

# Calculating the Number of Senses: Implications for Ambiguity Advantage Effect During Lexical Access

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## 1. Introduction

Calculating and representing a word's meaning is of central concern in lexicography, natural language processing, and psycholinguistics. A common difficulty researchers from these disciplines face is: when are two meanings the senses of a word, and when should they be treated as senses of distinct words? A more subtle yet related question is: what should and what should not count as the sense of a word? Different dictionaries frequently have unique ways of treating lexical meanings, depending on the theoretical and functional considerations lexicographers have in mind; for example, some dictionaries emphasize presenting a word's meaning with an eye to facilitating readers to understand the daily usages of that word, while others focus on providing the history of that word and listing overall definitions (archaic or not). Therefore, in constructing a contemporary model of lexical semantics that reflect people's actual semantic knowledge, it is not congenial to totally rely on dictionaries.

This paper aims at discussing the theoretical issues in constructing a lexical semantic theory that is linguistically, cognitively, and psychologically valid. It deliberates on such issues as polysemy and homonymy, metaphor and metonymy, and their implications in constructing a theoretical model that reflects language users' lexical semantic knowledge. This model further makes possible the calculation of word senses, based on which we design psycholinguistic experiments to examine a long-debated effect on lexical polysemy--the ambiguity advantage effect. Therefore in this paper, we start off from a cognitive lexical semantic theory and arrive at the psycholinguistic examination of word senses. In the end, we identify senses as a valid unit of lexical processing and corroborate the existence of the ambiguity advantage effect.

## 2. Polysemy and Homonymy

In calculating the senses of a word, the first step is to decide what should and what should not count as a word's meaning. This is related to the traditional distinction between polysemy and homonymy in lexical semantics, a distinction that is fundamental in almost every textbook of semantics. Lyons (1995: 55), for instance, defines *homonymy* as "the relation between distinct lexical entries" that have the following properties:

- (i) they will be unrelated in meaning;
- (ii) all their forms will be identical;
- (iii) the identical forms will be grammatically equivalent.

A typical example of homonymy is *bank*, which is a morphological form related to two distinct meanings: *bank*<sub>1</sub>, a business establishment and *bank*<sub>2</sub>, a steep natural incline (such as a *riverbank*). Based on this view, we would say *bank*<sub>1</sub> and *bank*<sub>2</sub> are two lexemes, each with a single meaning.

Whereas homonymy depicts the relation between distinct lexical entries, *polysemy* refers to meaning relation within a single lexeme. The most important criterion in deciding whether two meanings are polysemous is whether there is an overt relation between the meanings. For example, *bank* as a business establishment and *bank* as a place of safekeeping or storage (as in *a computer's memory bank*) are polysemies, namely meanings of the same lexical entry, because the relation between the two meanings is patent--both have to do with 'keeping and saving something'. In brief, Goddard's (1998) definitions of these two terms are hereby cited for reference:

(1) **Homonymy** designates a situation in which different words (homonyms) happen accidentally to have the same form.

(2) **Polysemy** designates a situation in which a single word has a set of related meanings. (Goddard, 1998: 18-19)

Clear as the distinction may seem, there are problems in the fuzzy area. What do we mean by meaning relation? Should two meanings be etymologically related in order to be seen as polysemous? What if people's intuition (popular etymology) contradicts the real etymological knowledge? Palmer (1986: 100-108) demonstrates several attempts to tear homonymy and polysemy apart, which all failed in one way or another<sup>1</sup>. There is hence no single criterion to distinguish between polysemy and homonymy. It is suggested that in constructing a model that represents language users' lexical semantic knowledge, we abandon the distinction between homonymy and polysemy and directly rely on people's perception of meaning relatedness. All the meanings associated with a morphological form are listed with the degrees of meaning relatedness labeled.

