The Delineation of ‘Throw’ Verbs in Mandarin Chinese: Behavioural and Perceptual Approaches

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Within a semantic domain, terms that can be used in a similar way to describe a similar event are members of the same class of words, or near-synonyms. They are common in a language but difficult to distinguish from one and another. Physical action verbs such as ‘throw’ verbs are a typical example of this. In this study we attempted to distinguish six Chinese ‘throw’ verbs (rēng, diū, pāo, tóu, shuāi, shuǎi) from each other within the framework of cognitive semantics. Two experiments were conducted with two groups of native Chinese speakers (60 participants in total) to examine their behavioural and perceptual responses to the throwing actions that can be typically described by each of the six verbs. The results show that the verbs the participants enacted revealed differences in terms of dimensional features. Further, visual input about the verb enacted, successfully elicited the participants’ responses corresponding to the semantics of each individual verb. Typical actions and differences between five dimensions were used as discriminative features of the verbs. The validity of action performance as a paradigm for verb meaning specification was verified.

Keywords: *cognitive semantics, mental representation, near-synonym, perception, throw verbs*

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1. Introduction

One important component of semantic organization is the hierarchical relationships between words, with a superordinate category (such as *animals*), a basic level (such as *birds*), and subordinate concepts (such as *chickadees* or *ravens*) (Collins & Loftus, 1975; Collins & Quillian, 1972; Warrington, 1975). In everyday discourse, speakers often use basic level words unless they wish to make a semantic distinction (such as precision) and/or a discursive point, such as emphasis or illustration (Downing, 1980). The lexical choice at the subordinate level can impact both the semantic and the pragmatic interpretation. For example, to have one's house invaded by *chickadees* might be mildly annoying but to have one's house invaded by *ravens* could be ominous.

In terms of lexical semantics, different phonological words that have the same or very similar meanings are referred to as synonyms (Saeed, 2009). All languages have such pairs of words, *large* and *big*, *couch* and *sofa* in English, tiělù 'steel road' and *tiědào* 'steel street', *tōngchàng* (literally: through smooth) and *chàngtōng* 'unobstructed' (literally: smooth through) in Chinese. However, there are not many such pairs in a language that share truly the same meanings. At the subordinate level, more words that have similar meanings are found to be near-synonyms, terms that can be used in a similar way to describe a similar event are members of the same class of words. Their meanings can be very similar, but not identical; not fully inter-substitutable, but instead "varying in their shades of denotation, connotation, implicature, emphasis, or register" (DiMarco, Hirst, & Stede, 1993), like *mother* and *mommy* or *emerald green* and *forest green*. Such word pairs often have different distributions along a number of parameters. For example, *drunk* and *sloshed* in English and *kàn* 'look' and *wàng* 'look' in Chinese differ either in focus of meaning representation or in pragmatic functions. For the 'throw' verbs in Chinese, for example, the two words, *pāo* and *shuǎi* can be classified as near-synonyms because they share major semantic properties of the word class. At the same time they can be discriminated from each other by the characteristics of the patient objects that the two action verbs can be associated with; that is, they can be distinguished by a type of non-denotational distinction: the patient objects of *pāo* can often be heavy in weight; and *shuǎi* almost involves a whipping or thrashing motion such that a certain flexibility or even elasticity is implied of its patient objects.

Usually near-synonyms yield sentence constructions that require similar agentive subjects and patient objects. Their sentence constructions can be exactly the same, but truth-conditions for patient objects can be different. Yet the differences do not destroy the synonymy as they are minor and/or backgrounded. They can also be termed as "plesionyms", a term used by Cruse (2000: 158) in contrast to the identical synonyms that he terms as "cognitive synonyms". To illustrate the meaning differences between a pair of plesionyms, Divjak (2010:4) used *kill* and *murder* in the sentence "*He was killed, but I can assure you he was not murdered*" as an example to make a contrast between a pair of cognitive synonyms such as *die* and *kick the bucket*. The sentence shows that the two words *kill* and *murder* expressed the same causative result but the focuses in the expressions of the intentional actions and manners can be understood as being different. This can be applied to the six near-synonyms in Chinese we studied. In the same manner, we can say, for example, *tā bù shì bǎ qiú rēng jìn lán lǐ de, shì diū jìn qù de* 'He did not just throw the ball into the basket but tossed it in. 他不是把球扔进篮里的，是投进去的。' These examples show that language speakers' physical experience of conducting the actions is conceptualized in the encoding of the nuances of near-synonynous pairs. Differences in construal of an experience, or "construing the world" (Geeraerts, 2006:4) may affect the encoding of the semantic features based on which words are acquired.

Speakers' knowledge of near-synonyms is assumed to be organized by the knowledge of relations between the meanings of constructions. It is noted that near-synonyms can often be used in the same syntactic frame (e.g., *lob* and *hurl* are near-synonyms and someone could *lob a ball* or *hurl a ball*), the distinction between near-synonyms must be related to the meanings of the words themselves. In other words, speakers must detect semantic differences between near-synonyms. The purpose of the present study is to explore reliable methods to identify fine-grained semantic distinctions between near-synonyms based on data of language speakers' behavioural and perceptual responses to human enacting of lexical words.

