漏在家。	Filler_UAV_U	N
3	他對手機要求很高，如果使用得不順手會考慮改用其他廠牌的產品。	Unrelated	N
4	故宮建築的外觀有如古代君王的殿堂，華麗之餘，也饒富中國風情。	Filler_MN_LR	Y
4	學長的勸勉像一劑定心丸，使原本挫敗的他又重新點燃了一絲希望。	Filler_MV_MR	Y
4	經濟學家預估最近幾年景氣不會好轉，股票的價格也將會持續偏低。	Filler_UAN_R	Y
4	政府制定的農業政策方向正確，因此間接促成經濟、社會快速進展。	Filler_UAV_U	Y
4	軟體業者最近舉辦一場研討會，公司決定選派有相關背景的人參加。	Unrelated	Y
4	畫家在創作的過程中需要花費許多精力，才能完成令人讚賞的作品。	Filler_MN_MU	N
4	家中陳舊的鋼琴經過調音師調音，彈奏起來十分悅耳，像新的一樣。	Filler_MV_LU	N
4	父親慷慨正直、穩重負責，所以在公司裡許多同事都對他十分欽佩。	Filler_UAN_U	N
4	強烈地震嚴重損壞他的宿舍，迫使他必須暫時到親戚那裡另覓住處。	Filler_UAV_R	N
4(C1)	經過多年的奮鬥，他終於獲得老闆的青睞，在公司中漸漸負有重責。	HMN_M	N
4(C2)	聽說沒有人數得清楚這座山上究竟有多少涼亭，聽來讓人頗覺好奇。	HMN_L	N
5	他雖然沉默寡言，但常能一眼看出問題的中心，並找到解決的方法。	Filler_MN_MR	Y

5	大批的記者在行政院外守候，準備行政院長一露面就衝上前去採訪。	Filler_MV_LR	Y
5	畫家爲了創造出令人感動的作品，不辭風雨在海濱作畫達數天之久。	Filler_UAN_U	Y
5	當今社會上廣泛存在的家庭暴力問題值得我們深思並仔細推想原因。	Filler_UAV_R	Y
5	婆婆對小兒子剛娶入門的媳婦懷有很深的成見，因此對她處處刁難。	Unrelated	Y
5	死而復活的例證，就如一粒麥子之種到地裡，至終繁殖出許多子粒。	Filler_MN_LU	N
5	他希冀能買下一座小島度假，長輩認爲這不啻是在作夢，不切實際。	Filler_MV_MU	N
5	新聞記者不斷追問搶案的細節，讓接受訪問的警官感到重大的壓力。	Filler_UAN_R	N
5	輔導問題兒童多年的老師在電視上宣導希望父母不吝花時間陪孩子。	Filler_UAV_U	N
5	國防部長在演說中勉勵將士一起爲國家安全努力，以確保人民福祉。	Unrelated	N
6	南亞地震的結果，造成數以萬計的人流離失所，也喪失摯愛的親人。	Filler_MN_LU	Y
6	看完同儕的演出後，他心中暗自定意向他們看齊，盼望有日能發表。	Filler_MV_MU	Y
6	競選期間各黨派的候選人無不利用各種機會發表政見，以得人支持。	Filler_UAN_R	Y
6	父親常年在外跑船，歷盡風霜，留下母親和子女們在家裡相依爲命。	Filler_UAV_U	Y
6	爲了妥善利用空間，爸爸將電腦桌和床鋪的位置對調，使動線流暢。	Unrelated	Y
6	這所安親班在傳單中宣傳它採取全美語教學以培養學童的英語能力。	Filler_MN_MR	N
6	診所開的藥膏放置過久未使用可能會變質，塗抹前需確認尚未過期。	Filler_MV_LR	N
6	經過多年軍校的訓練，他終於如願以償的當上軍官，開始帶兵演練。	Filler_UAN_U	N
6	政府不該聽任瀆職的官員繼續胡作非爲，必須設法制止，提升效率。	Filler_UAV_R	N
6(C1)	打工會佔用許多休息時間，他認爲這樣會賠上自己的健康，要謹慎。	HLN_M	N
6(C2)	和客運相比，高鐵雖然會增加交通成本，但也較爲省時，值得考慮。	HLN_L	N
7	進行學術研究就像執行一項浩大的工程，需要花費許多的精神體力。	Filler_MN_MR	Y
7	明天就是女兒出嫁的日子，他回想孩子成長的過程，感到十分欣喜。	Filler_MV_LR	Y
7	物質的身體需要食物才得飽足，而人心裡的虛空也同樣的需要滿足。	Filler_UAN_U	Y
7	醫生自從愛妻因癌症不幸喪生後，便致力研發可對抗這種病的藥劑。	Filler_UAV_R	Y
7	三級古蹟的整修工程現在進入最後收尾的階段，預計不久後可完工。	Unrelated	Y
7	根據聖經的預言，以色列復國是末後的時期將來到一個重要的徵兆。	Filler_MN_LU	N
7	此地的習俗是每逢月朔時，所有的人都留在家裡足不出戶以策安全。	Filler_MV_MU	N
7	外文系畢業後，她進入一所大學擔任研究助理，一面準備出國深造。	Filler_UAN_R	N
7	性情乖巧的妹妹從不違背父母的意思，即使心裡爲難她也照樣聽從。	Filler_UAV_U	N
7(C1)	輔導室的老師默默的坐在失戀的同學身旁，要聽他說出心裡的悲傷。	HLV_L	N
7(C2)	宇宙萬物奧妙和諧的運行使許多科學家不禁相信宇宙中有位造物主。	HLV_M	N
8	心臟病患應該聽從醫生建議，不要搭乘雲霄飛車等刺激性遊樂器材。	Filler_MN_LU	Y
8	這對夫妻經過意外喪女的創傷，決定移居國外療傷止痛，不再回國。	Filler_MV_MU	Y
8	弟弟從小成績優異，月考完後經常拿到獎狀，令家人感到十分欣慰。	Filler_UAN_R	Y
8	有人建議都市規劃局將夜市區域規劃爲行人徒步區，俾利民眾通行。	Filler_UAV_U	Y
8	苦難是化妝的祝福，因此每當遇到困難時不妨把它看成學習的機會。	HMV_M	Y

8	人權團體在各地致力種種運動，希望廢除奴隸制度，確保基本人權。	Filler_MN_MR	N
8	從小他的夢想就是擁有一棟圖書館一般的房屋，可以致力閱讀寫作。	Filler_MV_LR	N
8	環保人士高聲疾呼國人注意山坡地水土保持，好留給後人安居之所。	Filler_UAN_U	N
8	校務會議決定將期末考試延後一週，以因應國定假日所造成的影響。	Filler_UAV_R	N
8(C1)	檢察官經過長期努力，才漸漸了解受害人的家庭，希望能幫助他們。	HLN_M	N
8(C2)*	黑暗之中他只能試圖摸黑尋找通往房門的出路，但不清楚方向爲何。		

***** These two are modified versions. After the first six participants finished experiment 3, these items were modified to correct some errors or to make the item clearer. Hence these items' data points were removed from the first six participants' data. For our experimental purpose the influence seems minute.

APPENDIX VI. Sentence Completion Task Data

APPENDIX VI.A Highly Literal Nouns

1.

廢物	
Literally-biased Context	*Metaphorically-biased Context*
化學肥料工廠依規定須妥善處理加工過程中產生的	從小祖母就諄諄告誡他：不要做個混吃等死的

Subject ID		*Subject ID*	
S1	副產品所造成的汙染	*S23*	窮光蛋
S2	廢棄物	*S24*	廢物
S3	化學廢棄物	*S25*	廢渣
S4	廢物	*S26*	廢人
S5	廢棄物	*S27*	米蟲
S6	廢料	*S28*	米蟲
S7	廢水及污水	*S29*	肥豬
S8	廢料	*S30*	米蟲
S9	廢棄物	*S31*	小混混
S10	廢棄物	*S32*	無賴
S11	化學毒素	*S33*	廢物
S12	廢棄物。	*S34*	人
S13	廢料	*S35*	青年
S14	有毒廢物	*S36*	蠹蟲。
S15	有毒廢棄物。	*S37*	無業遊民
S16	有毒廢棄物	*S38*	無用之人
S17	廢物。	*S39*	無賴
S18	廢物		
S19	污染廢水		
S20	各式廢棄或有害物質		
S21	疏失		
S22	污染物質。		

2.

櫥窗	
Literally-biased Context	*Metaphorically-biased Context*
時裝店老闆經常會將最流行的衣飾展示在店門邊的	經濟部官員表示，股市是展示一個國家經濟情形的

Subject ID		*Subject ID*	
S1	櫥窗櫃內	*S23*	重要指標
S2	櫥窗	*S24*	重要指標
S3	模特兒身上	*S25*	指標
S4	櫥窗	*S26*	指標
S5	櫥窗上	*S27*	最佳數據
S6	櫥窗	*S28*	縮圖
S7	櫥窗裡	*S29*	指標
S8	櫥窗	*S30*	正相關指標
S9	櫥窗	*S31*	轉盤
S10	櫥窗	*S32*	縮影
S11	櫥窗來招攬客人	*S33*	縮影
S12	以吸引顧客的目光。	*S34*	重要指標
S13	櫥窗	*S35*	重要指標
S14	櫥窗	*S36*	衰華。
S15	人形模特兒身上。	*S37*	最佳角度
S16	櫥窗中	*S38*	指標
S17	模特兒身上。	*S39*	重要指標
S18	模特兒身上		
S19	模特兒上		
S20	最顯眼的櫥窗內		
S21	櫥窗		
S22	櫥窗內。		

3.

孤兒	
Literally-biased Context	*Metaphorically-biased Context*
高中時他的雙親因車禍不幸喪生，從此他成了	因為長期缺乏邦交國，許多人認為台灣是國際間的

Subject ID		*Subject ID*	
S1	舉目無親的孤兒	*S23*	孤兒
S2	孤兒	*S24*	獨行俠
S3	無父無母的小孩	*S25*	孤兒
S4	孤兒	*S26*	孤兒
S5	孤兒	*S27*	孤兒
S6	孤兒	*S28*	孤立國
S7	孤兒	*S29*	孤兒
S8	孤兒	*S30*	孤島
S9	孤兒	*S31*	孤兒
S10	孤兒	*S32*	孤兒。
S11	孤兒	*S33*	衝突隱雷
S12	毫無依靠的孤兒。	*S34*	自閉兒
S13	孤苦無依的小孩	*S35*	孤島
S14	孤兒	*S36*	孤島。
S15	自立自強的半工半讀生。	*S37*	被孤立者
S16	無依無靠的孤兒	*S38*	孤兒
S17	孤兒。	*S39*	孤兒
S18	孤兒		
S19	皮球		
S20	孤單而自閉的孩子		
S21	孤兒		
S22	孤兒。		

4.

成本	
Literally-biased Context	*Metaphorically-biased Context*
和空運相比，船運的速度雖慢卻能大幅減少營運的	打工會佔用許多讀書時間，他考慮這樣做所需的

Subject ID		*Subject ID*	
S1	支出	*S23*	成本
S2	風險	*S24*	付出值不值得
S3	成本	*S25*	成本
S4	成本	*S26*	機會成本
S5	費用	*S27*	機會成本
S6	成本	*S28*	機會成本
S7	負擔	*S29*	機會成本
S8	成本	*S30*	機會成本於是放棄打工專心課業
S9	成本	*S31*	機會成本為何
S10	成本	*S32*	機會成本
S11	成本	*S33*	生理成本與心理負擔
S12	成本。	*S34*	時間成本
S13	成本耗損	*S35*	成本
S14	成本費用	*S36*	取捨。
S15	成本。	*S37*	成本代價
S16	成本	*S38*	犧牲
S17	成本。	*S39*	代價
S18	負擔		
S19	成本		
S20	花費		
S21	價格		
S22	成本。		

5.

跑道	
Literally-biased Context	*Metaphorically-biased Context*
學校最近得到經費，在體育場上鋪設了一條新的	在政府工作三十年的父親幾經考慮，決定改換

Subject ID		*Subject ID*	
S23	PU 跑道	*S1*	換面
S24	pu 跑道	*S2*	跑道
S25	跑道	*S3*	跑道，另覓他職
S26	跑道	*S4*	跑道
S27	PU 跑道	*S5*	跑道，開展事業的第二春
S28	腳踏車道	*S6*	職場
S29	pu 跑道	*S7*	跑道找尋他業
S30	PU 跑道	*S8*	跑道
S31	運動跑道	*S9*	工作跑道
S32	跑道	*S10*	跑道。
S33	pu 跑道	*S11*	工作, 自營餐飲小店
S34	走道	*S12*	跑道，開始賣起雞排。
S35	ＰＵ跑道	*S13*	工作自立門戶
S36	跑道。	*S14*	工作跑道
S37	跑道	*S15*	跑道，投入慈善事業。
S38	跑道	*S16*	跑道
S39	塑膠跑道	*S17*	工作跑道。
		S18	職業
		S19	跑道
		S20	工作跑道
		S21	跑道
		S22	到民營企業去上班。

6.