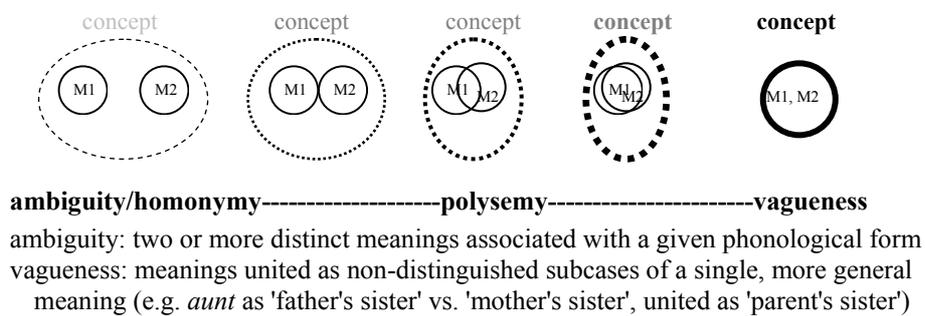
This view coincides with the cognitive model of lexical ambiguity constructed by Tuggy (1993), who perceives the fuzzy boundaries among homonymy, polysemy, and vagueness, and thinks of these three as located at different positions of a continuum. *Vagueness* is defined as "a lexeme with a single, but nonspecific meaning, i.e., the lexeme may subsume other meanings but those meanings are not

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<sup>1</sup> The tests Palmer (1986) demonstrates includes 1) etymology, 2) existence of general remarks (predictability) about difference of meaning, 3) pursuit of a central or core meaning, and 4) the test of ambiguity--the co-ordination test. These all prove to be problematic in one way or another.

distinguished from each other or from the more inclusive true meaning (Tuggy, 1993: 275)." Chinese examples for prototypical homonymy, polysemy, and vagueness are *yibiao* (儀表), *yinying* (陰影), and *youjia* (油價). *Yibiao* is associated with two rather unrelated senses: (1) the appearances or manners a person bears, and (2) instrument or meter. *Yinying* is associated with two related senses both having to do with darkness: (1) shade, and (2) a feeling of unhappiness. The meaning of *youjia* "price of gasoline" vs. *youjia* "price of edible oil" are intuitively united into one--"the price of oil".

According to Tuggy, whether two meanings are homonymous, polysemous, or simply vague is a matter of how related these meanings are, and how easy it is to find a concept to incorporate these meanings. This idea is illustrated in Figure 1 below. The circles represent the meanings associated with a word. When the meanings are distinct from one another, the circles do not overlap, and a common concept is hardly existent. When these meanings are closer to each other and start to overlap, we could find the relatedness between the meanings more easily, and a common concept for the meanings becomes more salient. To the extreme, the meanings are merely different aspects of one single well-established concept, and are called linguistic vagueness. The main parameter that locates meaning status on the continuum is "the degree of salience of subcases vis a vis a subsuming schema (273)."



**Figure 1.** Ambiguity, polysemy, and vagueness on a continuum.

### 3. Metaphor and Metonymy

In order to decide a word's number of meanings, it is quintessential to define what the sense of a word is. Sense definition is no easy job, as linguistic philosophers have long been questioning the meaning of meaning, and no easy answer has yet been stipulated. As discussed in section 2, the meanings of a word are more often than not related in one way or another. The question now is: if lexical meanings are related, is there an apparent way to delimit among them? What should count as a sense, and what should count as a sub-sense? Is there a hierarchy in the organization of word meanings?

As far as meaning relatedness and semantic extension are concerned, metaphor and metonymy are two essential processes that get different meanings associated. A

metonymy, by definition, involves mapping that occur within rather than between conceptual domains, whereas a metaphor involves mapping from a source domain to a target domain (Lakoff, 1987: 288). Take *huoguo* (火鍋) for example. It could mean "the hot pot above fire" and "the soup in the hot pot" in sentence (1), "the person eating the cooking pot" in (2), and "a blocked shot" in sentence (3). Do we say *huoguo* has four meanings? Do the metonymic relations among the first three meanings have the same status as the less related fourth meaning?

(1) 這 火鍋 有 許多 青菜。  
 zhe huoguo you xuduo qingcai  
 this hot pot/soup EXIST many vegetables  
 'There are many vegetables in the hot pot/soup.'

(2) 那 火鍋 付 錢 了 嗎？  
 na huoguo fu qian le ma  
 that hot pot pay money asp. question  
 'Has the person eating that hot pot paid?'

(3) 他 吃 了 我 一 記 火鍋。  
 ta chi le wo yi ji huoguo  
 he eat asp. I one classifier blocked shot  
 'I blocked his shot.'

