The Structure of Polysemy:
A study of multi-sense words based on WordNet

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Abstract

The issues in polysemy with respect to the verbs in WordNet will be discussed in this paper. The hypernymy/hyponymy structure of the multiple senses is observed when we try to build a bilingual network for Chinese and English. There are several types of polysemic patterns and a co-hypernym may have the same word form as its subordinates. Fellbaum (2000) dubbed autotroponymy that the verbs linked by manner relation share the same verb form. However, her syntactic criteria seem not compatible to the hierarchies in WN. Either the criteria or the network should be reconducted. For most verbs in WN 1.7, polysemous relations are unlikely to extend over 3 levels of *IS-A* relation. Highly polysemous verbs are more complicated and may be involved in certain semantic structures. Semi-automatic sense grouping may be helpful for multimlinguital information retriveal.

1. Introduction

WordNet (WN), which is a large scale, domain-dependent semantic network of English words, provides a broad-coverage of lexical information. It represents a system of semantic relations among words, between words and synsets[1], and between synsets themselves (Miller, 1990, 1995). Two features of the system are concept definitions and an inheritance hierarchy of concept types. Rather than using lexical entries only, the design is based on linguistic theories about cognitive organization of natural languages. English nouns, verbs, adjectives, and adverbs are arranged to synsets that are in turn linked through semantic relations such as antonymy, hypernymy, etc.

Like other conventional dictionaries and thesauri, WordNet also provides different meanings for one word. The lexicographic database represents a complex linguistic structure in which a word form may carry multiple senses. These word senses that are related in systematic ways build different synsets for each sense of a word. A word meaning then, is the pairing of a word form with a synset. However, WordNet's sense distinctions are more fine-grained than other machine-readable dictionaries, resulting in abundant polysemy and difficulty of computation (Kilgarriff 1997).

In this paper, we will pay particular attention to the issues in polysemy with respect to the verbs in WordNet 1.7 and attempt to find a typical hypernymy/hyponymy structure for the multiple senses of a word form. In the following sections we will briefly overview the verb hierarchies in WN and illustrate the patterns of sense clusters. The types of autotroponymy will be discussed as well.

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[1] A set of synonyms refering to the same concept is called a synset. Members of synsets may be simple words or compounds.

2. Hierarchical Organizations of Verbs

The most important semantic relation in WordNet is hypernymy/hyponymy that links general and more specific concepts in both directions. The hierarchies are built not only for individual words but also synsets, from more general hypernyms to specific hyponyms or from more specific hyponyms to general hypernyms. A given concept thus inherits all the information from its more general superordinate via the tree diagram. This is helpful for sense disambiguation when a word form has more than one sense. A distinction can be drawn between the general and the more specific concepts.

2.1 Entailment and Troponymy

Only nouns and verbs are organized into the lexical hierarchies in WordNet. For example, a terrier is a kind of dog. The noun *terrier* inherits the properties of the noun *dog* but has a more specific concept and therefore is a hyponym of *dog*. On the other hand, it is not easy to arrange verbs into the is-kind-of tree structures of nouns and not all verbs can be grouped under a single top node or unique beginner (UB). Since the organization of verbs in semantic memory differs from the organization of

Table 1. The relations found in WN for nouns and verbs

Semantic Relation	Noun	Verb
Similar relation	Synonymy	
Opposite relation	Antonymy	
Superordinate-Subordinate relation	Hypernymy	
	Hyponymy	Troponymy
Part-whole/manner relation	Holonymy	Entailment
	Meronymy	Cause

(From WordNet. Fellbaum 1998)

nouns, the semantic distinction between two verbs is different from that of two nouns in a hypernymy/hyponymy relation. The is-kind-of relation between nouns that makes the hierarchical relation explicit is comparable to the is-manner-of relation between verbs on the basis of entailment associated with temporal inclusion. This is expressed as the relation of troponymy that is the most frequently found relation among verbs (Fellbaum and Miller, 1990). The manner relation is polysemous and many different semantic elements are hidden behind the label 'manner' (Fellbaum 2000). Table 1 shows that troponymy is the verbal equivalent of hyponymy and entailment is the verbal equivalent of holonymy.