主角	
Literally-biased Context	*Metaphorically-biased Context*
韓劇「七年之夢」的導演看中資歷最淺的他擔任	三月間盛開的櫻花，是每年阿里山花季的

Subject ID		*Subject ID*	
S23	男主角	*S1*	重頭戲
S24	男主角	*S2*	賣點
S25	主角	*S3*	一大特色
S26	新戲的男主角，希望可以增加觀眾的新鮮感	*S4*	噱頭
S27	男主角	*S5*	一大主角
S28	男主角	*S6*	主角
S29	男主角	*S7*	重頭戲
S30	戲份吃重的第二男主角	*S8*	主角
S31	要角	*S9*	顏色
S32	要角	*S10*	主角
S33	此劇的靈魂要角	*S11*	賞花經典
S34	男主角	*S12*	主角。
S35	主角	*S13*	觀賞重點
S36	男主角。	*S14*	一大賣點
S37	本劇的男主角	*S15*	主角。
S38	主角	*S16*	主角
S39	男主角	*S17*	主角。
		S18	高潮
		S19	活招牌
		S20	重頭戲之一
		S21	焦點
		S22	重頭戲。

7.

生態	
Literally-biased Context	*Metaphorically-biased Context*
雪霸國家公園完整保存了三千公尺以上的高山	立委呼籲大家遵守誠信原則，以改善台灣政治的

Subject ID		*Subject ID*	
S23	作為研究之用	*S1*	困境
S24	供人們欣賞	*S2*	可信度
S25	環境	*S3*	環境
S26	讓世世代代的人都可以欣賞他們的美	*S4*	亂象
S27	植物	*S5*	混亂現象
S28	原始風貌	*S6*	生態
S29	生態	*S7*	亂象
S30	植披與動物生態	*S8*	風氣
S31	冰河美景	*S9*	可笑
S32	同時也保護了生存其中的生物及整個生態圈	*S10*	不良風氣
S33	未受開發的原貌	*S11*	黑金形象
S34	林地	*S12*	惡劣風氣。
S35	美景	*S13*	貪污狀況
S36	物種。	*S14*	黑金來往問題
S37	稀有植物	*S15*	烏煙瘴氣。
S38	自然景觀	*S16*	責任歸屬問題
S39	自然資源	*S17*	亂象。
		S18	混亂
		S19	腐敗
		S20	紛亂現象
		S21	秩序
		S22	亂象。

8.

輪廓	
Literally-biased Context	*Metaphorically-biased Context*
黑暗之中他只能勉強辨認遠方走來的人臉孔的	檢察官經過長期的偵訊，才漸漸了解整個案情的

Subject ID		*Subject ID*	
S23	大小	*S1*	由來
S24	樣子	*S2*	脈絡
S25	輪廓	*S3*	來龍去脈
S26	樣子	*S4*	始末
S27	輪廓	*S5*	來龍去脈
S28	大略模樣	*S6*	來龍去脈
S29	輪廓	*S7*	來龍去脈
S30	模糊五官	*S8*	經過
S31	輪廓	*S9*	始末
S32	輪廓	*S10*	前因後果
S33	輪廓	*S11*	來龍去脈
S34	輪廓	*S12*	真相。
S35	粗略影像	*S13*	完整脈絡
S36	輪廓。	*S14*	膠著之處
S37	輪廓	*S15*	來龍去脈。
S38	輪廓	*S16*	始末
S39	模糊輪廓	*S17*	來龍去脈。
		S18	來龍去脈
		S19	經過
		S20	來龍去脈
		S21	脈絡
		S22	來龍去脈。

APPENDIX VI.B Highly Metaphorical Nouns

1.

角度	
Literally-biased Context	*Metaphorically-biased Context*
專家測量的結果證實,比薩斜塔傾斜的	人生在世挫折、痛苦經常在所難免；學習換一個

Subject ID		*Subject ID*	
S1	情況會越來越大	*S23*	想法
S2	幅度越來越大	*S24*	心情去面對
S3	角度越來越大	*S25*	環境
S4	角度	*S26*	角度看事情心情會更好些
S5	的角度日漸具增	*S27*	角度看事情
S6	角度有變	*S28*	角度看，會有不同感受
S7	角度極大	*S29*	角度看世界
S8	歷史悠久	*S30*	態度面對也許能雨過天晴
S9	角度為 xxxx	*S31*	角度與心情去面對
S10	角度很奇特	*S32*	角度、心情看待發生的事情
S11	角度越來越大	*S33*	心境看待人世的悲歡離合
S12	角度是...度。	*S34*	角度看事情
S13	的情況越來越嚴重	*S35*	角度來看，
S14	角度越來越大	*S36*	心境面對。
S15	角度其實很小。	*S37*	角度看世界
S16	角度為○度	*S38*	人生觀點
S17	角度較過去更大了。	*S39*	樂觀的心情面對生命中的不如意，也許就會看見另一番風景
S18	角度		
S19	方向		
S20	角度是有特殊意義的		
S21	角度?		
S22	程度越來越大。		

2.

觸角	
Literally-biased Context	*Metaphorically-biased Context*
弟弟蹲在廚房角落觀察地上的蟑螂兩根竄動的	公司為了進一步發展，決定往大陸市場伸出業務的

Subject ID		*Subject ID*	
S1	鬚角	*S23*	觸角
S2	鬍鬚	*S24*	觸角
S3	鬍鬚	*S25*	觸角
S4	觸角	*S26*	觸手
S5	觸鬚	*S27*	魔手
S6	觸角	*S28*	開發計畫
S7	觸鬚	*S29*	觸角
S8	觸鬚	*S30*	觸角
S9	觸角	*S31*	觸角
S10	觸鬚	*S32*	觸角。
S11	觸鬚	*S33*	觸角
S12	觸角。	*S34*	觸手
S13	觸角	*S35*	另一新端
S14	觸鬚	*S36*	支線。
S15	觸鬚。	*S37*	探測觸角
S16	鬍鬚	*S38*	另一遍天
S17	觸角。	*S39*	觸手
S18	觸鬚		
S19	觸鬚		
S20	觸鬚		
S21	觸角		
S22	觸鬚。		

3.

本錢	
Literally-biased Context	*Metaphorically-biased Context*
媽媽為了經營路邊攤位，只好變賣自己的首飾作為	要做籃球選手，需要足夠的身高和充沛的體力作

Subject ID		*Subject ID*	
S1	成本	*S23*	後盾
S2	商品	*S24*	為自己最厲害的武器
S3	創業資金	*S25*	基礎
S4	資本	*S26*	為一切的基礎
S5	週轉金來源	*S27*	基礎
S6	資金來源	*S28*	基本的門檻
S7	資金	*S29*	後盾
S8	資金	*S30*	基礎
S9	資金	*S31*	後盾
S10	資金	*S32*	為基礎
S11	資金來源	*S33*	全場攻防的準備
S12	創業資本。	*S34*	後盾
S13	資金	*S35*	後盾
S14	經營成本	*S36*	後盾。
S15	營運的資本。	*S37*	基礎
S16	開業基金	*S38*	後盾
S17	生意開張的資金。	*S39*	基礎
S18	本金		
S19	建國基金		
S20	創業基金		
S21	資金		
S22	經營的本錢。		

4.

戰術	
Literally-biased Context	*Metaphorically-biased Context*
我軍這次能夠獲勝，是因為將領發展出變化多端的	球隊這次能夠奪得冠軍是因為教練運用的

Subject ID		*Subject ID*	
S1	戰術	*S23*	迂迴戰術
S2	隊形	*S24*	戰術十分得當
S3	戰鬥策略	*S25*	戰術
S4	計謀	*S26*	戰術十分成功
S5	戰術	*S27*	戰略成功
S6	戰略	*S28*	策略得當
S7	進攻策略	*S29*	秘密戰術
S8	戰略	*S30*	戰術得當
S9	戰略	*S31*	策略得宜
S10	作戰隊形	*S32*	戰術成功
S11	戰略	*S33*	戰術得當
S12	戰術與戰略。	*S34*	戰術得宜
S13	隊形配上合適的計謀	*S35*	戰術得當
S14	戰術	*S36*	戰略成功得體。
S15	謀略。	*S37*	戰術得宜
S16	戰略	*S38*	計略戰術
S17	作戰策略。	*S39*	策略得當的緣故
S18	陣行		
S19	陣行		
S20	陣勢與謀略		
S21	戰略		
S22	作戰策略。		

5.

焦點	
Literally-biased Context	*Metaphorically-biased Context*
太陽光通過透鏡會聚集在另一側的	同學作弊被發現後支吾其詞，企圖轉移大家關切的

Subject ID		*Subject ID*	
S23	鏡面	*S1*	眼神
S24	焦點上	*S2*	注意力
S25	空白	*S3*	眼神
S26	白紙上	*S4*	目標
S27	焦點上	*S5*	焦點
S28	焦點上	*S6*	焦點
S29	焦點	*S7*	眼光
S30	焦點上	*S8*	焦點
S31	焦點	*S9*	焦點
S32	焦點上	*S10*	焦點。
S33	焦點	*S11*	焦點
S34	一點	*S12*	焦點。
S35	焦點	*S13*	焦點
S36	焦點。	*S14*	焦點
S37	焦點	*S15*	焦點。
S38	一點	*S16*	眼神
S39	焦點上	*S17*	眼神。
		S18	焦點
		S19	眼神
		S20	眼光
		S21	眼光
		S22	焦點。

6.

角色	
Literally-biased Context	*Metaphorically-biased Context*
初次進到演藝圈時，他在連續劇中扮演失業父親的	在台灣現代文學發展的過程中，他擔任承先啟後的

Subject ID		*Subject ID*	
S23	兒子	*S1*	重要人物
S24	兒子	*S2*	轉捩點
S25	腳色	*S3*	關鍵人物
S26	心酸及無奈	*S4*	角色
S27	角色	*S5*	重要角色
S28	無奈一生	*S6*	重要推手
S29	兒子	*S7*	重要角色
S30	唯一的兒子	*S8*	角色
S31	角色	*S9*	角色
S32	角色	*S10*	重要角色
S33	頹廢與挫折	*S11*	重要關鍵
S34	角色	*S12*	重要角色。
S35	角色	*S13*	重要角色
S36	角色。	*S14*	重要人物
S37	唯妙唯肖	*S15*	關鍵人物。
S38	兒子	*S16*	角色
S39	角色	*S17*	關鍵位置。
		S18	重要人物
		S19	人物
		S20	重要角色
		S21	角色
		S22	重要角色。

7.

壓力	
Literally-biased Context	*Metaphorically-biased Context*
氣象學課上教授正介紹大氣在地面高度造成的	繁重的課業和兼差的工作對他成為巨大的

Subject ID		*Subject ID*	
S23	壓力	*S1*	肩擔
S24	壓力有什麼不同	*S2*	負擔
S25	颶風	*S3*	負擔
S26	不同影響	*S4*	負擔
S27	影響	*S5*	壓力來源
S28	低氣壓	*S6*	壓力
S29	氣壓	*S7*	負擔
S30	溫度差異	*S8*	壓力
S31	壓力不同	*S9*	壓力
S32	壓力	*S10*	負荷
S33	不同程度的大氣壓力	*S11*	負擔
S34	壓力差	*S12*	心理壓力。
S35	影響	*S13*	負擔
S36	壓力差。	*S14*	壓力
S37	壓力	*S15*	壓力。
S38	大氣壓	*S16*	壓力
S39	溫度與壓力變化	*S17*	負荷。
		S18	壓力
		S19	重擔
		S20	壓力
		S21	負擔
		S22	壓力與負擔。

8.

階級	
Literally-biased Context	*Metaphorically-biased Context*
聽說沒有人數得清楚通往這座山頂的石梯有多少	經過多年的努力，他終於成為社會上中上層

Subject ID		*Subject ID*	
S23	階	*S1*	的菁英
S24	階	*S2*	份子
S25	階	*S3*	的一份子
S26	階	*S4*	階級
S27	階	*S5*	階級的一份子
S28	階	*S6*	階級
S29	階	*S7*	白領階級
S30	層台階	*S8*	白領階級
S31	級	*S9*	階級
S32	階	*S10*	中流砥柱
S33	一二三四五...	*S11*	階級中有頭有臉的人物
S34	階	*S12*	階級的人。
S35	層	*S13*	階級
S36	階。	*S14*	階級的人物
S37	階	*S15*	階級的翹楚。
S38	層級	*S16*	的管理階級
S39	階	*S17*	階級。
		S18	份子
		S19	的米蟲
		S20	階級的人物
		S21	階級人物
		S22	階級人士。

APPENDIX VI.C Highly Literal Verbs

1.