Metonymic expressions are usually quite conventionalized and productive (Taylor, 1995: 123). For instance, the name of a manufacturer or an artist could almost always refer to their product as in *I bought a Gucci* or in *that Picasso is more expensive than this one*. These expressions usually have to be understood within context. Metaphors, by contrast, are less predictive, more creative, and stand more apparently as independent senses. Supporting evidence comes from our experiment asking 20 people to define the word *houtai* (後台). Our subjects generally gave two classes of definitions: (1) the backstage, and (2) backstage supporters (metaphorical extension of the first). None of the 20 subjects gave any metonymic definitions like the people at the backstage or the structure (e.g. pillar) of the backstage. Metaphorical expressions that are well established appear to stand on their own as senses, while metonymic expressions tend to be realized and understood more latently within context.

#### 4. Constructing a Semantic Theory for Chinese Nominals--Ahrens et al. (1998)

Considering the nature of polysemy, homonymy, metaphor, and metonymy mentioned above, Ahrens et al. (1998) proposed a semantic model, which distinguishes two

levels of lexical meanings: senses and meaning facets. This model delineates three crucial respects of lexical meaning:

- **orthographic and phonological representations**
- **senses**, related or not<sup>2</sup>
- **meaning facets**, which reflect an aspect of a sense

The basic semantic representation of the model is in (4):

- (4) **Orthographic Representation**
- **Sense<sub>1</sub>: PHONOLOGICAL REPRESENTATION *definition***
    - **Meaning facet<sub>1</sub>: *definition***
    - **Meaning facet<sub>2</sub>: *definition***
    - :
  - **Sense<sub>2</sub>: PHONOLOGICAL REPRESENTATION *definition***
    - **Meaning facet<sub>1</sub>: *definition***
    - **Meaning facet<sub>2</sub>: *definition***
    - :
  - **Sense<sub>3</sub>: PHONOLOGICAL REPRESENTATION *definition***
    - **Meaning facet<sub>1</sub>: *definition***
    - **Meaning facet<sub>2</sub>: *definition***
    - :
- :
- :

What are the senses and meaning facets of a word? According to Ahrens (1999), the *senses* of a word have the following properties:

- A) a sense is not an instance of metonymic or meronymic extension, but may be an instance of metaphorical extension;
- B) the extension links between two senses cannot be inherited by a class of nouns;
- C) senses cannot appear in the same context (unless the complexity is triggered).

Meaning facets, on the other hand, "reflect an aspect of a sense" (Ahrens et al., 1998: 52). A *meaning facet*, as "an extension from a particular sense", has the following properties:

- A) meaning facets are instances of metonymic or meronymic extension;
- B) nouns of the same semantic classes will have similar extension links to

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<sup>2</sup> The senses could be either related or unrelated. Polysemous and homonymous senses are not differentiated in this model.

related meaning facets;

- C) it can appear in the same context as other meaning facets (Note: this condition is weakened in the cases of mono-syllabic words).

This theory captures the essential differences between meronymic, metonymic and metaphorical extensions. Meronymic and metonymic extensions are two main ways to derive meaning facets. Meronymic extensions involve part/whole relations, by which part stands for whole or whole stands for part.<sup>3</sup> Metonymic extensions are different from meronymy in that the extended meaning, though related to, is not inherent to the basic sense.<sup>4</sup>

Productivity is an important concept in this theory. When the relation between two meanings are easily found (namely, productive) among words of the same semantic class, these meanings are treated as meaning facets, which can then be derived by inheritance rules. This makes the representation and processing of language more economical and efficient, since only the semantic information that cannot be derived by rules is listed as sense (distinct semantic entries).

The distinction between senses and meaning facets is therefore based on three aspects: (A) the conceptual domains involved, (B) productivity and predictability of meaning relations, and (C) the linguistic context. We find this model rather apposite in semantic representation and sense calculation because it makes use of a linguistic test--whether two meanings could co-exist in the same linguistic context. Only meaning facets could co-occur in the same linguistic context as aspects of the same sense.

Take *huoguo* for example; it has two senses and three meaning facets under the first sense. The meanings of *huoguo* are represented in (5).