The verb hierarchies are constructed based on the troponymy relation but the semantic organization of verbs is more complex than the semantic organization of nouns because troponymy is a particular kind of entailment (Fellbaum, 1990; Fellbaum & Miller 1990). This involves temporal co-extensiveness for the two verbs. Take the verb *reason* and *think* for example. It is acceptable to say that *reason* is a troponym of *think* because to *reason* is to *think* in a particular way (i.e. logically). On the other hand, thinking is part of the definition of reasoning because the troponym *reason* inherits the properties of the hypernym *think* and thus entails *think*. When one reasons he must think in some ways

Fig 1. Three kinds of relations between verbs
(From Fellbaum and Miller, 1990)

at the same time. The pair of the verbs is coextensive. Figure 1 shows the relations among three kinds of lexical entailments between English verbs. Note that verbs related by entailment and proper temporal inclusion is not possible to be related by troponymy (e.g. snore and sleep).

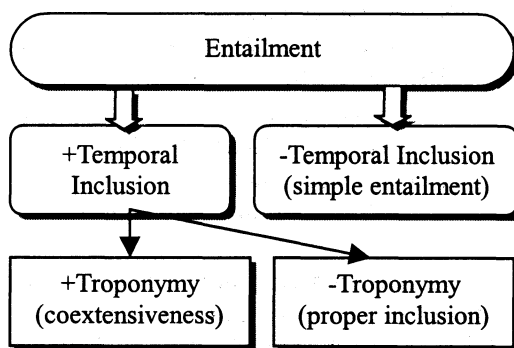## 3. Sense Clusters of Polysemous Verbs

In WN, verbs are organized into senses based on synsets and other verb features such as entailment and polysemy. There are fewer verbs than nouns in English but verbs are approximately twice as polysemous as nouns (Fellbaum, 1990). As we mentioned, sense distinctions in WN are too fine-grained and therefore results in excessive polysemy. The relations of the extended senses can be categorized in several types and the phenomena are illustrated in the following subsections. These patterns of sense clusters can be done automatically.

3.1 Sisters

The word senses are called sisters if two or more word senses share the same hypernym. Examples are listed in the following[2]. In (1a) and (1b), both senses of *see* have {visit, call in, call} as their direct hypernym:

(1a) see[11] --{*see*}-- go to see for professional or business reasons; "You should see a lawyer"
(1b) see[12] --{*see*}-- go to see for a social visit; "I went to see my friend Mary the other day"
@→ {visit, call in, call}-- pay a brief visit; "The mayor likes to call on some citizens"

Some sister senses have quite close meanings as (2a) and (2b) illustrated:

(2a) cook[1] --{*cook*}-- prepare a hot meal; "John doesn't cook"
(2b) cook[2] --{*cook*, fix, ready, make, prepare}-- prepare for eating by applying heat;
    "Cook me dinner, please"
@→ {create from raw material, create from raw stuff}-- make from scratch

However, the definition of the sisters can be quite different:

(3a) flash[2] --{*flash*}-- appear briefly; "The headlines flashed on the screen")
(3b) flash[8] --{*flash*}-- emit a brief burst of light; "A shooting star flashed and was gone."
@→ {appear} -- come into sight or view; "A new star appeared on the horizon"

The sister relation can be still validate when more than two senses of a word share the same hypernym although the senses belong to different synsets:

(4a) eat[2] --{*eat*}-- eat a meal; take a meal; "We did not eat until 10 P.M."
(4b) eat[1] --{*eat*}-- take in solid food; "She was eating a banana"
(4c) eat[3] --{feed, *eat*}-- take in food; used of animals only: "What do whales eat?"
@→ {consume, ingest, take in, take, have}-- serve oneself to, or consume regularly;
"I don't eat chicken"
(5a) dance[1] --{*dance*}-- move in a graceful and rhythmical way
(5b) dance[2] --{*dance*, trip the light fantastic}-- move in a pattern; usually to musical
    accompaniment; do or perform a dance
(5c) dance[3] --{*dance*}-- skip, leap, or move up and down or sideways; "He danced with joy"
@→ {move}-- move so as to change position, as of a body part (nontranslational motion):
    "He moved his hand slightly to the right"

Note that a particular word may exhibit more than one kind of sister relation and it may be one of the most frequent word. For example, there are two types of sister relation for the verb *bring*. (6a), (6b), and (6c) have {change, alter} as the hypernymic synset while (6d) and (6e) are the troponymic synset of {make, create}.

(6a) bring[2] --{*bring*}-- cause to come into a particular state or condition: "Bring water to me"
(6b) bring[5] --{*bring*, land}-- bring into a different state; "This may bring you in jail"
(6c) bring[8] --{lend, impart, bestow, contribute, add, *bring*}-- of a quality, as in:
    "She brings a special atmosphere to our meetings"

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[2] @ → stands for the symbol code of hypernymy.

@→ {change, alter}-- cause to change; make different; cause a transformation; "The discussion has changed my thinking about the issue"

(6d) bring[3]-- {*bring*, work, play, wreak, make for} -- cause to happen or to occur as a consequence; "The rain brought relief to the drought-stricken area"

(6e) bring[7]-- {institute, *bring*} -- advance or set forth in court; "bring charges "

@→ {make, create} -- make or cause to be or to become; "make a mess in one's office";

WN has 2508 sisters and 1176 of them are verbs. No matter how many word senses share the same hypernym and how many types of sister relation a word may have it is true that the sister senses share the meaning of the direct co-hypernym and inherit its property.

3.2 Twins

Synsets in WN that have identical members are called twins. For example, the twin synsets {tune, tune up} have exactly the same hypernym although the meanings are extended in different ways (Fig. 2). Certain synsets are twins due to the spelling variation such as *idealize* and *idealise*. However, some twins do not have direct co-hypernym as Fig. 3 shown. The nominal components are different but the activities are quite similar. In addition, some twins have distinct meanings. In the example below, the meanings are defined as 'be used by; as of a utility' and 'mate with', respectively.

(7a) serve[4] -- {serve, service}

(7b) serve[12] -- {serve, service}

There are also diathesis alternations between twins as (8a) and (8b) illustrated:

(8a) tauten[1] -- {firm, tauten}
-- become taut or tauter

(8b) tauten[2] -- {firm, tauten}
-- make taut or tauter

There are total 1457 twin synsets in WN and 295 of them are verbs[3]. At most, twin synsets are able to have 4 members in common. Basically, the twins can be treated as a group in that the members of the synsets have similar usages.

Fig. 2. The hierarchy of the twin synsets {tune, tune up}.

Fig. 3. The hierarchy of the twin synsets {feather, square}.