說出	
Literally-biased Context	*Metaphorically-biased Context*
輔導室的老師默默的坐在被記過的同學身旁，聽他	許多人相信宇宙萬物的存在和運行

Subject ID		*Subject ID*	
S1	說話	*S23*	遵循一定的法則
S2	懺悔	*S24*	是遵循一定的軌道
S3	娓娓道來緣由	*S25*	受冥冥的力量操控
S4	懺悔	*S26*	都有一定的規律
S5	訴說心中的委屈	*S27*	遵循一定的法則
S6	說話	*S28*	的定律
S7	為自己辯解	*S29*	有一定的法則
S8	哭訴	*S30*	是出自上帝之手
S9	抱怨	*S31*	相輔相成
S10	訴說一切事由	*S32*	的法則
S11	解釋原委	*S33*	有一軌跡可追尋
S12	哭訴犯錯的經過。	*S34*	有一定規則
S13	慢慢訴苦	*S35*	的方式
S14	的懺悔	*S36*	都有一定的道理。
S15	把自己犯錯的緣由娓娓道來。	*S37*	是依照一套完整的公式
S16	訴說心情	*S38*	的規律
S17	道出自己的故事。	*S39*	有其既定的道理和法則
S18	解釋		
S19	抱怨執法過當		
S20	傾訴心中的不平		
S21	辯解		
S22	懺悔他的過錯及傾訴他的感		

2.

毀容	
Literally-biased Context	*Metaphorically-biased Context*
無情的火災造成他全身高度灼傷，臉部將近	無限制開發山坡地的結果，使原本青翠的山崗

Subject ID		*Subject ID*	
S1	不成人形	*S23*	變得光禿禿了
S2	全毀	*S24*	變成一片死寂
S3	全毀	*S25*	消失
S4	潰爛	*S26*	消失了，剩的只有光禿禿的山坡
S5	全毀難以辨認	*S27*	不再青翠
S6	全毀	*S28*	已成為光禿禿的一片
S7	百分之九十嚴重燒燙傷	*S29*	全變了調
S8	全毀	*S30*	變得童山濯濯
S9	全毀	*S31*	不再美麗
S10	毀容	*S32*	變得光禿禿
S11	全毀	*S33*	成為濯濯童山
S12	80%都用繃帶包著。	*S34*	枯黃
S13	全毀	*S35*	失去原來的容貌
S14	毀容	*S36*	變成光禿一片。
S15	九成皮膚皆須換膚。	*S37*	光禿一片
S16	百分之 80 的燒燙痕跡	*S38*	變光禿禿的
S17	毀容。	*S39*	淪為禿黃一片
S18	全毀		
S19	無從辨識		
S20	毀容		
S21	全毀		
S22	百分之七十燒傷。		

3.

動工	
Literally-biased Context	*Metaphorically-biased Context*
校長計畫要在校園內蓋造新大樓，預估將會在最近	他努力想論文題目，希望題目確定後論文就能準備

Subject ID		*Subject ID*	
S1	開始籌劃	*S23*	開始
S2	動工	*S24*	的順利一些
S3	開始動工	*S25*	動工
S4	落成	*S26*	的很順暢
S5	動工	*S27*	開始動工
S6	完工	*S28*	著手開始
S7	公開藍圖	*S29*	開工了
S8	動工	*S30*	進到實驗階段
S9	動工	*S31*	進入備戰狀態
S10	動工	*S32*	開工。
S11	舉辦動土儀式	*S33*	全力以赴
S12	開始招商。	*S34*	就緒
S13	舉行說明	*S35*	開始著筆
S14	落成	*S36*	定案。
S15	開始動工。	*S37*	得盡善盡美
S16	招開會議	*S38*	著手
S17	完工。	*S39*	開始動筆
S18	動工		
S19	招標		
S20	動土開工		
S21	開工		
S22	正式公布建設案。		

4.

走路	
Literally-biased Context	*Metaphorically-biased Context*
孩子剛出生幾個月時還只會在地上爬，不會	經濟蕭條使得許多企業財務吃緊，老闆只得請員工

Subject ID		*Subject ID*	
S1	站著走	*S23*	走路回家
S2	走路	*S24*	回家吃自己
S3	走路	*S25*	走路
S4	行走	*S26*	共體時艱，一起度過這些日子
S5	站立走路	*S27*	回家吃自己
S6	走	*S28*	自動減薪
S7	行走	*S29*	走路
S8	站立行走	*S30*	回家吃自己
S9	走	*S31*	走路
S10	走路	*S32*	加倍努力工作，不然就得裁員了
S11	走	*S33*	共體時艱
S12	站起來走路。	*S34*	回家吃自己
S13	站著走路	*S35*	回家
S14	走路	*S36*	走路。
S15	站立行走。	*S37*	捲鋪蓋走路
S16	站起來	*S38*	走路
S17	走路。	*S39*	回家吃自己
S18	站立走路		
S19	站		
S20	坐，不會站，更不會行走		
S21	行走		
S22	用兩隻腳直立走路。		

5.

散去	
Literally-biased Context	*Metaphorically-biased Context*
婚宴上賓客們盡情吃喝閒聊，結束後大家各自	這些國家原本彼此結盟，後來意見不合，紛紛

Subject ID		*Subject ID*	
S23	解散	*S1*	離開
S24	續攤繼續喝	*S2*	出走
S25	道別離去	*S3*	退出
S26	散場回家	*S4*	絕裂
S27	離去	*S5*	退出聯盟
S28	散去	*S6*	解散結盟
S29	鳥獸散	*S7*	退出聯盟
S30	搭車回家	*S8*	拆夥
S31	三三兩兩結伴離去	*S9*	做鳥獸散
S32	離去	*S10*	分崩離析
S33	離開這紛鬧回歸平靜	*S11*	獨立不再合作
S34	返家	*S12*	互相攻擊。
S35	回家	*S13*	退出聯盟
S36	離席。	*S14*	解除盟約
S37	走向不同的方向	*S15*	宣告離開聯盟組織。
S38	散會	*S16*	退出了聯盟
S39	作鳥獸散	*S17*	解除合作關係。
		S18	退出
		S19	退出
		S20	反目為仇
		S21	決裂
		S22	解散，分道揚鑣。

6.

上臺	
Literally-biased Context	*Metaphorically-biased Context*
他從小個性內向，最怕公開表現或者被叫到要	總統大選結束以後，政權轉移，新的總統即將

Subject ID		*Subject ID*	
S23	發表意見	*S1*	步入總統府
S24	發表意見或感想	*S2*	上任
S25	發言	*S3*	上任
S26	發表自己的感想之類的	*S4*	上任
S27	上台說話	*S5*	於 5/20 日上任
S28	在眾人面前說話	*S6*	就任
S29	上台自我介紹	*S7*	上任
S30	自我介紹	*S8*	就職
S31	上台說話	*S9*	上任
S32	回答問題	*S10*	大刀闊斧改革
S33	回答問題	*S11*	走馬上任
S34	在台上表演	*S12*	上任。
S35	回答問題	*S13*	登位
S36	上台表演。	*S14*	上任
S37	上台演講	*S15*	上任。
S38	上台發表	*S16*	上任
S39	上台發表意見	*S17*	走馬上任。
		S18	上任
		S19	徹查貪污
		S20	走馬上任
		S21	上任
		S22	在明年一月正式就職。

7.

長大	
Literally-biased Context	*Metaphorically-biased Context*
母親細心的照顧餵養孩子，看著孩子一天天	他外表看來像很有資歷的人，但其實內心尚未

Subject ID		*Subject ID*	
S23	長大	*S1*	經過社會的洗禮
S24	成長茁壯	*S2*	成熟
S25	茁壯	*S3*	成熟
S26	的健康長大	*S4*	成熟
S27	成長	*S5*	受社會的黑暗所汙染
S28	的成長	*S6*	有把握
S29	長大	*S7*	成熟
S30	成長茁壯	*S8*	成熟
S31	長大成人	*S9*	蛻下稚幼的外衣
S32	茁壯成長	*S10*	發育成熟
S33	成長茁壯	*S11*	對事世有所領略
S34	茁壯	*S12*	成熟。
S35	長大	*S13*	成熟
S36	長大。	*S14*	成熟
S37	長大茁壯	*S15*	成熟。
S38	成長茁壯	*S16*	成熟
S39	成長茁壯	*S17*	調整好以適應多變的職場環
		S18	開化
		S19	成熟
		S20	成熟
		S21	成熟
		S22	成熟。

8.

吞下	
Literally-biased Context	*Metaphorically-biased Context*
從小我就不喜歡吃藥，每到服藥時總將藥丸一口	原本正要發言的他看見情況不對，將要說的話硬是

Subject ID		*Subject ID*	
S23	吐掉	*S1*	活生生的說了出來
S24	吞下然後喝一大杯水	*S2*	吞了下去
S25	吞下	*S3*	吞了回去
S26	吞下，這樣只需要忍耐一次	*S4*	忍住
S27	吞下	*S5*	吞進了肚裡
S28	吞下	*S6*	轉了風向
S29	吞下	*S7*	吞回肚裡去
S30	吞下	*S8*	吞回去
S31	吞下	*S9*	吞下肚去
S32	吞下，配上大量白開水	*S10*	活生生的吞下
S33	吞下	*S11*	吞了回去
S34	吞入	*S12*	吞回肚子裡。
S35	吐出	*S13*	吞回肚裡去
S36	吞下。	*S14*	收回
S37	吞下	*S15*	吞下了喉嚨。
S38	吞下去	*S16*	吞下
S39	氣吞下	*S17*	吞了回去。
		S18	吞了回去
		S19	吞回喉嚨
		S20	吞回肚子裡
		S21	嚥了回去
		S22	收了回去。

APPENDIX VI.D Highly Metaphorical Verbs

1.

站穩	
Literally-biased Context	*Metaphorically-biased Context*
搬家工人說，要搬重物時須把重心放低、雙腳	現今創業艱難，老闆認為要先讓公司在國內業界

Subject ID		*Subject ID*	
S1	要站穩馬步	*S23*	站穩腳步
S2	打開	*S24*	占有一席之地
S3	站穩	*S25*	站穩腳步
S4	微彎	*S26*	蓬勃發展然後才拓展海外
S5	與肩膀同寬	*S27*	取得一席之地
S6	站穩	*S28*	穩住陣角
S7	站穩	*S29*	闖出名號
S8	站穩	*S30*	至少先奠定根基
S9	踩定	*S31*	闖出一片天
S10	站穩	*S32*	奠定基礎
S11	平行	*S33*	打響知名度
S12	微彎，與肩同寬。	*S34*	打下基礎
S13	站穩	*S35*	立足穩定的地位
S14	微彎	*S36*	打開市場。
S15	著地。	*S37*	站穩腳步
S16	微蹲	*S38*	打下根基
S17	站穩。	*S39*	踏穩腳步
S18	踏穩		
S19	扎穩馬步		
S20	向外張開		
S21	微彎		
S22	打開約與肩同寬。		

2.

帶動	
Literally-biased Context	*Metaphorically-biased Context*
小學時校長會固定利用朝會時間請體育老師在臺上	政府積極發展此地的交通設施和觀光事業，盼能

Subject ID		*Subject ID*	
S1	做健康體操	*S23*	增進居民的福利
S2	帶操	*S24*	將此地改造成另一個台北市區
S3	帶大家做體操	*S25*	刺激經濟
S4	作體操	*S26*	使地方經濟有顯著成長
S5	帶大家做早操	*S27*	使經濟蓬勃
S6	宣布事項	*S28*	促使經濟繁榮
S7	帶動健康操	*S29*	帶動經濟發展
S8	帶早操	*S30*	吸引更多觀光客到此一遊
S9	廢話	*S31*	將此地發展為一觀光都市
S10	帶大家暖身	*S32*	為此地帶來工作機會
S11	帶領同學做早操	*S33*	刺激此地的經濟發展
S12	宣導運動的重要性。	*S34*	振興此地
S13	進行健康操教學	*S35*	吸引更多的移民
S14	教大家做早操	*S36*	減少人口外流的問題。
S15	帶著大家做早操。	*S37*	增加政府收入
S16	帶動健康操	*S38*	帶動經濟
S17	帶操。	*S39*	藉此帶動當地的經濟
S18	帶做健康操		
S19	帶健康操		
S20	帶早操		
S21	帶操		
S22	帶大家做早操。		

3.