- (5) *huoguo* 火鍋
- **Sense<sub>1</sub>**: HUOGUO *a pot above the fire for cooking*
    - **Meaning facet<sub>1</sub>**: *physical object: hot pot, the container*
    - **Meaning facet<sub>2</sub>**: *the food contained (i.e. soup)*
    - **Meaning facet<sub>3</sub>**: *the person eating the hot pot*
  - **Sense<sub>2</sub>**: HUOGUO *a blocked shot, a term in basketball games*

The advantage of this theory is that it structurally represents all the meanings of a

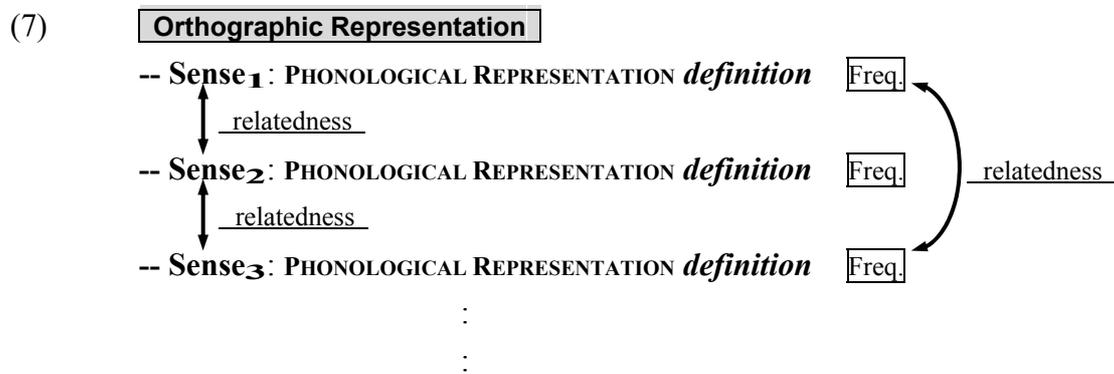
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<sup>3</sup> An instance of meronymic extension is *plum-flowers* in *There are many plum-flowers in the garden*. The plum-flowers stand for the whole plum tree.

<sup>4</sup> Metonymic extensions include: ① agentivization: information media → information creator; ② product instantiation: institution → product; ③ grinding: individual → mass; ④ portioning: information media → information, container → containee, body part → function; ⑤ space mark-up: landmark → space in vicinity, structure → aperture, institution → locus; ⑥ time mark-up: event → temporal period, object → process, locus → duration (Ahrens et al., 1998: 57).

word and the links among the meanings. It allows meanings to co-exist at the facet level, and postulates metonymy and meronymy as links between the facets. It states three applicable tests to decide whether two meanings are senses or facets, and it is conceptually explanatory.

In the calculation of word meanings, we propose to focus on senses rather than meaning facets. Our reason is that senses are the most overt semantic level. Meaning facets are derived by applying the inheritance rules to the senses. Calculating meaning facets is of little significance given that they have to be ascertained only within context, and that similar semantic classes of senses usually have similar extensions of semantic aspects. Incorporating the degree of meaning relatedness within this model, we get the following representation of lexical meanings, and this is the model based on which we further examine the ambiguity advantage effect.



### 5. Ambiguity Advantage Effect

A line of research in the psycholinguistic literature for the past thirty years has been debating the effect of ambiguity advantage during lexical access. This effect predicts that words with a greater number of meanings are recognized faster than those with few meanings. Some research found the effect (Rubenstein et al., 1971; Jastrzembski & Stanners, 1975; Jastrzembski, 1981; Kellas et al., 1988; Millis & Button, 1989; Borowsky & Masson, 1996; Hino & Lupker, 1996), while others did not (Clark, 1973; Forster & Bednall, 1976; Gernsbacher, 1984; Azuma & Van Orden, 1997).

After reviewing the related literature, we found that in the past, researchers have been inconsistent in the following aspects, which may explain why they obtained contradictory results.