3.3 Child

Because the superordinate synset may have the same lexicon entry as its subordinate synset it is possible that the hypernymy/troponymy relation may link the multiple senses of a polysemous verb. For example, Fig. 4 shows the relation of the two senses of *think*. Both meanings involve judgments but the latter sense is more specific: *think* in "*I think Mary is smart*" means 'judge or
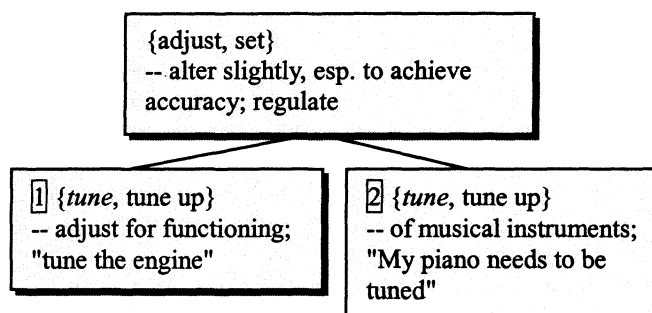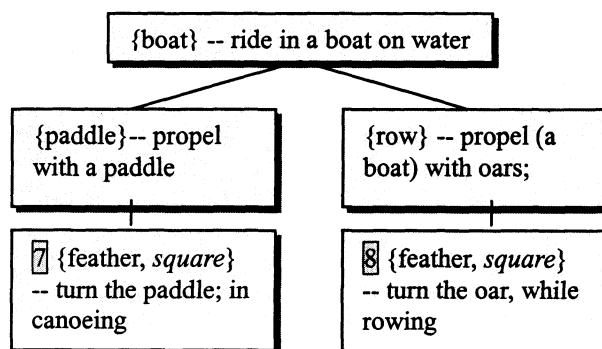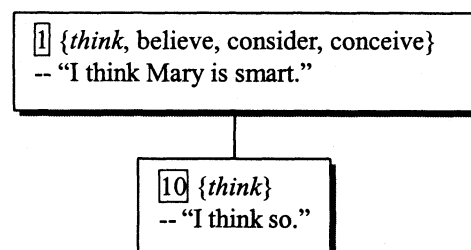

Fig.4. The simple tree of the two senses of the verb *think*.

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[3] Especially thank Jia-Ming You, CKIP for the work.

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regard', whereas in "*Think hard*" it means 'focus one's attention on a certain state' and it has concentration sense. When one says "*I think Mary is smart*" he forms an opinion of the person Mary and believes it. When one says "*I think so*" he has an opinion on "*I think Mary is smart*" and disposes the mind in a certain way. According to Pustejovsky (1995), the multiple senses of a word that have overlapping, dependent, or shared meanings have some systematic relations. The lexical category and form does not change. Furthermore, the conceptual context of a word should be taken into account to clarify its meaning. Fellbaum (2000) has generalized some principles of polysemy and lexicalizations for verbs. The lexicalization of verbs mainly depends upon the predictability of meanings in the context. That is to say that verbs which can yield predictable meanings may not require distinct lexicalizations. There are some examples of child relation listed below:

(9a) dress[4] --{*sing*}-- dress in a certain manner "She dresses in the latest Paris fashion."

@→ (9b) dress[1] --{*sing*}-- put on clothes "She is not dressed."

(10a) sing[1] --{*sing*}-- deliver by singing; "Sing Christmas carols"

@→ (10b) sing[2] --{*sing*}-- produce musical tones with the voice; "She was singing"

This leads to the generalization that the hypernymic sense includes the troponymic senses. Usually the troponym has a more specific meaning which bears an extra feature that the hypernym does not have and may have a specific usage.

3.4 Chain

It is also possible that more than two senses share a hypernymic/troponymic chain and all of them share the same word form. Very few words have a chain-like sense structure as Fig. 5 shown. There are nine senses of *fit* and three of them share the same hypernymic chain. This shows that the senses are very similar in semantic coverage and the troponym is used in a specific domain. There are only three verbs found in WN 1.7: *fit*, *lay*, and *make*. The verb *make* have two types of chain structure. Many multiple senses of a polysemous verb have more than 2 levels of troponymy relation but the members of the intermediate synsets do not have the same verb form.
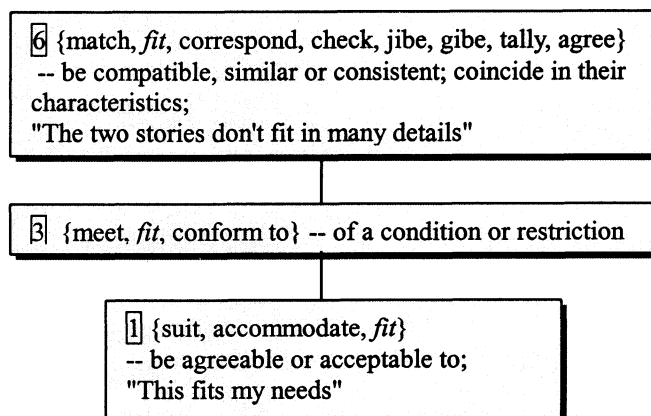
6 {match, *fit*, correspond, check, jibe, gibe, tally, agree} -- be compatible, similar or consistent; coincide in their characteristics; "The two stories don't fit in many details"