喚起	
Literally-biased Context	*Metaphorically-biased Context*
每天早晨當我還在沉睡，媽媽總會輕聲將我	環保人士在電視上宣傳汙染的嚴重性，希望能

Subject ID		*Subject ID*	
S1	喚醒	*S23*	喚醒民眾環保的重要
S2	喚醒	*S24*	減緩人類放肆的汙染
S3	喚醒	*S25*	拯救地球
S4	喚醒	*S26*	讓更多人關心我們居住的環境
S5	喚起	*S27*	喚醒大眾的注意
S6	喚醒	*S28*	讓大家正視此議題
S7	喚醒	*S29*	喚起大眾的環保意識
S8	喚醒	*S30*	達到警告世人目的
S9	喚醒	*S31*	引起有志之士的共鳴
S10	喚醒	*S32*	喚醒國民的道德心
S11	喚醒	*S33*	啟迪民智
S12	喚起。	*S34*	喚起民眾的重視
S13	從睡夢中喚醒	*S35*	給大家正確的觀念
S14	喚醒	*S36*	告訴大眾環保的重要性。
S15	喚醒。	*S37*	喚醒大眾的環保意識
S16	搖醒	*S38*	喚起眾人的意識
S17	喚醒。	*S39*	喚起民眾的環保意識
S18	喚醒		
S19	喚醒		
S20	喚醒		
S21	喚醒		
S22	叫醒。		

4.

看成	
Literally-biased Context	*Metaphorically-biased Context*
這對兄弟長得很相像，人從遠方常常會把弟弟	苦難是化妝的祝福，因此每當遇到困難時不妨把它

Subject ID		*Subject ID*	
S1	誤認成哥哥	*S23*	視作一種正面的力量
S2	誤認成哥哥	*S24*	想成會有好事發生
S3	誤認成哥哥	*S25*	擦掉
S4	誤認	*S26*	當作是個祝福
S5	誤認為哥哥	*S27*	看成是上天送的化妝品
S6	看成哥哥	*S28*	當做是一種磨練
S7	錯認成哥哥	*S29*	卸妝
S8	誤認為是哥哥	*S30*	卸下就有可能看到祝福
S9	誤認	*S31*	昇華而美化
S10	誤認為哥哥	*S32*	轉化成一種美麗的事務
S11	錯認為哥哥	*S33*	當成一個刺激的歷險
S12	誤認成哥哥。	*S34*	當美好的禮物
S13	誤認成哥哥	*S35*	當作是對人生的期許祝福
S14	誤認為哥哥	*S36*	輕鬆面對。
S15	認作為哥哥。	*S37*	當作是好事
S16	當成哥哥	*S38*	轉為動力
S17	誤認為哥哥。	*S39*	視為成長的機會
S18	誤認為哥哥		
S19	當成哥哥		
S20	誤認為哥哥		
S21	錯認為哥哥		
S22	誤認成哥哥。		

5.

浸淫	
Literally-biased Context	*Metaphorically-biased Context*
他拿一塊海綿泡在實驗用的藥劑裡，讓藥水充分	音樂廳中演奏著優美的鋼琴名曲，走進其中讓人

Subject ID		*Subject ID*	
S23	被吸收	*S1*	心曠神怡
S24	被海綿吸收	*S2*	心情舒暢
S25	吸收	*S3*	身心舒暢
S26	地被海棉吸收	*S4*	如癡如醉
S27	被海棉吸收	*S5*	覺得身心舒暢
S28	吸收	*S6*	忘我
S29	被海綿吸收	*S7*	如走入‘貝多芬的世界裡
S30	浸到海綿裡	*S8*	身心愉悅
S31	被吸收	*S9*	心曠神怡
S32	被吸收	*S10*	飄飄然
S33	滲入海綿中	*S11*	陶醉忘我
S34	被海綿吸收	*S12*	心曠神怡。
S35	滲透進去	*S13*	沉醉不已
S36	浸潤。	*S14*	深深陶醉
S37	吸收	*S15*	心情愉悅。
S38	吸收	*S16*	忘卻煩惱
S39	被吸收	*S17*	陶醉不已。
		S18	高級了起來
		S19	自慚形穢
		S20	不禁陶醉
		S21	通體舒暢
		S22	陶醉不已，心情沉澱了下來。

6.

打斷	
Literally-biased Context	*Metaphorically-biased Context*
昨晚牯嶺街發生少年圍毆事件，受害人腿骨被棍棒	前天在廣場上舉辦的音樂會被一場突來的雷雨

Subject ID		*Subject ID*	
S23	打斷	*S1*	搞得七零八落
S24	打斷	*S2*	搞砸
S25	打斷	*S3*	給中途打斷
S26	打斷，痛的直流眼淚	*S4*	中斷
S27	擊碎	*S5*	中斷
S28	打斷	*S6*	破壞
S29	打斷	*S7*	硬生生的澆熄了
S30	打成嚴重開放性骨折	*S8*	打亂
S31	擊碎	*S9*	轟得亂七八糟
S32	打斷	*S10*	給打斷了
S33	硬生打斷	*S11*	打亂了晚會流程
S34	打碎	*S12*	打亂了。
S35	打斷	*S13*	打斷
S36	打斷。	*S14*	給中斷了
S37	重擊打斷	*S15*	給中斷了。
S38	打碎	*S16*	打斷了
S39	多處打斷	*S17*	打亂了節奏。
		S18	掃興
		S19	澆息了熱情
		S20	而打斷
		S21	打斷
		S22	打斷了。

7.

湧起	
Literally-biased Context	*Metaphorically-biased Context*
颱風來時海上颳起大風浪，一陣陣的波瀾從海面上	每當兒女有所成就時，一種滿足感總會從父母心裡

Subject ID		*Subject ID*	
S23	洶湧而來	*S1*	感到欣慰
S24	朝著村落襲擊	*S2*	浮現
S25	襲來	*S3*	油然而生
S26	迎來，讓小船在海上浮浮沉沉	*S4*	油然而生
S27	席捲而來	*S5*	浮現
S28	襲捲而來	*S6*	湧出
S29	撲來	*S7*	湧現
S30	席捲而來	*S8*	湧起
S31	呼嘯而來	*S9*	萌生
S32	打向岸邊	*S10*	油然而生
S33	奔襲而來	*S11*	湧然浮現
S34	躍起	*S12*	油然而生。
S35	席捲而過	*S13*	油然而生
S36	捲起。	*S14*	油然而生
S37	拍打上岸	*S15*	油然而生。
S38	撲上岸	*S16*	湧出
S39	翻騰而起	*S17*	油然而生。
		S18	油然而生
		S19	湧出
		S20	深處滿滿地湧上來
		S21	湧出
		S22	油然而生。

8.

面臨	
Literally-biased Context	*Metaphorically-biased Context*
輪船上的乘客走到護欄旁邊,讓自己	金融風暴以後公司營運越來越困難，危機重重，現在

Subject ID		*Subject ID*	
S23	吹吹海風	*S1*	已經所剩無幾了
S24	透透氣	*S2*	岌岌可危
S25	思緒清晰	*S3*	要更加小心經營
S26	享受海風吹拂在臉上的感覺	*S4*	窒礙難行
S27	舒適一些	*S5*	已經面臨倒閉
S28	的暈眩感消失	*S6*	是景氣寒冬期
S29	迎著海風	*S7*	面臨倒閉
S30	吹吹海風	*S8*	如履薄冰
S31	吸收點新鮮空氣	*S9*	正處於危急存亡之秋
S32	吹吹風、透透氣	*S10*	更是。
S33	再吸一口故鄉的氧氣	*S11*	公司職員都惶惶不安
S34	能吹吹海風	*S12*	許多公司都倒閉了。
S35	倚著護欄欣賞美景	*S13*	找工作越來越難了
S36	吹吹海風。	*S14*	正大幅裁員
S37	欣賞美麗的風景	*S15*	人心惶惶，不曉得能不能保的
S38	感受陽光的溫暖	*S16*	人人都擔心被裁員
S39	能因應風浪產生的顛簸	*S17*	又開始裁員。
		S18	幾近倒閉
		S19	已經越來越好了
		S20	急需大家同心協力度過難關
		S21	瀕臨倒閉
		S22	可能會有少數員工被迫裁員。

APPENDIX VII. Word Association Task Data (Experiment 1)

APPENDIX VII.A Highly Literal Nouns

	廢物		櫥窗
Subject ID		*Subject ID*	
	1 垃圾		*1* 商業
S1	*2* 廢人	*S1*	*2* 透明
	3 丟棄		*3* 浪漫
	1 垃圾		*1* 熊
S2	*2* 黃金	*S2*	*2* 色彩
	3 廚餘		*3* 玻璃
	1 利用		*1* 專櫃
S3	*2* 破壞	*S3*	*2* 衣服
	3 鬼王達		*3* 百貨
	1 臭		*1* 古董
S4	*2* 垃圾	*S4*	*2* 納尼亞傳奇
	3 汙水		*3* 爺爺的照片
	1 利用		*1* 花車
S5	*2* 朽木	*S5*	*2* 飾品
	3 資源回收		*3* 商店
	1 垃圾		*1* 商品
S6	*2* 資源回收	*S6*	*2* 典雅
	3 生氣		*3* 明亮
	1 垃圾		*1* 展示
S7	*2* 輕蔑	*S7*	*2* 節慶
	3 回收		*3* 希望
	1 垃圾		*1* 精品
S8	*2* 髒亂	*S8*	*2* 品味
	3 不舒服		*3* 身份
	1 利用		*1* 展示
S9	*2* 回收	*S9*	*2* 衣服
	3 想法		*3* 櫃子
	1 底層		*1* 觀賞
S10	*2* 痛苦	*S10*	*2* 密室
	3 希望		*3* 囚禁

孤兒			成本		
Subject ID			*Subject ID*		
	1	無依		*1*	機會
S1	*2*	孤單	*S1*	*2*	得失
	3	心靈殘弱		*3*	花費
	1	孤兒院		*1*	利潤
S2	*2*	孤雛淚	*S2*	*2*	物價
	3	小孩		*3*	錢
	1	院		*1*	經濟
S3	*2*	小甜甜	*S3*	*2*	機會
	3	卡通		*3*	會計
	1	眼睛		*1*	老闆娘
S4	*2*	淚	*S4*	*2*	算盤
	3	非洲		*3*	招財蟾蜍
	1	長腳叔叔		*1*	機會
S5	*2*	悲慘世界	*S5*	*2*	會計
	3	育幼院		*3*	售價
	1	堅強		*1*	價錢
S6	*2*	脆弱	*S6*	*2*	市場
	3	災難		*3*	商人
	1	伶仃		*1*	效益
S7	*2*	希望	*S7*	*2*	財務
	3	記憶		*3*	生意
	1	遺憾		*1*	控制
S8	*2*	獨立	*S8*	*2*	佔有
	3	脆弱		*3*	欲望
	1	移居		*1*	估計
S9	*2*	收容	*S9*	*2*	代價
	3	保母		*3*	效益
	1	冷漠		*1*	效益
S10	*2*	獨立	*S10*	*2*	利潤
	3	堅強		*3*	函數

跑道			主角		
Subject ID			*Subject ID*		
	1	操場		*1*	男
S1	*2*	跑步	*S1*	*2*	女
	3	運動		*3*	我
	1	運動會		*1*	演戲
S2	*2*	賽跑	*S2*	*2*	表演
	3	接力賽		*3*	自己
	1	pu		*1*	男生
S3	*2*	小學	*S3*	*2*	戲劇
	3	賽跑		*3*	電影
	1	選手		*1*	白癡
S4	*2*	法拉利	*S4*	*2*	漫畫
	3	美國亞利桑那州		*3*	男性
	1	比賽		*1*	聚光燈
S5	*2*	飛機	*S5*	*2*	排練
	3	裁判		*3*	完美演出
	1	比賽		*1*	搶眼
S6	*2*	賽車	*S6*	*2*	配角
	3	職場		*3*	俊美
	1	飛機		*1*	聚焦
S7	*2*	擅場	*S7*	*2*	冒險
	3	助跑		*3*	重要
	1	石灰		*1*	電影
S8	*2*	高溫	*S8*	*2*	門票
	3	便當		*3*	金錢
	1	範圍		*1*	死亡
S9	*2*	寬度	*S9*	*2*	出發
	3	長度		*3*	存檔
	1	賽車		*1*	舞台
S10	*2*	柏油	*S10*	*2*	聚光燈
	3	高溫		*3*	幕後人員