First of all, past research has been inconsistent in calculating word meanings. Some researchers (Jastrzembski & Stanners, 1975; Jastrzembski, 1981; Gernsbacher, 1984) rely on the listing of meanings in dictionaries. Dictionary representation of meanings not only varies from dictionary to dictionary, but also provides meanings that are no longer familiar to language users. Lin (1999a), for instance, examines the number of meanings listed in three dictionaries, showing that for the same set of 200

words, the numbers of meanings listed in different dictionaries are significantly different from one another.<sup>5</sup> It is also found that for certain words, the same numbers of meanings across dictionaries do not guarantee the same content of meanings listed.

Most other research gathers meanings from subjects (Rubenstein et al., 1971; Clark, 1973; Forster & Bednall, 1976; Gernsbacher, 1984; Kellas et al., 1988; Millis & Button, 1989; Borowsky & Masson, 1996; Hino & Lupker, 1996; Azuma & Van Orden, 1997). Resorting to subjects for their linguistic knowledge may sound more germane to our purpose of examining language users' semantic knowledge, but then researchers still differ as to the way of calculating the collected meanings. Some researchers calculate the first meanings subjects provided, others the total number of meanings, still others the average number of meanings. Some referred to dictionaries for meaning delimitation; others determined the numbers of meanings subjects provided by intuition. These all render past research rather inconsistent in talking about word meaning and ambiguity advantage. The selection of a word with MANY senses in one research may turn out to be one with FEW senses in another.

Secondly, research in the past has been inconsistent in the types of nonwords used in lexical decision tasks. Some used illegal nonwords, others legal nonwords, still others pseudohomophones.<sup>6</sup> The use of nonwords influences the strategy subjects apply in doing the task, and thus affects the reaction times. When pseudohomophones are used as nonwords, semantic effects are easier to be observed because they are more word-like. This is what Azuma and Van Orden (1997) calls the "nonword effect"--the more word-like the nonwords are, the more difficult it is to make lexical decisions, and the more likely the semantic information of a word would influence lexical decisions. Semantic knowledge is more likely to be activated using legal nonwords instead of illegal nonwords, using pseudohomophones instead of legal nonwords.

Third, meaning relatedness among the meanings is a semantic dimension that may confound the ambiguity advantage effect, but little previous research has taken this into consideration. Jastrzemski (1982) considers the etymological derivations and clusters the meanings of his stimuli. Azuma and Van Orden (1997) collect the rating of semantic relatedness from subjects. No other research has controlled for this variable in their experiments.

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<sup>5</sup> The three dictionaries examined are *Gwoyeuryhbaw Dictionary* 國語日報辭典 (1989), the *Revised Chinese Dictionary* 重編國語辭典(修訂本) (1997), a computerized Chinese dictionary issued by the Ministry of Education of ROC, and *The Warmth Modern Chinese-English Dictionary* 旺文現代漢英辭典 (1997).

<sup>6</sup> *Illegal nonwords* are unpronounceable meaningless words (BFLE, 呖). *Legal nonwords* are pronounceable, meaningless words (BELF, 仁依). *Pseudohomophones* are nonwords that have the same pronunciation as real words (BEAF, 剩立)

Lastly, all previous research uses stimuli of various parts of speech--nouns, verbs, adjectives, etc. Some stimuli themselves embody meanings of various parts of speech. This may also confound the ambiguity advantage effect due to the very different semantic/syntactic attributes different word classes possess.

Therefore, this paper reports the experiment in Lin (1999b), which examines the ambiguity advantage effect based on the definition of senses described in section 4, using pseudohomophones as nonwords, and only Chinese disyllabic nouns as stimuli.

## **6. Experiments and Implications of Lin (1999b)**

This section reports the findings of Lin (1999b) concerning ambiguity advantage effect. There are two experiments, one experiment of off-line sense generation tasks, and one on-line experiment of lexical decision tasks.

### **Sense Generation Tasks**

#### **Subjects**

Three hundred and thirty-six undergraduates (219 females, 117 males) from National Chengchi University participated in the meaning generation task. To keep the linguistic background of subjects homogeneous, all the subjects were native speakers of Mandarin who were exposed to both (and only) Mandarin Chinese and Taiwan Southern Min before the age of seven. They had to rate their general proficiency of Mandarin above 5 (out of 7) to qualify as a native speaker of Mandarin Chinese. Those who did not fit the linguistic criteria were screened out.