3 {meet, *fit*, conform to} -- of a condition or restriction

1 {suit, accommodate, *fit*} -- be agreeable or acceptable to; "This fits my needs"

Fig.5. The chain of the three senses of the verb *fit*.

3.5 Triangle

A triangle is that the sister senses have a co-hypernym which shares the same word form as the sisters. Figure 6 shows that two of the five senses of *happen* are related and assigned to their co-hypernym sense to build a triangle structure for the word form *happen*. Here we list the 5 senses of the verb *happen*:

1. *happen*, hap, go on, pass off, occur, pass -- come to pass; occur
2. *happen*, befall, bechance -- happen, occur, or be the case in the course of events or by chance
3. *happen* -- chance to be or do something, without intention or causation
4. *happen*, materialize -- come into being;

1 {*happen*, hap, go on, pass off, occur, pass, come about, take place} -- "What is happening."

2 {*happen*, befall, bechance} -- "It happens that today is my birthday."

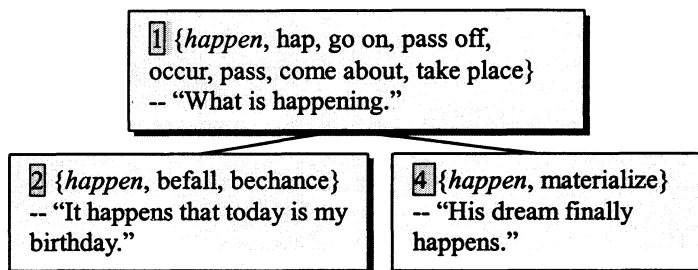4 {*happen*, materialize} -- "His dream finally happens."

Fig. 6 The triangle structure of the verb *happen*.

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become reality

5. find, *happen*, chance, hit, bump, encounter -- come upon, as if by accident; meet with

Sometimes a sense tree may be more complex than the patterns described above. In general, WordNet does not explicitly specify how the multiple senses are related. Different senses are distinguished but WN seldom indicates that the multiple senses are related. It is not easy to detect the sense arrangements without notification.

4. Analysis of Polysemic Patterns for the multiple senses

In section 3, we illustrate the phenomena of sense clusters and several patterns emerged although they are not productive. Table 2 shows the count of cluster patterns. This should specify for a particular usage of a particular sense of a word in a particular synset. The multiple senses may be extended in such patterns and express the polysemic structure of a word. In order to search a co-hypernym that share the same verb form as its troponyms the relations are defined as *SIS*, *IS-A₁*, *IS-A₂*, *IS-A₃*, and *IS-A₄* relation. Here *SIS* denotes that the two senses are sisters that have the same hypernym. $IS\text{-}A_i$ denotes that the two senses of a polysemous verb have i level(s) of troponymy-hyponymy relation.

Table 2. The number of sense clusters in WN

Cluster patterns	Cluster count
Sisters	1176
Twins	295
Child	250
Chain	3
Triangle	11

The source is WordNet 1.7[4] in which six kinds of semantic relations among verbs are defined. Table 3 shows the count of the semantic relations with symbol codes. To discover the desired relations, we select candidates for different levels of $IS\text{-}A_i$ relation. Table 4 shows the number of the candidate relations in different levels.

Table 3. The number of synsets with different semantic relations.