生態			輪廓		
Subject ID			*Subject ID*		
	1	環境		*1*	印象
S1	*2*	生物	*S1*	*2*	清晰或模糊
	3	能量		*3*	素描
	1	生物		*1*	臉
S2	*2*	水池	*S2*	*2*	長相
	3	青蛙		*3*	原住民
	1	保育		*1*	朦朧
S3	*2*	環保	*S3*	*2*	臉龐
	3	教育		*3*	倒影
	1	綠		*1*	少女
S4	*2*	山水	*S4*	*2*	圖畫
	3	青蛙		*3*	相框
	1	保育		*1*	素描
S5	*2*	回收	*S5*	*2*	黑白照
	3	節能減碳		*3*	人物畫
	1	鴨子		*1*	臉孔
S6	*2*	地球	*S6*	*2*	圖畫
	3	節能省碳		*3*	景物
	1	保育		*1*	顏面
S7	*2*	多樣	*S7*	*2*	情勢
	3	滅絕		*3*	設計
	1	保育		*1*	模糊
S8	*2*	動物	*S8*	*2*	唯美
	3	臭		*3*	回憶
	1	變遷		*1*	鮮明
S9	*2*	革命	*S9*	*2*	深刻
	3	化學		*3*	模糊
	1	環境		*1*	剪影
S10	*2*	森林	*S10*	*2*	平面
	3	河流		*3*	黑白

APPENDIX VII.B Highly Metaphorical Nouns

角度			觸角		
Subject ID			*Subject ID*		
	1	眼光		*1*	廣度
S1	*2*	不同	*S1*	*2*	延伸
	3	數學		*3*	昆蟲
	1	照相		*1*	蟲
S2	*2*	事情	*S2*	*2*	章魚
	3	測量		*3*	學習
	1	撞球		*1*	昆蟲
S3	*2*	圓規	*S3*	*2*	伸展
	3	反射		*3*	企業
	1	鏡頭		*1*	蝸牛
S4	*2*	數學	*S4*	*2*	蛞蝓
	3	天空		*3*	血
	1	三角形		*1*	獨角仙
S5	*2*	拍照	*S5*	*2*	領域
	3	量角器		*3*	遠景
	1	眼鏡		*1*	獨角仙
S6	*2*	觀點	*S6*	*2*	蝴蝶
	3	數學		*3*	心有靈犀
	1	數學		*1*	昆蟲
S7	*2*	分析	*S7*	*2*	偵測
	3	美學		*3*	機械
	1	弧線		*1*	昆蟲
S8	*2*	籃球	*S8*	*2*	蛋白質
	3	卡通		*3*	必須品
	1	觀點		*1*	廣闊
S9	*2*	重點	*S9*	*2*	天線
	3	知覺		*3*	發達
	1	立場		*1*	昆蟲
S10	*2*	堅持	*S10*	*2*	2 蟑螂
	3	偏見		*3*	3 遊走

本錢			戰術		
Subject ID			*Subject ID*		
	1	年輕		*1*	計謀
S1	*2*	資金	*S1*	*2*	防守
	3	老本		*3*	搶攻
	1	未來		*1*	線上遊戲
S2	*2*	前途	*S2*	*2*	孫子兵法
	3	用功		*3*	奸詐
	1	吃		*1*	比賽
S3	*2*	食物	*S3*	*2*	教練
	3	賭博		*3*	心機
	1	貪		*1*	孫子兵法
S4	*2*	銀行	*S4*	*2*	周瑜
	3	錢		*3*	金庸
	1	美色		*1*	策略
S5	*2*	天份	*S5*	*2*	魔獸
	3	財富		*3*	三國
	1	年輕		*1*	戰爭
S6	*2*	自我	*S6*	*2*	智謀
	3	浪費		*3*	孫子兵法
	1	健康		*1*	攻防
S7	*2*	財務	*S7*	*2*	軍事
	3	後台		*3*	運動
	1	特色		*1*	團體
S8	*2*	標籤	*S8*	*2*	合作
	3	價錢		*3*	默契
	1	利用		*1*	指南
S9	*2*	揮霍	*S9*	*2*	方針
	3	充足		*3*	決策
	1	年齡		*1*	軍營
S10	*2*	失敗	*S10*	*2*	地圖
	3	經驗		*3*	棋子

焦點			角色		
Subject ID			*Subject ID*		
	1	注目		*1*	扮演
S1	*2*	透鏡	*S1*	*2*	分工
	3	聚集		*3*	劇情
	1	新聞		*1*	主角
S2	*2*	聚光	*S2*	*2*	扮演
	3	閃光燈		*3*	演戲
	1	人物		*1*	扮演
S3	*2*	燈	*S3*	*2*	人物
	3	新聞		*3*	主角
	1	鎂光燈		*1*	勇士
S4	*2*	妮可基嫚	*S4*	*2*	公主
	3	被凸透鏡聚光燒掉了的紙		*3*	莎士比亞
	1	透鏡		*1*	戲劇
S5	*2*	新聞	*S5*	*2*	徵選
	3	目光		*3*	花旦
	1	新聞		*1*	戲劇
S6	*2*	公眾人物	*S6*	*2*	表演
	3	報紙		*3*	個性
	1	光芒		*1*	影視
S7	*2*	重要	*S7*	*2*	小說
	3	局勢		*3*	評斷
	1	新聞		*1*	男女
S8	*2*	政治	*S8*	*2*	情愛
	3	無聊		*3*	冷漠
	1	目光		*1*	扮演
S9	*2*	神經	*S9*	*2*	邏輯
	3	視覺		*3*	神秘
	1	鏡頭		*1*	身分
S10	*2*	報紙	*S10*	*2*	自我
	3	社會事件		*3*	逃離

壓力			階級		
Subject ID			*Subject ID*		
	1	緊張		*1*	鬥爭
S1	*2*	情緒	*S1*	*2*	分級
	3	影響生理		*3*	貧富
	1	很大		*1*	勞工
S2	*2*	帕斯卡	*S2*	*2*	劃分
	3	物理		*3*	種族
	1	鍋		*1*	鬥爭
S3	*2*	力學	*S3*	*2*	馬克思
	3	白努力		*3*	社會學
	1	鍋子		*1*	印度
S4	*2*	蓋子變扁	*S4*	*2*	婆羅門
	3	車子		*3*	中古歐洲
	1	課業		*1*	貧富
S5	*2*	期末考	*S5*	*2*	M型社會
	3	實驗室		*3*	制度
	1	崩潰		*1*	公司
S6	*2*	焦躁	*S6*	*2*	社會
	3	成長		*3*	國王
	1	焦灼		*1*	劃分
S7	*2*	企盼	*S7*	*2*	意識
	3	壓抑		*3*	評等
	1	真實		*1*	權力
S8	*2*	存在	*S8*	*2*	不公平
	3	無奈		*3*	難過
	1	沈重		*1*	鬥爭
S9	*2*	空氣	*S9*	*2*	平等
	3	摳米(yarikomi=卯起來玩[日語])		*3*	差異
	1	鞭策		*1*	分化
S10	*2*	反抗	*S10*	*2*	鬥爭
	3	衝突		*3*	流血

APPENDIX VII.C Highly Literal Verbs

說出			毀容		
Subject ID			*Subject ID*		
	1	話		*1*	引人注意
S11	*2*	想法	*S11*	*2*	自信心
	3	意見		*3*	關懷
	1	讓別人了解		*1*	情殺
S12	*2*	不隱藏自己	*S12*	*2*	化學藥劑
	3	解開誤會		*3*	殘酷
	1	膽量		*1*	硫酸
S13	*2*	秘密	*S13*	*2*	報復
	3	清楚		*3*	自卑
	1	心裡話		*1*	絕望
S14	*2*	勇敢	*S14*	*2*	整形
	3	對方		*3*	女性
	1	坦白		*1*	王水
S15	*2*	事實	*S15*	*2*	車禍
	3	心情		*3*	情殺
	1	理念		*1*	硫酸
S16	*2*	期望	*S16*	*2*	新竹
	3	表達		*3*	愛情
	1	表達		*1*	硫酸
S17	*2*	語言	*S17*	*2*	報復
	3	想法		*3*	意外
	1	事實		*1*	鹽酸
S18	*2*	故事	*S18*	*2*	車禍
	3	秘密		*3*	仇恨
	1	事實		*1*	台大毀容院
S19	*2*	驚人的	*S19*	*2*	硫酸
	3	話		*3*	可怕
	1	很好		*1*	王水
S20	*2*	講話	*S20*	*2*	血
	3	大膽		*3*	酸

動工			走路		
Subject ID			*Subject ID*		
	1	工程		*1*	跌倒
S11	*2*	專案	*S11*	*2*	逃走
	3	建築		*3*	快步
	1	建築工地		*1*	健康
S12	*2*	作業	*S12*	*2*	踏實
	3	新開始		*3*	到達
	1	開始		*1*	散步
S13	*2*	忙碌	*S13*	*2*	放鬆
	3	完成		*3*	運動
	1	開始		*1*	很近
S14	*2*	工作	*S14*	*2*	累
	3	懶惰		*3*	運動
	1	土木		*1*	跑
S15	*2*	開始	*S15*	*2*	跌倒
	3	延宕		*3*	遠
	1	土堆		*1*	逛街
S16	*2*	儀式	*S16*	*2*	減重
	3	打掃		*3*	運動
	1	開始		*1*	交通
S17	*2*	勞動	*S17*	*2*	運動
	3	建造		*3*	跑步
	1	破土		*1*	跌倒
S18	*2*	竣工	*S18*	*2*	跑步
	3	開始		*3*	腳
	1	開挖		*1*	專心
S19	*2*	打地基	*S19*	*2*	跌倒
	3	灌水泥		*3*	平靜
	1	軟開		*1*	駝背
S20	*2*	程式	*S20*	*2*	飛快
	3	作業		*3*	老人

散去			上臺		
Subject ID			*Subject ID*		
	1	人潮		*1*	報告
S11	*2*	潮水	*S11*	*2*	緊張
	3	珠子		*3*	講台
	1	人潮		*1*	發表意見
S12	*2*	演唱會	*S12*	*2*	呈現
	3	釋懷		*3*	膽怯
	1	雲霧		*1*	緊張
S13	*2*	清晰	*S13*	*2*	自信
	3	雨過天晴		*3*	儀態
	1	雲霧		*1*	緊張
S14	*2*	人潮	*S14*	*2*	表現
	3	結束		*3*	焦慮
	1	霧		*1*	演說
S15	*2*	惡靈	*S15*	*2*	表演
	3	飄落		*3*	老師
	1	烏雲		*1*	演講
S16	*2*	憂鬱	*S16*	*2*	表演
	3	群眾		*3*	演員
	1	離開		*1*	表演
S17	*2*	結束	*S17*	*2*	緊張
	3	人潮		*3*	準備
	1	霧		*1*	表演
S18	*2*	人群	*S18*	*2*	唱歌
	3	錢財		*3*	合唱
	1	人群		*1*	演講
S19	*2*	冷清	*S19*	*2*	報告
	3	惆悵		*3*	出醜
	1	鳥獸散		*1*	說話
S20	*2*	體育課	*S20*	*2*	演講
	3	雲		*3*	報告

長大			吞下		
Subject ID			*Subject ID*		
	1	成熟		*1*	雞蛋
S11	*2*	現實	*S11*	*2*	棗子
	3	面對		*3*	噎到
	1	承擔		*1*	委屈
S12	*2*	負責	*S12*	*2*	藥丸
	3	保護		*3*	吸收掉
	1	成熟		*1*	藥丸
S13	*2*	工作	*S13*	*2*	隱忍
	3	賺錢		*3*	成熟
	1	責任		*1*	口水
S14	*2*	壓力	*S14*	*2*	魚刺
	3	理想		*3*	種子
	1	18 歲		*1*	筆
S15	*2*	心靈	*S15*	*2*	雞蛋
	3	負責任		*3*	口水
	1	責任		*1*	囫圇吞棗
S16	*2*	青春	*S16*	*2*	藥丸
	3	成年		*3*	口水
	1	成熟		*1*	喉嚨
S17	*2*	蛻變	*S17*	*2*	委曲
	3	責任		*3*	忍受
	1	小孩		*1*	藥
S18	*2*	小樹	*S18*	*2*	苦水
	3	老化		*3*	硬幣
	1	成人		*1*	藥丸
S19	*2*	老	*S19*	*2*	辛酸
	3	成熟		*3*	安眠藥
	1	大樹		*1*	彈珠
S20	*2*	總統	*S20*	*2*	喉嚨
	3	未來		*3*	口水