#### **Materials**

Two hundred disyllabic Chinese nouns were selected from *The Most Frequent Nouns in Journal Chinese and Their Classification: Corpus-Based Research Series no.4*, published by Chinese Knowledge Information Processing Group (CKIP, 1993). The words used were selected with a view to including 100 potentially ambiguous nouns and 100 potentially unambiguous nouns, and they were all classified only as nouns in the CKIP corpus. The two groups of a hundred nouns were matched for both word frequency and character frequency, according to the CKIP balanced corpus of Mandarin Chinese (CKIP, 1993; CKIP, 1995). The stimulus items (200 in total) were then randomly assigned to ten booklets of twenty words. Each booklet was organized in two random orders. There were 20 different booklets.

#### **Procedure**

The subjects were randomly given a booklet containing a set of instructions, a list of 20 words, and answer sheets (please refer to Appendix 3 for the instructions). Without time limit, the subjects were asked to write down as many meanings as possible for each word by first thinking about the meaning of each word, then using

the word in a sentence, and defining the word as they had used it in the sentence. The subjects took approximately 30 minutes to complete each booklet.

## **Results**

A hundred and thirty-six subjects were screened out because their linguistic background did not fit our criteria. Data from two hundred subjects (126 females, 74 males) were used for analysis. We had an average of twenty subjects providing meanings for each of the 200 words.

Two experimenters independently decided the number of different senses each subject provided for each word, based on the definition of word senses in the lexical semantic theory of Ahrens et al. (1998) and Ahrens (1999).

The *total number of senses*, which included the overall number of distinct senses among the meanings that all subjects generated for each word, was thus obtained. The senses should be provided by at least 15% of the subjects (3 subjects out of 20). This threshold was imposed to avoid idiosyncratic responses. Among the 526 senses collected, 146 of them (27.76 %) were thus excluded.

## **Lexical Decision Tasks**

### **Subjects**

Thirty-four undergraduates (28 females, 6 males) of National Taiwan University with normal or corrected-to-normal vision were paid to participate in the experiment. The subjects were native speakers of Mandarin who were exposed to both (and only) Mandarin and Taiwan Southern Min before the age of seven. They were taken from the same population as those who generated word senses. Subjects were screened for any brain injury that has affected the subject's cognitive ability, or other abnormal neural and mental behavior. None of the students who participated in previous tasks served as subjects in this experiment.

### **Stimulus Materials**

One hundred and forty disyllabic Chinese nouns were selected from the initial set of words to serve as stimuli in the experiment. One hundred and forty pseudohomophones that resembled the sound of real words but differed in word forms were created as nonwords. No characters (i.e. the basic writing units of Chinese) in this experiment would occur more than once.

Forty-eight disyllabic Chinese nouns were selected from the 140 stimulus words for the verification of the ambiguity advantage effect. Half of the words had one sense, and the other half had an average of 3.33 senses ( $SD = 0$ ,  $SD = 0.64$ , respectively). The numbers of sense for the two groups were significantly different ( $t = 17.944$ ,  $p < .000$ ).

The two groups of words were equated for printed word frequency ( $M = 782.41$ ,

$SD = 1998.54$ ;  $M = 784.33$ ,  $SD = 2089.21$ , respectively), character frequency (1<sup>st</sup> character:  $M = 17906.1$  &  $14533.0$ ,  $SD = 15635.8$  &  $14715.4$ ; 2<sup>nd</sup> character:  $M = 12362.7$  &  $12311.3$ ,  $SD = 14807.2$  &  $16650.7$ ) and for experiential familiarity ( $M = 6.78$ ,  $SD = 0.17$ ;  $M = 6.74$ ,  $SD = 0.17$ , respectively).<sup>7</sup> *T*-tests show no significant differences between the printed word frequency ( $t = .003$ ,  $p = .997$ ), character frequency (1<sup>st</sup> character:  $t = -.770$ ,  $p = .445$ ; 2<sup>nd</sup> character:  $t = -.011$ ,  $p = .991$ ), and experiential familiarity ( $t = -1.029$ ,  $p = .309$ ) of the two groups. For the list of stimulus items selected, please refer to the appendix.