Relation	Symbol	Count
Hypernym	@	12154
Troponym	~	12155
Antonym	!	1075
Entailment	*	426
Cause	>	216
Also see	^	611
Total		26627

Table 4. The number of candidate relations.

Level of Relation	Count
IS-A₁ Relation	12155
IS-A₂ Relation	9103
IS-A₃ Relation	5355
IS-A₄ Relation	2562
IS-A₅ Relation	1178

While looking for the semantic relations of different synsets the words are selected for polysemy count. 10806 verbs are found in WordNet and 5955 of them are monosemous. Among the 4851 polysemous verbs there are a total of 17319 senses and the average of sense number is 3.57 (c.f. Table 5).

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[4] The latest version WN 1.7 released in July, 2001.

Table 5. Word count and Sense count of verbs in WN 1.7

Polysemy count		Word count	Sense count
Monosemy	(1)	5955	5955
Polysemy	(>1)	4851	17319
	2	2344	4688
	3	1037	3111
	4	540	2160
	5	336	1680
	6-10	459	3302
	11-20	100	1310
	20+	35	1056
Total		10806	23274
Average Sense Number = 3.57 (For polysemous verbs only)			

Then the polysemous verbs are selected to examine whether the two senses of a verb form an $IS\text{-}A_i$ relation. Table 6 shows that the total number of the verbs decreases as the degree of relation complexity increases. Only 2 of 416 (0.48%) verbs have $IS\text{-}A_4$ relation. On the other hand, $IS\text{-}A_1$, $IS\text{-}A_2$, $IS\text{-}A_3$ can be found in any group of the polysemous verbs. Compared with Table 6a, all of the 35 verbs that have more than 20 senses have $IS\text{-}A_i$ relation and the level count is 76. This reveals that the more polysemous a verb is the more complicated sense structure it has.

Table 6. The number of the polysemous verbs in different levels of relation.

Polysemy Count	Level of Relation				Total
	$IS\text{-}A_1$	$IS\text{-}A_2$	$IS\text{-}A_3$	$IS\text{-}A_4$	
2	32	8	3	1	44(10.58%)
3	31	11	1	0	43(10.34%)
4	20	10	1	0	31(7.45%)
5	26	14	2	0	42(10.10%)
6-10	80	32	6	0	88(21.15%)
11-20	42	10	3	0	52(12.50%)
20+	45	31	6	1	76(18.27%)
Level Count	276 (66.35%)	116 (27.88%)	22 (5.29%)	2 (0.48%)	416
Note: There is no word found in $IS\text{-}A_5$ level.					

Table 6a. Word count of the polysemous verbs

Word count (From Table 4)
2344
1037
540
336
459
100
35
Total: 4851

When we go through the 4851 polysemous verbs 11 verbs are selected because of the triangle structure (see 3.5). Only three words have a polysemy structure more complicated than a triangle: travel, think, and make.

4.1 Autotroponyms in WordNet

It is unusual that the verbs linked by manner relation share the same verb form and this is called autotroponymy (Fellbaum 2000). Fellbaum distinguishes several kinds of autotroponymy on the basis of syntactic criteria. Some verbs exhibit autotroponymy that the troponyms conflate with a component that distinguishes them from their hypernyms. Therefore, the nouns, verbs, or adjectives are conflated to yield new word meanings. However, not all of her examples match the hierarchies of polysemous verbs in WN.

First, denominal verbs may have an autotroponymy relation between the multiple senses. Example are illustrated in (11a) and (11b). In WN, the two senses of *furnish* are each other's hypernym or hyponym. The superordinate sense furnish[1] does not include the nominal component which the verb is based and the more specific sense furnish[2] keep the meaning of the noun.

(11a) furnish[1] --{supply, provide, render, *furnish*}-- provide or furnish with; "We provided the room with an electrical heater"

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@ → (11b) furnish[2] --*{furnish}*-- provide or equip with furniture:
"We furnished the house in the Biedermeyer style"

Another example *sail*, on the other hand, have different hypernymic synsets that have the same members.