APPENDIX VII.D Highly Metaphorical Verbs

站穩			櫥窗		
Subject ID			*Subject ID*		
	1	腳		*1*	鼓勵
S11	*2*	鞋子	*S11*	*2*	炒熱氣氛
	3	腿		*3*	討論
	1	立正		*1*	氣氛
S12	*2*	支撐	*S12*	*2*	活潑大方
	3	勇敢		*3*	一起飛翔
	1	安全		*1*	風氣
S13	*2*	跌倒	*S13*	*2*	律動
	3	恐懼		*3*	熱情
	1	腳步		*1*	氣氛
S14	*2*	平衡	*S14*	*2*	帶動唱
	3	邊緣		*3*	牽引
	1	獨木橋		*1*	唱
S15	*2*	懸崖	*S15*	*2*	懶
	3	風		*3*	跑
	1	台階		*1*	工作
S16	*2*	公車	*S16*	*2*	行動
	3	地位		*3*	歌舞
	1	雙腳		*1*	促進
S17	*2*	意志	*S17*	*2*	周圍
	3	根基		*3*	提升
	1	腳步		*1*	唱歌
S18	*2*	地位	*S18*	*2*	氣氛
	3	跌倒		*3*	時尚潮流
	1	腳步		*1*	氣氛
S19	*2*	市場	*S19*	*2*	(帶動)唱
	3	跌倒		*3*	情緒
	1	商場		*1*	士氣
S20	*2*	風大	*S20*	*2*	氣氛
	3	連戰		*3*	波浪舞

喚起			看成		
Subject ID			*Subject ID*		
	1	記憶		*1*	別人
S11	*2*	舊時光	*S11*	*2*	錯認
	3	回憶		*3*	以為
	1	記憶		*1*	假裝
S12	*2*	搜尋	*S12*	*2*	迷糊
	3	抽離現實		*3*	幻象
	1	回憶		*1*	誤認
S13	*2*	起床	*S13*	*2*	想像
	3	童年		*3*	扭曲
	1	記憶		*1*	你
S14	*2*	往日	*S14*	*2*	花
	3	名字		*3*	其他人
	1	精神		*1*	搞錯
S15	*2*	召喚獸	*S15*	*2*	出錯
	3	起床		*3*	認錯
	1	記憶		*1*	錯誤
S16	*2*	睡眠	*S16*	*2*	眼睛
	3	晨興		*3*	記憶
	1	回憶		*1*	眼花
S17	*2*	刺激	*S17*	*2*	辯認
	3	感傷		*3*	判斷
	1	記憶		*1*	誤認
S18	*2*	起床	*S18*	*2*	看錯
	3	睡覺		*3*	搞錯對象
	1	記憶		*1*	眼花
S19	*2*	認同	*S19*	*2*	乍看之下
	3	意識		*3*	別人
	1	不好的記憶		*1*	豬
S20	*2*	過去	*S20*	*2*	別人
	3	回憶		*3*	對的

浸淫			打斷		
Subject ID			*Subject ID*		
	1	回憶		*1*	對話
S11	*2*	液體	*S11*	*2*	思緒
	3	沾濕		*3*	想法
	1	培養		*1*	思緒
S12	*2*	美好的事物	*S12*	*2*	被迫中止
	3	充實		*3*	回歸當下
	1	癡狂		*1*	無禮
S13	*2*	鑽研	*S13*	*2*	跋扈
	3	知識		*3*	強勢
	1	文字		*1*	對話
S14	*2*	自然	*S14*	*2*	不好意思
	3	藝術		*3*	急事
	1	性		*1*	談話
S15	*2*	沈迷	*S15*	*2*	破壞
	3	專家（達人）		*3*	脆
	1	田野		*1*	談話
S16	*2*	民族誌	*S16*	*2*	下雨
	3	人類學		*3*	吃醋
	1	徜徉		*1*	停下
S17	*2*	氣氛	*S17*	*2*	干擾
	3	享受		*3*	冒犯
	1	文學		*1*	別人說話
S18	*2*	書法	*S18*	*2*	骨頭
	3	沉醉		*3*	腿
	1	文學世界		*1*	講話
S19	*2*	(浸淫)日久	*S19*	*2*	靜默
	3	的環境		*3*	冷場
	1	這是什麼		*1*	賤
S20	*2*	淫穢	*S20*	*2*	沒禮貌
	3	低級		*3*	國中生

湧起			面臨		
Subject ID			*Subject ID*		
	1	淚水		*1*	問題
S11	*2*	回憶	*S11*	*2*	危機
	3	泉水		*3*	面對
	1	感想		*1*	即將來到
S12	*2*	思念	*S12*	*2*	面對
	3	忽然浮現甚麼		*3*	考驗
	1	海浪		*1*	壓力
S13	*2*	溢出	*S13*	*2*	選擇
	3	上升		*3*	勇敢
	1	海浪		*1*	遭遇
S14	*2*	思緒	*S14*	*2*	危機
	3	情緒		*3*	兩難
	1	海浪		*1*	挫折
S15	*2*	負面情感	*S15*	*2*	轉捩點
	3	一堆人		*3*	死亡
	1	水泉		*1*	危機
S16	*2*	思緒	*S16*	*2*	困難
	3	意識		*3*	考驗
	1	流露		*1*	困難
S17	*2*	浪潮	*S17*	*2*	環境
	3	心底		*3*	挑戰
	1	風雲		*1*	難關
S18	*2*	海浪	*S18*	*2*	兵臨城下
	3	泉源		*3*	臨危不亂
	1	海浪		*1*	危機
S19	*2*	心中的愁緒	*S19*	*2*	未來
	3	潮汐		*3*	未知
	1	風起雲湧		*1*	困難
S20	*2*	海浪	*S20*	*2*	壓力
	3	怒火		*3*	狀況

APPENDIX VIII. Instructions of Sentence Completion Tasks, Relatedness Ratings for Words in Isolation and in Context, Experiment 1, Pretest 4, Experiment 2, and Screen Shots

APPENDIX VIII.A Sentence Completion Task

指導語

同學您好，

謝謝您來參與本實驗。這個實驗的目的，是要了解人們如何使用語言，所以它並非一般的智力測驗，題目中也不包含陷阱，請您放鬆心情作答即可。

本實驗共包含 32 個不完整的句子。實驗過程中，您會在螢幕上看到欲請您閱讀的句子，每句都會中斷在句中某處，下面並有一個空格。這時您所需要做的，就是請您 閱讀完句子之後，根據您的直覺，寫下您第一個想到完成此句子的方式。本實驗沒有標準答案，請您只需依照你的直覺做答即可。

例如：看到以下不完整的句子：

「他自從感情失意以後，每天過著頹廢的生活，縱情於」

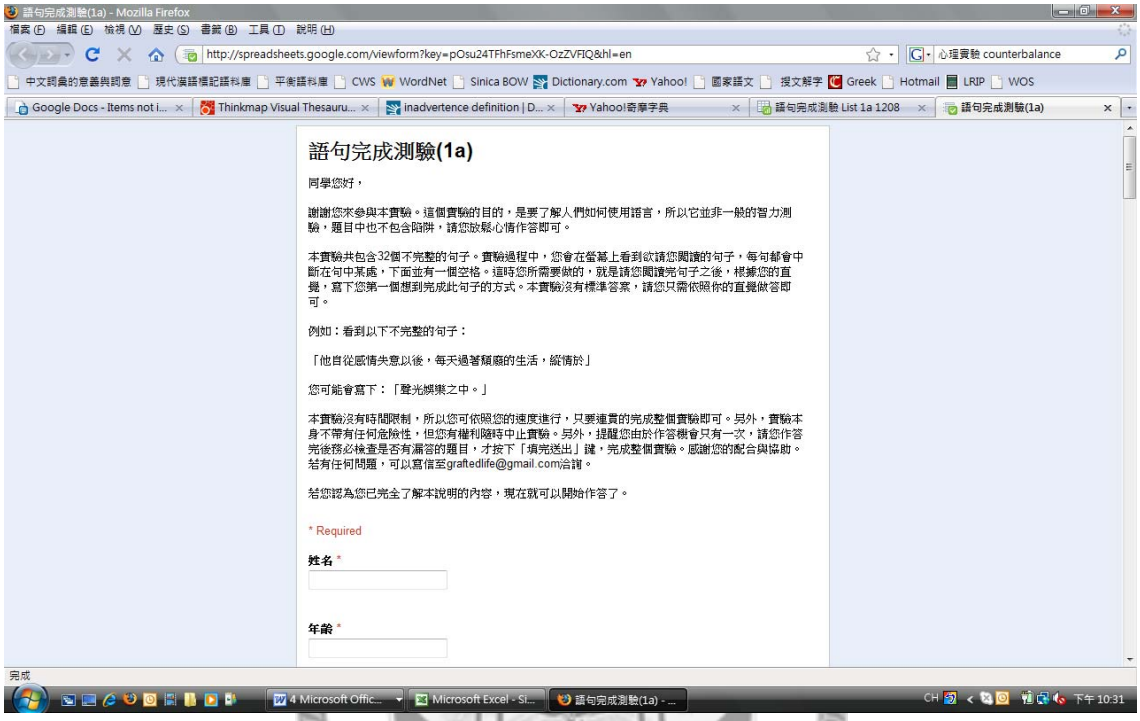
您可能會寫下：「聲光娛樂之中。」

本實驗沒有時間限制，所以您可依照您的速度進行，只要連貫的完成整個實驗即可。另外，實驗本身不帶有任何危險性，但您有權利隨時中止實驗。另外，提醒您由於 作答機會只有一次，請您作答完後務必檢查是否有漏答的題目，才按下「填完送出」鍵，完成整個實驗。感謝您的配合與協助。若有任何問題，可以寫信至 graftedlife@gmail.com 洽詢。

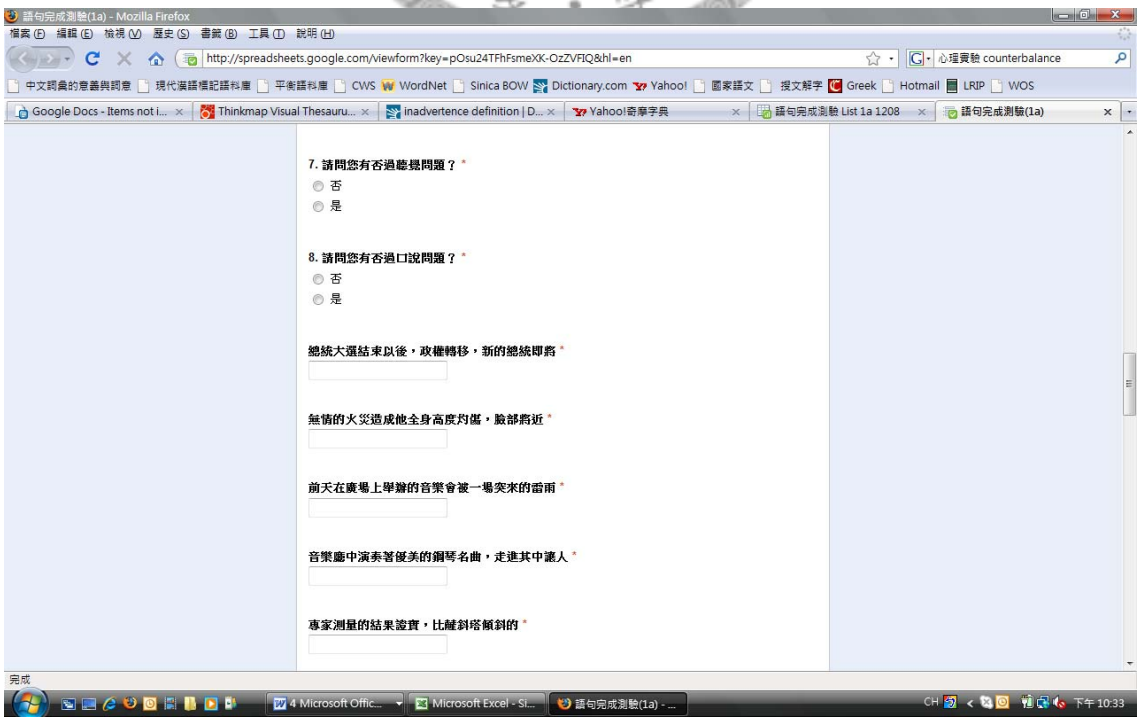
若您認為您已完全了解本說明的內容，現在就可以開始作答了。

Screenshots for Sentence Completion Task

Introduction:



Response Section:



APPENDIX VIII.B Relatedness Ratings for Words in Isolation

指導語

同學您好，

謝謝您來參與本實驗。這個實驗的目的，是要了解人們如何使用語言，所以它並非一般的智力測驗，題目中也不包含陷阱，請您放鬆心情作答即可。

本實驗的目的在於測試人們對詞彙相關性的感受，內容包含 64 對詞語。實驗過程中，您會在螢幕上方看到欲請您閱讀的兩個詞語，這時您所需要做的，就是請您根據 您的直覺，判斷這兩個詞彙意義相關的程度；題目的下方並附有一量表，其上的數字由 1 至 7 代表從「非常不相關」到「非常相關」之間程度上的差異，請您點選您 認為合適的數字作答即可。