### **Procedure**

The subjects were tested individually in a quiet room. They first filled out an information sheet of linguistic background, and then were instructed how lexical decision tasks proceed.

At the beginning of each trial, a fixation point (+) was presented in the center of the screen for 500 msec, after which a stimulus item appeared immediately to the left of the place where the fixation point had been. It remained on the screen for two seconds, or until the subjects responded. The offset of the stimulus item was followed by an interval of 1500 msec before the next trial began. The stimuli were viewed at a distance of about 30 cm. The subjects' attention was focused on the middle of the screen by means of a black mask that allowed only a small word-sized area of the screen to be visible. The subjects were instructed always to keep their hands on the two buttons of the button box, to press the right button (marked 'word') with their right hand if the stimulus was a word, and to press the left button (marked 'nonword') with their left hand otherwise. They were instructed to respond as quickly and accurately as possible. To familiarize the subjects with the task, 20 practice trials (10 words and 10 nonwords) were run prior to the experimental trials. An internal dedicated CPU in the button box measured the time from the presentation of the visual target till a response was made on the button box or 3500 ms had passed, whichever was earlier. The measurements were accurate to the thousandths of a millisecond (.001 ms), and were recorded to the nearest millisecond. The entire experiment lasted 15 minutes.

### **Results**

The data of four subjects (3 females, 1 male) were excluded. One of the subjects was excluded because she made mistakes in more than 10% of trials (including words and nonwords). Another subject was excluded because he complained of excessive tiredness during the experiment. The remaining two subjects were excluded because there was outside interference during the experiment. The results were therefore

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<sup>7</sup> Experiential familiarity for the stimuli was collected in a separate off-line rating. Twenty-eight native speakers of Chinese rated the familiarity of these words on a 7-point scale.

taken from the correct responses to real words of the rest 30 subjects (25 females, 5 males).<sup>8</sup> Response times were faster to words with multiple senses (549 ms,  $SD = 102$ ) than to words with one sense (578 ms,  $SD = 125$ ) ( $p < .001$ ,  $t = 4.753$ ). The mean RTs, standard deviations, and error rates are shown in Table 1.

Table 1. Mean Reaction Times (in ms), Standard Deviations, and Error Rates for the Stimulus Words in the Verification of the NOS Effect

	Number of senses	
	One Sense	Multiple Senses
RT (SD)	578 (125)	549** (102)
Error Rate (%)	3.75	1.81

\*\*  $p < .001$

## Discussion

Our finding confirms the ambiguity advantage effect. Words with more senses are indeed recognized faster. With a careful selection of stimulus items based on linguistic criteria of word senses, the ambiguity advantage effect, which Azuma and Van Orden (1997), rebutted is found in this research.

This finding has several implications: From a linguistic viewpoint, our linguistic model that takes into account the cognitive nature of word meaning and stipulates senses as a basic representation level is psychologically valid. The sense level not only serves as the most salient level subjects depend on in defining words, but makes good processing units for lexical access. From a psycholinguistic viewpoint, ambiguity advantage effect does exist at the sense level. Our next challenge will be to account for such an effect during lexical access in a psycholinguistic model of lexical processing.

## 7. Conclusion

In this paper, we emphasize that in conducting psycholinguistic research on word meanings, lexical semantic and cognitive linguistic considerations are indispensable. They help design rigorous experiments and clarify the focus of research. Concerning the ambiguity advantage effect, specifically, we need to understand what is the meaning we are looking at. Only in this way can we claim that ambiguity advantage effect does or does not exist at a certain semantic level. This paper shows that ambiguity advantage effect exists when meanings are defined as senses according to Ahrens et al. (1998). The methodology depicted in this paper should have implications for further research on the psychological aspect of word meaning.

<sup>8</sup> "Correct responses" refer to pressing the 'word' button when seeing a real word on the screen.

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**Appendix:** Words used to verify the advantage ambiguity effect in the lexical decision tasks.