(12a) sail[1] --*{sail}*-- travel by ship on (a body of water); "We sailed the Atlantic"
@→ {travel, journey} -- travel upon or across; "travel the oceans"
(12b) sail[4] --{voyage, *sail*, navigate}-- travel by boat
@→ {travel, journey} -- travel as for pleasure and sightseeing; go on travels

The second type of autotroponymy is the conflation of superordinate argument. Fellbaum points out that that intransitive sense of a verb denotes an activity itself while transitive use of a verb has an accomplishment reading. However, the verbs displayed as sisters in the WN hierarchies. The sentences are listed in the following to compare with (2a), (2b), (4a), (4b), (5a), (5b), respectively. Note that the *cook* and *eat* in (13c) and (14c) have a second transitive accomplishment reading by a particular adjunct phrase but they are not treated as extra senses in WN.

(13a) Mary cooked. (=Mary cooked a meal.)
(13b) Mary cooked lunch/ dinner.
(13c) Mary cooked (in an hour).
(=Mary cooked a meal.)
(14a) Mary ate.
(=Mary ate some food/a meal.)
(14b) Mary ate an apple/orange.
(14c) Mary ate (in an hour).
(=Mary ate a meal.)
(15a) Mary danced.
(15b) Mary danced a Tango/Waltz.

(2a) cook[1]-- prepare a hot meal
(2b) cook[2]-- prepare for eating by applying heat
@ → {create from raw material, create from raw stuff}-- make from scratch
(4a) eat[2]-- eat a meal; take a meal
(4b) eat[1-- take in solid food
@ → {consume, ingest, take in, take, have}-- serve oneself to, or consume regularly; "I don't eat chicken"
(5a) dance [1]-- move in a graceful and rhythmical way
(5b) dance [2]—move in a pattern; usually to musical accompaniment;do or perform a dance
@→ {move}-- move so as to change position, as of a body part (nontranslational motion): "He moved his hand slightly to the right"

The only compatible pattern is that the conflated noun arguments that are part of the verbs' meanings are very specific. Cases such as *cater* and *expect* have a hypernymy/troponymy relation found in WN:

(16a) The Chinese restaurant catered.
-- cater[2] --*{cater}*-- supply food ready to eat; for parties and banquets
@ → (16b) The hostess catered lunch for all the guests.
-- cater[1] --{provide, supply, ply, *cater*}-- provide what is desired or needed, esp. support, food or sustenance
(17a) She is expecting (in March).
-- expect[6] --*{expect}*-- look forward to the birth of a child
@ → (17b) She is expecting visitors.
-- expect[3] --*{expect*, look, await, wait}-- look forward to the probably occurrence of

These troponyms have a very specific reading category of objects. Another similar example is *pour*. The conflated noun in (18a) is more specific than the one in (18b):

(18a) pour[3] --{decant, *pour*, pour out}-- pour out; of wines or sherry
@ → (18b) pour[1] --*{pour}*-- cause to run; of liquids

However, there are still exceptions as (19a) and (19b) illustrated. The two sense of *drink* are sister senses in WN:

(19a) drink[1] --*{drink*, imbibe}-- take in liquids
(19b) drink[2] --*{drink*, booze, fuddle}-- consume alcohol

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@ → {consume, ingest, take in, take, have}-- serve oneself to, or consume regularly

As for Stimulus Subject Perception Verbs[5] (Levin 1993), *smell* is the sepecial case that fits Fellbaum's generalization and WN hierarchy. The adjective is the bad pole of a scale that has good and bad as its endpoints.