例如：您可能會讀到如下的題目：

外界──地點

1 2 3 4 5 6 7

非常不相關 非常相關

這時，您可能會按下「7」，表示您認為這兩個詞彙非常相關。

相對的，若問題是：

外界──用途

1 2 3 4 5 6 7

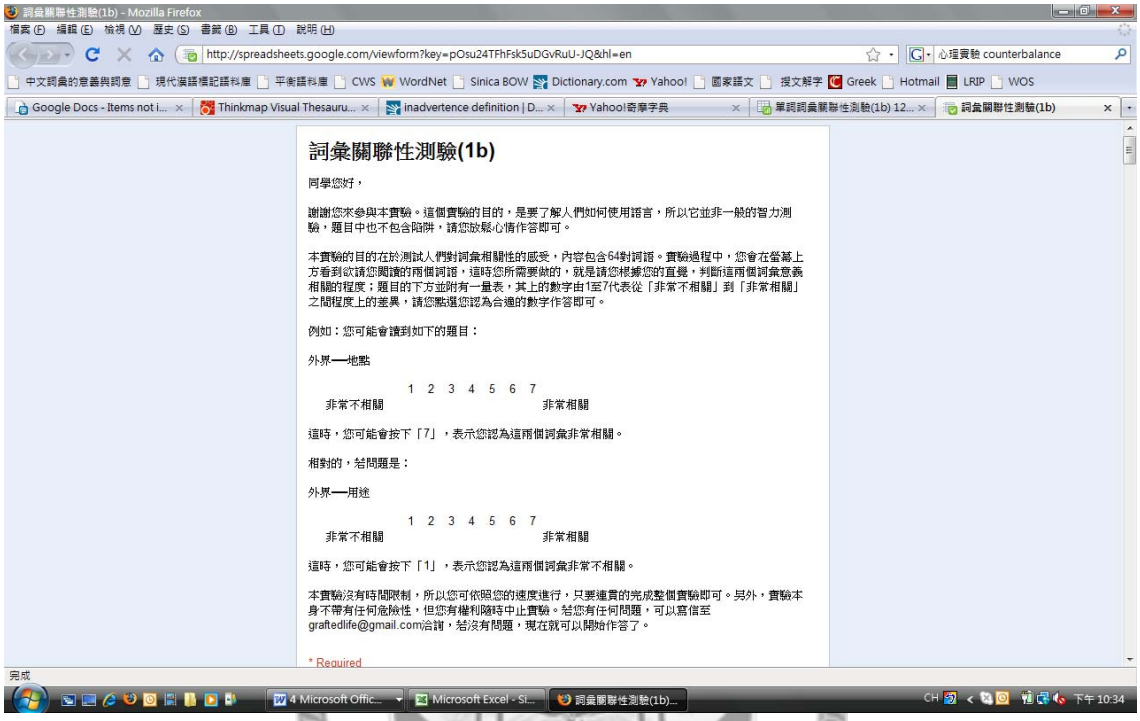
非常不相關 非常相關

這時，您可能會按下「1」，表示您認為這兩個詞彙非常不相關。

本實驗沒有時間限制，所以您可依照您的速度進行，只要連貫的完成整個實驗即可。另外，實驗本身不帶有任何危險性，但您有權利隨時中止實驗。若您有任何問題，可以寫信至 graftedlife@gmail.com 洽詢，若沒有問題，現在就可以開始作答了。

Screenshots for Relatedness Ratings for Word in Isolation

Introduction:



Response Section:

APPENDIX VIII.C Relatedness Ratings for Words in Context

指導語

同學您好，

謝謝您來參與本實驗。這個實驗的目的，是要了解人們如何使用語言，所以它並非一般的智力測驗，題目中也不包含陷阱，請您放鬆心情作答即可。所收集之資料惟作實驗分析之用，個人資訊將不公開，敬請放心。

本實驗的目的在於測試人們對詞彙相關性的感受，內容包含 128 個句子和欲請您判斷的詞語。實驗過程中，您首先會在螢幕上方看到欲請您閱讀的句子，這時您所需 要做的，就是仔細閱讀並理解這個句子，句子中會有一個由星號標出的詞彙（如：「**外界**」），句子末尾還會跟著一個詞彙。請您根據括號中的詞彙在句子中的意義，憑您的直覺，判斷它和句後附加的詞彙意義相關的程度；題目的下方並附有一量表，其上的數字由 1 至 7 代表從「非常不相關」到「非常相關」之間程度 上的差異，請您點選您認為合適的數字作答即可。

例如：您可能會讀到如下的題目：

實驗時受試者被隔離在黑暗的房間裡，無法接觸**外界**的燈光或聲音。──地點

1 2 3 4 5 6 7

非常不相關 非常相關

這時，您可能會按下「7」，表示您認為這兩個詞彙非常相關。

相對的，若問題是：

實驗時受試者被隔離在黑暗的房間裡，無法接觸**外界**的燈光或聲音。──用途

1　2　3　4　5　6　7

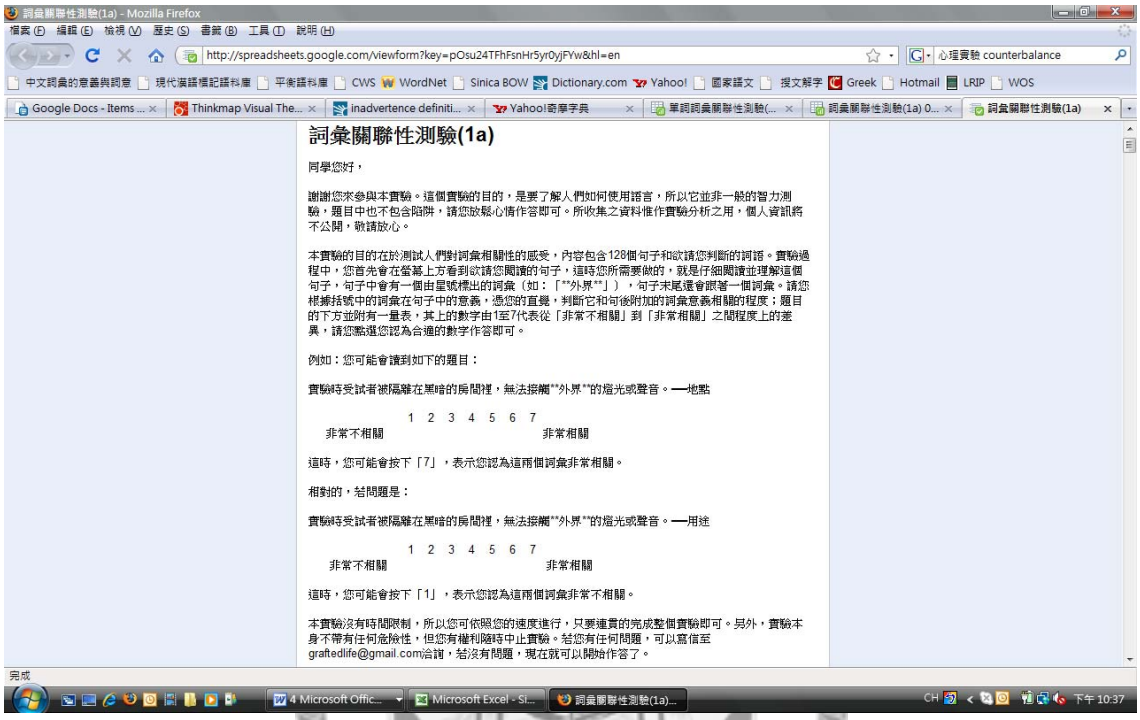
非常不相關　　非常相關

這時，您可能會按下「1」，表示您認為這兩個詞彙非常不相關。

本實驗沒有時間限制，所以您可依照您的速度進行，只要連貫的完成整個實驗即可。另外，實驗本身不帶有任何危險性，但您有權利隨時中止實驗。若您有任何問題，可以寫信至 graftedlife@gmail.com 洽詢，若沒有問題，現在就可以開始作答了。

Screenshots for Relatedness Ratings for Words in Context

Introduction:



Response Section:

APPENDIX VIII.D Experiment 1: Word Association Task

指導語

同學您好，

謝謝您來參與本實驗。這個實驗的目的，是要了解人們如何使用語言，所以它並非一般的智力測驗或語文能力測驗，題目中也不包含陷阱，請您放鬆心情作答即可。所收集之資料惟作實驗分析之用，個人資訊將不公開，敬請放心。

本實驗共包含 16 個詞彙。實驗過程中，您會在螢幕上看到欲請您閱讀的詞彙，詞彙的下方並有一個空格。這時您所需要做的，就是請您針對這個詞彙，根據您的直覺，在空格中填入您第一個聯想到的詞彙，並在前面標號 1，再填入其次聯想到的詞彙，標號 2，再填入接下來聯想到的詞彙，標號 3。本實驗沒有標準答案，請您只需依照你的直覺做答。

例如，看到：「聲光」，您可能會寫下：

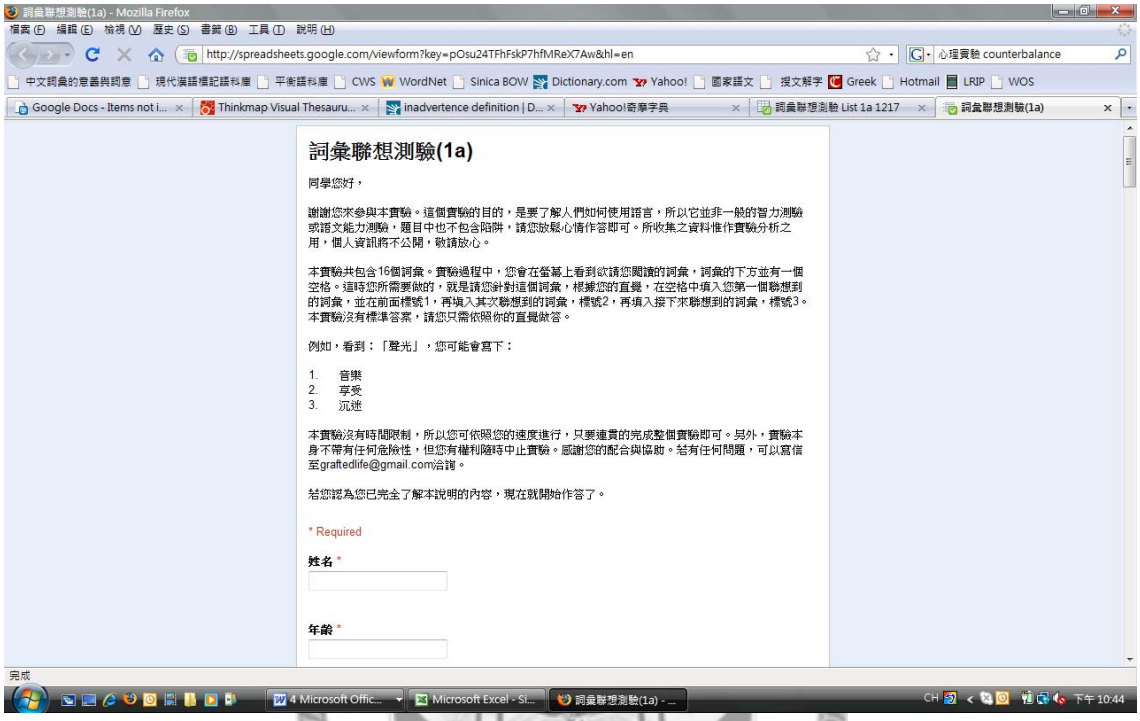
1. 音樂
2. 享受
3. 沉迷

本實驗沒有時間限制，所以您可依照您的速度進行，只要連貫的完成整個實驗即可。另外，實驗本身不帶有任何危險性，但您有權利隨時中止實驗。感謝您的配合與協助。若有任何問題，可以寫信至 graftedlife@gmail.com 洽詢。

若您認為您已完全了解本說明的內容，現在就開始作答了。

Screenshots for Word Association Task

Introduction:



Response Section:

APPENDIX VIII.E Pretest 4: Cross-modal Priming Lexical Decision Task for Words in Isolation (Pseudohomophones)

指導語

同學您好，

謝謝您來參與本實驗。這個實驗的目的，是要了解人們如何使用語言，所以它並非一般的智力測驗，題目中也不包含陷阱，請您放鬆心情作答即可。在實驗正式開始前，我們再次提醒您將手機關機，以免影響實驗進行，謝謝您的配合。

本實驗為跨模組詞彙判斷作業，分為兩大階段進行，其間間隔五分鐘。實驗過程中，您會在螢幕中央看到一個十字形錨點，請您注視這個錨點，這時您會在耳機中聽到一個詞語，例如：「會議」，而錨點的位置上則會出現一個字串。這時您所要作的，就是注意聆聽耳機裡播放的詞語，同時**儘速且正確**的判斷**螢幕**上所出現的字串是否為**中文裡存在的詞彙**，並在您前方的反應盒上作答。例如：「藥物」是一個存在的詞彙，而「酵毅」則不是一個存在的詞彙。