Word	PinYin	Total No. of Senses	Frequency		Familiarity	RT	
			Word	Character 1 Character 2			
<b>Words with One Sense</b>							
前妻	<i>qianqi</i>	1	37	50655	1881	6.68	558.5
車速	<i>chesu</i>	1	62	28603	6341	6.82	657.2
法官	<i>faguan</i>	1	688	45901	10246	6.86	557.1
居所	<i>juxuo</i>	1	24	5995	43444	6.79	652.0
清晨	<i>qingchen</i>	1	621	11820	3263	6.89	547.2
勁敵	<i>jindi</i>	1	22	1044	751	6.89	707.8
睡眠	<i>shuimian</i>	1	49	830	251	6.86	512.3
心願	<i>xinyuan</i>	1	125	25445	5816	6.86	505.0
體能	<i>tineng</i>	1	90	17092	37889	6.71	587.9
石塊	<i>shikuai</i>	1	75	5765	1224	6.82	538
感觸	<i>ganchu</i>	1	56	8291	1724	6.75	605.3
設備	<i>shebei</i>	1	2312	22012	9974	6.93	541.1
作物	<i>Zuou</i>	1	151	37130	11847	6.07	672.8
政府	<i>zhengfu</i>	1	8823	43968	25629	6.64	499.9
其他	<i>qita</i>	1	4723	32547	49438	6.89	531.2
外號	<i>waihau</i>	1	25	34509	10473	6.89	524.8
請帖	<i>qingtie</i>	1	12	12274	60	6.75	669.9
證件	<i>zhengjian</i>	1	230	11413	11783	6.86	590.1
聯考	<i>liankao</i>	1	192	13277	10049	6.82	533.1
雨傘	<i>yusan</i>	1	33	2176	192	6.93	549.6
傷勢	<i>shangshi</i>	1	114	5595	10155	6.71	572.4
鋼筋	<i>gangjin</i>	1	97	2148	448	6.68	656.7
真理	<i>zhenli</i>	1	124	6088	36671	6.79	591.6
班級	<i>banji</i>	1	93	5168	7156	6.89	552.1
<b>Mean</b>		<b>1</b>	<b>782.42</b>	<b>17906.1</b>	<b>12362.7</b>	<b>6.78</b>	<b>577.6</b>
<b>Words with Multiple Senses</b>							
經典	<i>jingdian</i>	3	37	41024	2122	6.75	530.2
兩極	<i>liangji</i>	3	74	20654	7463	6.68	633.4
黃金	<i>huangjin</i>	3	688	11608	24968	6.75	555.8
跳板	<i>tiaoban</i>	3	24	1445	2750	6.71	568.2
呼聲	<i>husheng</i>	4	122	2606	6615	6.86	586
牛郎	<i>niulang</i>	4	22	2119	1214	6.71	529.0
杜鵑	<i>dujuan</i>	3	46	948	50	6.75	544.2
明日	<i>mingri</i>	3	126	22207	63985	6.82	579.4
斷層	<i>duanceng</i>	3	90	4616	4337	6.68	582.5
小弟	<i>xiaodi</i>	5	76	25415	2060	6.61	503.5
低潮	<i>dichao</i>	3	51	8015	2146	6.75	549.2
精神	<i>jingshen</i>	3	1934	5319	5566	6.89	487.1
同志	<i>tongzhi</i>	3	151	28913	3051	6.82	502.9
單位	<i>danwei</i>	3	8928	16036	24829	6.86	510.7
地方	<i>difang</i>	3	5570	55300	51247	6.89	498.3
家教	<i>jiajiao</i>	3	25	34730	17010	6.82	537.2
少爺	<i>shaoye</i>	3	12	15886	365	6.64	565.7
學院	<i>xueyuan</i>	3	217	28205	20539	6.86	506.8
格局	<i>geju</i>	3	188	8761	30181	6.36	572.2
輪廓	<i>lunkuo</i>	3	30	2259	50	6.68	585.6
逃兵	<i>taobin</i>	3	113	3374	2669	6.68	552.4
靈魂	<i>linghun</i>	5	93	1360	303	6.89	527.5
龍頭	<i>longtou</i>	4	114	5681	12144	6.64	629.0
頻率	<i>pinlyu</i>	4	93	2310	9806	6.61	543.3
<b>Mean</b>		<b>3.33</b>	<b>784.33</b>	<b>14533.0</b>	<b>12311.3</b>	<b>6.74</b>	<b>548.7</b>