(20a) smell[3] --{smell}-- smell bad; "He rarely washes, and he smells"

@ → (20b) smell[2] --{smell}-- emit an odor; "The soup smells good"

Taste is another example that fall into the WN hierarchy but it allows a conflated noun instead of an adjective:

(21a) taste[4] --{smack, taste}-- have a distinctive or characteristic taste; "This tastes of nutmeg"

@ → (21b) taste[1] --{taste, savor, savour}-- have flavor; taste of something

Finally, Fig. 7 shows the conflation of adverbials but this only explains one kind of sense extension. The co-hypernymic sense serves as the core meaning of the triangle and the sister hyponymic senses should share the meaning of the hypernymic sense. In this case, there is an auto-relation between the senses. The hyponymy senses *impress*[2] entails *impress*[1] in a particular way. It is clear that the senses are related via troponymy. Another example of autotroponymy is *dress* shown in (22a) and (22b) but the conflated adverbs have a blur meaning coverage:

(22a) Did you dress warmly/well?

(22b) Do we have to dress on Saturday?

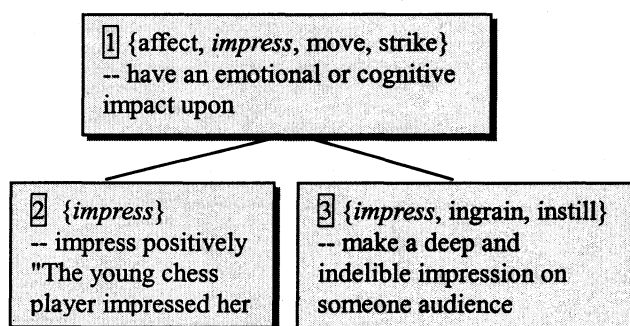(=Do we have to dress formally/well?)

Fig. 7. The triangle structure of the verb *impress*.

(9a) dress[4] -- dress in a certain manner
"She dresses in the latest Paris fashion."

@ → (9b) dress[1] -- put on clothes
"She is not dressed."

As the examples examined above, the semantic of the conflated nouns, verbs, adjectives, or adverbials cannot be the only criteria for the verb hierarchies in WN. There are more constraints that distinguish the extended senses from the hypernyms.

5 Conclusion

There is no agreement among lexicographers and proficient speakers in dividing the semantic contents of polysemous words into distinct senses (Fellbaum 1995). In Jorgenson's (1990) research, 'linguistically naive speakers' consistently refuse to recognize more than about three senses. Table 5 shows that the average sense number is 3.57 and this suggests that the speakers cannot divide up the conceptual space as finely as the lexicographers hade done in different dictionaries.

There are several types of senses clusters but it seems that there are few cases consistent with the assumption that the multiple senses may have a co-hypernymy structure. More than 99% of the polysemous verbs have less than 4 levels of *IS-A* relation. This indicates that polysemy relations are unlikely to extend over 3 levels of *IS-A* relations. The more complicated relation such as *IS-A₄* and above should be ignored for investigating polysemy relation.

It is believed that the more polysemous verbs may have more complicated polysemy structures.

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[5] The verbs of the same category are feel, look, smell, and taste.

This is to say that the structured polysemy is important to the understanding of highly polysemous verbs. Fellbaum distinguishes several kinds of autroponymy that the multiple senses linked by manner relation share the same verb form. However, the autroponymic patterns are not compatible to the sense hierarchies in WN. An alternative explanation should be brought out in different aspects.

Future work is to reduce the excessive polysemous senses to achieve a minimal set of senses used in the context. A semantic network like WN can help distinguishing different word senses for information retrieval and identifying conceptually related terms. We should try to avoid the proliferation of meaning distinctions for nouns and verbs from the beginning of the wordnet building because not all sense distinctions in a lexical database are meaningful for multilingual information retrieval. When the original set of polysemous search words is being extended from the synset in WordNet the query results are enormously interfered in retrieval. Grouping the structured multiple senses may be useful to extend the WordNet hierarchies for other languages although it needs to be done semi-automatically to avoid overgeneralization. The level of ambiguity will be reduced from coarser sense distinctions and the degree of polysemy for nouns and verbs can be reduced. It is possible to apply selective query expansion by simply including synset members from relevant word senses of the search word.

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