在您前方有一個反應盒，最右邊的按鈕代表「詞」，最左邊的按鈕代表「非詞」；我們提醒您一面須注意耳機播放的內容，一面請您作判斷時依據**顯示在螢幕上的字串**是否真實存在而按鈕作答。現在我們請您將左右手的食指分別放在這兩個按鈕上；您現在就可以試著按按看這兩個按鈕。要請您注意的是，實驗進行的過程中，**請勿將手指從反應盒上移開**；如果作答時發現不小心按錯了，只需繼續進行直到實驗完成即可，然而我們仍要請您儘速且正確的作答。

每隔一段時間，螢幕上會出現一個記憶測驗，請您判斷剛才是否**曾在耳機中聽到過**螢幕上所顯示的詞彙。這時，螢幕上會指示：按下右邊的按鍵代表「**是，剛才曾聽到**」，而按下左邊的按鍵則代表「**否，剛才沒有聽到**」。記憶測驗沒有時間限制，和之前不同，所以這時您可依照您的速度作答。但測驗結束後，螢幕上會提醒您準備繼續進行下一段實驗，也就是儘速且正確的判斷螢幕上的字串為詞或非詞，以及其後的記憶測驗。實驗流程如此循環直到整個階段結束。

本實驗不具任何危險性，但您有權利隨時中止實驗，另外，由於實驗在密閉的空間進行，實驗進行時只會留下一盞燈光，若您感到任何不適，可以隨時向施測者提出來。並且實驗正式開始前，會有一個練習階段供您練習。若您已完全了解本說明內容，請向施測者確認可以開始練習。請問您有否任何問題？

APPENDIX VIII.F Experiment 2: Cross-modal Priming Lexical Decision Task for Words in Isolation (Legal Nonwords)

指導語

同學您好，

謝謝您來參與本實驗。這個實驗的目的，是要了解人們如何使用語言，所以它並非一般的智力測驗，題目中也不包含陷阱，請您放鬆心情作答即可。在實驗正式開始前，我們再次提醒您將手機關機，以免影響實驗進行，謝謝您的配合。

本實驗為跨模組詞彙判斷作業，分為兩大階段進行，其間間隔五分鐘。實驗過程中，您會在螢幕中央看到一個十字形錨點，請您注視這個錨點，這時您會在耳機中聽到一個詞語，例如：「會議」，而錨點的位置上則會出現一個字串。這時您所要作的，就是注意聆聽耳機裡播放的詞語，同時**儘速且正確**的判斷**螢幕**上所出現的字串是否為**中文裡存在的詞彙**，並在您前方的反應盒上作答。例如：「藥物」是一個存在的詞彙，而「酵乖」則不是一個存在的詞彙。

在您前方有一個反應盒，最右邊的按鈕代表「詞」，最左邊的按鈕代表「非詞」；我們提醒您一面須注意耳機播放的內容，一面請您作判斷時依據**顯示在螢幕上的字串**是否真實存在而按鈕作答。現在我們請您將左右手的食指分別放在這兩個按鈕上；您現在就可以試著按按看這兩個按鈕。要請您注意的是，實驗進行的過程中，**請勿將手指從反應盒上移開**；如果作答時發現不小心按錯了，只需繼續進行直到實驗完成即可，然而我們仍要請您儘速且正確的作答。

每隔一段時間，螢幕上會出現一個記憶測驗，請您判斷剛才是否**曾在耳機中聽到過**螢幕上所顯示的詞彙。這時，螢幕上會指示：按下右邊的按鍵代表「**是，剛才曾聽到**」，而按下左邊的按鍵則代表「**否，剛才沒有聽到**」。記憶測驗沒有時間限制，和之前不同，所以這時您可依照您的速度作答。但測驗結束後，螢幕上會提醒您準備繼續進行下一段實驗，也就是儘速且正確的判斷螢幕上的字串為詞或非詞，以及其後的記憶測驗。實驗流程如此循環直到整個階段結束。

本實驗不具任何危險性，但您有權利隨時中止實驗，另外，由於實驗在密閉的空間進行，實驗進行時只會留下一盞燈光，若您感到任何不適，可以隨時向施測者提出來。並且實驗正式開始前，會有一個練習階段供您練習。若您已完全了解本說明內容，請向施測者確認可以開始練習。請問您有否任何問題？

APPENDIX VIII.G Experiment 3: Cross-modal Priming Lexical Decision Task for Words in Context

指導語

同學您好，

謝謝您來參與本實驗。這個實驗的目的，是要了解人們如何使用語言，所以它並非一般的智力測驗，題目中也不包含陷阱，請您放鬆心情作答即可。在實驗正式開始前，我們再次提醒您將手機關機，以免影響實驗進行，謝謝您的配合。

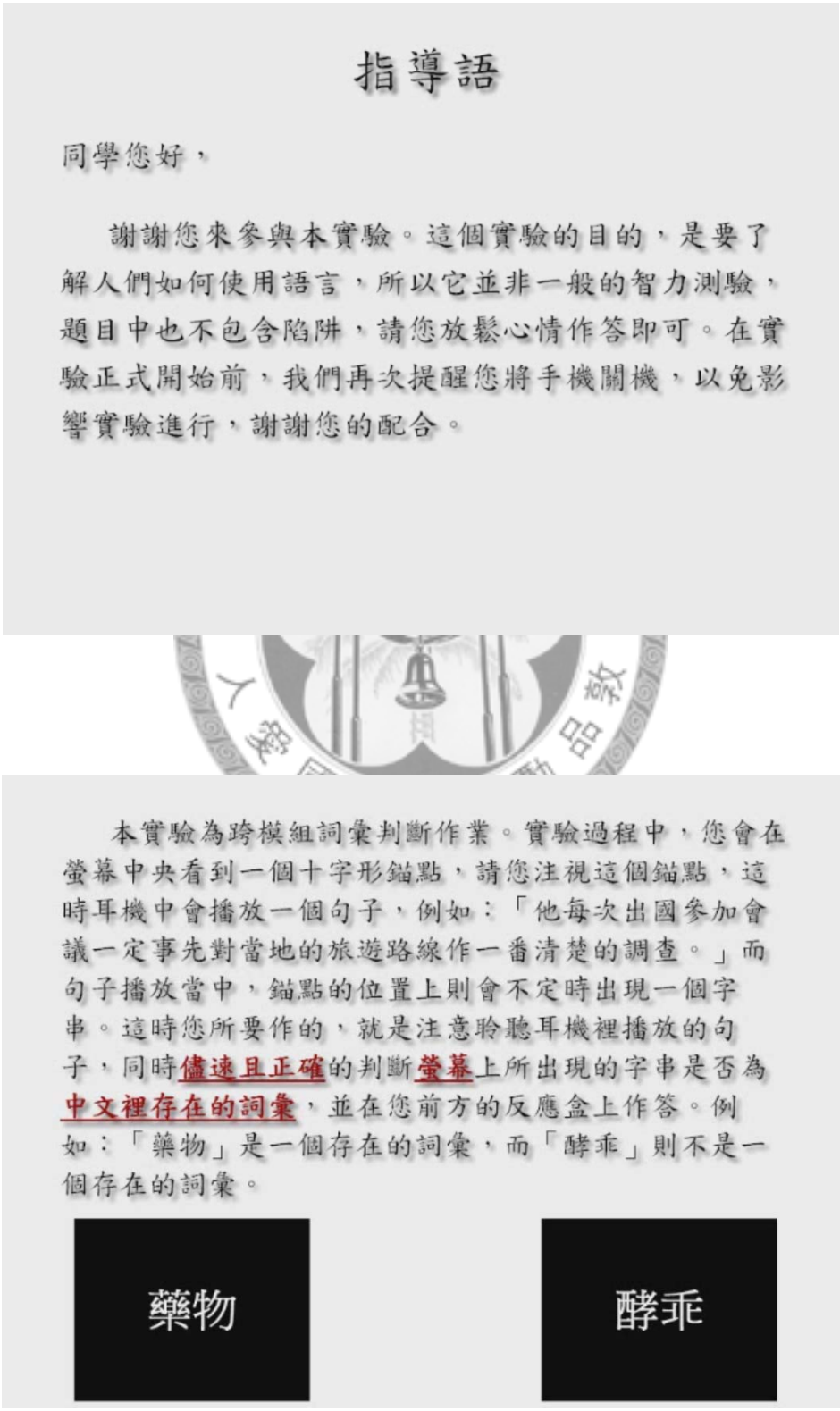
本實驗為跨模組詞彙判斷作業。實驗過程中，您會在螢幕中央看到一個十字形錨點，請您注視這個錨點，這時耳機中會播放一個句子，例如：「他每次出國參加會議一定事先對當地的旅遊路線作一番清楚的調查。」而句子播放當中，錨點的位置上則會不定時出現一個字串。這時您所要作的，就是注意聆聽耳機裡播放的句子，同時**儘速且正確**的判斷**螢幕**上所出現的字串是否為**中文裡存在的詞彙**，並在您前方的反應盒上作答。例如：「藥物」是一個存在的詞彙，而「酵乖」則不是一個存在的詞彙。

在您前方有一個反應盒，最右邊的按鈕代表「詞」，最左邊的按鈕代表「非詞」；我們提醒您一面須注意耳機播放的內容，一面請您作判斷時依據**顯示在螢幕上的字串**是否真實存在而按鈕作答。現在我們請您將左右手的食指分別放在這兩個按鈕上；您現在就可以試著按按看這兩個按鈕。要請您注意的是，實驗進行的過程中，**請勿將手指從反應盒上移開**；如果作答時發現不小心按錯了，只需繼續進行直到實驗完成即可，然而我們仍要請您儘速且正確的作答。

每隔一段時間，螢幕上會出現一個記憶測驗，請您判斷剛才是否**曾在耳機中聽到過**螢幕上所顯示的句子。這時，螢幕上會指示：按下右邊的按鍵代表「**是，剛才曾聽到完全相同的句子**」，而按下左邊的按鍵則代表「**否，螢幕上的句子和剛才聽到的不同**」。記憶測驗沒有時間限制，所以這時您可依照您的速度作答。但測驗結束後，螢幕上會提醒您準備繼續進行下一段實驗，也就是儘速且正確的判斷螢幕上的字串為詞或非詞，以及其後的記憶測驗。實驗流程如此循環直到整個實驗結束。

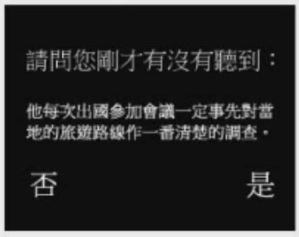
本實驗不具任何危險性，但您有權利隨時中止實驗，另外，由於實驗在密閉的空間進行，實驗進行時只會留下一盞燈光，若您感到任何不適，可以隨時向施測者提出來。並且實驗正式開始前，會有一個練習階段供您練習。若您已完全了解本說明內容，請向施測者確認可以開始練習。請問您有否任何問題？

Screenshots for Introductory Video



在您前方有一個反應盒，最右邊的按鈕代表「詞」，最左邊的按鈕代表「非詞」；我們提醒您一面須注意耳機播放的內容，一面請您作判斷時依據**顯示在螢幕上的字串**是否真實存在而按鈕作答。現在我們請您將左右手的食指分別放在這兩個按鈕上；您現在就可以試著按按看這兩個按鈕。要請您注意的是，實驗進行的過程中，**請勿將手指從反應盒上移開**；如果作答時發現不小心按錯了，只需繼續進行直到實驗完成即可，然而我們仍要請您儘速且正確的作答。

每隔一段時間，螢幕上會出現一個記憶測驗，請您判斷剛才是否**曾在耳機中聽到過**螢幕上所顯示的句子。這時，螢幕上會指示：按下右邊的按鍵代表「**是，剛才曾聽到完全相同的句子**」，而按下左邊的按鍵則代表「**否，螢幕上的句子和剛才聽到的不同**」。記憶測驗沒有時間限制，所以這時您可依照您的速度作答。但測驗結束後，螢幕上會提醒您準備繼續進行下一段實驗，也就是儘速且正確的判斷螢幕上的字串為詞或非詞，以及其後的記憶測驗。實驗流程如此循環直到整個實驗結束。



本實驗不具任何危險性，但您有權利隨時中止實驗，另外，由於實驗在密閉的空間進行，實驗進行時只會留下一盞燈光，若您感到任何不適，可以隨時向施測者提出來。並且實驗正式開始前，會有一個練習階段供您練習。若您已完全了解本說明內容，請向施測者確認可以開始練習。請問您有否任何問題？