In addition to the theoretical importance, near-synonym discrimination plays an important role in applied areas. For example, it has various practical values in the studies of lexicography and second language teaching. Defining near-synonymous sets is part of the main construction of establishing semantic relationships in building lexical databases, such as WordNet and Germanet (Hamp & Feldweg, 1997; Miller, Beckwith, Fellbaum, Gross, & Miller, 1990). Natural language generation and machine translation research also rely on the knowledge of the properties of near-synonyms for automatic identification of appropriate words among near-synonym sets (Inkpen & Hirst, 2002; Knight & Luk, 1994; Reiter & Sripada, 2004).

Previous attempts at discriminating near-synonyms have relied largely on either dictionary definitions or collocational differences. These approaches do not always capture the fine-grained distinctions between near-synonyms. In the study presented in this article, we turn to an alternative approach, namely speakers' behaviour and perception to explore the possibilities in discriminating near-synonyms. This study focuses specifically on Chinese 'throw' verbs. These verbs are functionally equivalent but semantically different "by virtue of the contrasting images they convey" (Langacker, 1987: 111). We consider these differences are cognitively fundamental for language acquisition as well as for the understanding of synonymy.

2. Previous approaches to near-synonym discrimination

Previous research on near-synonym discrimination has focused on different dimensions of the words. That is, the differences in near-synonyms have been carefully specified, often according to denotational variations, that is in terms of the concept and idea (e.g. *produce* differs from *create* as it lacks the semantic component of innovation), collocational variations including distribution patterns and syntactical restrictions (e.g. *look*, rather than *see*, is often followed by *at*), expressive variations as in emotion and attitude (e.g. *father* expresses less intimacy than *daddy*), and stylistic variations such as dialect and tone (e.g. *chips* is more used in British English, whereas *fries* is more often used in American English) (Cruse, 1986; DiMarco, Hirst, & Stede, 1993; Edmonds, 1999).

Researchers attempting to build lexical databases have identified near-synonyms mainly from reference books (DiMarco & Hirst, 1993; Gao & Ouyang, 2009; Inkpen & Hirst, 2001, 2006). However, the critics of near-synonym dictionaries have pointed out that many terms were listed and poorly defined, often in a circular manner, sometimes with example sentences, but not well-defined in terms of overlaps of word meaning, usage patterns, contextual specifications, syntactical and semantic restrictions (Church, Gale, Hanks, Hindle, & Moon, 1994; Liu, 2010; Storjohann, 2006; Susur, 2010).

Methods of measuring semantic distance between near-synonyms based on WordNet hierarchies, such as Wang and Hirst’s (2011) study on English near-synonyms and Kennedy and Hirst’s (2012) work on relatedness of near-synonyms across languages using word-distribution data derived from French and English Wikipedia pages have been attempted. The results were modest, but above baseline, suggesting that better methods of distinguishing near-synonyms are still possible.

To address some of the issues with relying on dictionaries, research has focused primarily on the collocational differences, especially the interaction of their syntactic behaviour and semantic properties. Such research often relies on corpus-based studies, allowing researchers access to rich data on collocational behaviours. Corpus-based methods have been employed to distinguish synonymous nouns (Hindle, 1990; Rojo Lopez, 2011; Xiao & McEnery, 2006), verbs (Arppe, 2002; Atkins & Levin, 1995; Berez & Gries, 2008; Biber, Conrad, & Reppen, 1998; De Jonge, 1993; Divjak, 2006; Divjak & Gries, 2006, 2008; Liu, Huang, Lee, & Lee, 2000; Mondry & Taylor, 1992; Tsai, et al., 1998; Xiao & McEnery, 2006), adjectives (Chief, Huang, Chen, Tsai, & Chang, 2000; Church, Gale, Hanks, & Kindle, 1991; Glynn & Levshina, 2010; Liu, 2010, 2013; O’Connor & Corteel, 2010; Storjohann, 2009; Taylor, 2003) and adverbs (Dalmas & Dobrovol’skij, 2010; Wiemer & Socka, 2010) in many languages. Through this examination, researchers have deduced semantic differences in near-synonyms. In turn, the nuances in the semantic properties were considered as the underlying motivation causing the variation in the surface structures (Atkins & Levin, 1995; Liu, 2010, 2013; Tsai, Huang, Chen, & Ahrens, 1998).

Corpus-based approaches reveal the linguistic properties of near-synonyms (e.g., for verbs, Goal and Patient Object, since these are often explicitly mentioned), but may not result in adequate distinctions between near-synonyms to allow discriminations. For some near-synonyms, the Goal and the Patient Objects could be similar, if not identical (e.g., one could *fling* a ball at someone or *hurl* a ball at someone) and yet the meaning (such as the force with which throwing occurs) and/or discursive effect can be quite different. It is important to complement corpus-based analyses with other approaches in order to distinguish near-synonyms (Atkins & Levin, 1995; Meijs, 1996).

In recent years, elicited data from native speakers were considered another source for near-synonym studies (Divjak, 2006; Gao, 2001a; Liu, 2013; Oversteegen, 2010). Even though the importance of linguistic intuition has long been argued (Carroll, Bever, & Pollack, 1981; Wasow & Arnold, 2005), it was considered unreliable (Stubbs, 1983), especially the intuition of non-linguists (Spencer, 1973). However, we do not believe that reliability of linguistic intuition is the problem; rather, the problem is the use of inappropriate methods that elicit unreliable data. Our view is that as long as a method of data collection is valid and effective, linguistic intuition can be a valuable source for detecting the subtle meanings not represented in surface structures. Besides, we believe that a method that is effective and reliable for one type of synonymous words may not be so for the other types. More importantly, no single method appears to be sufficient for any given type of words alone. In other words, to really adequately differentiate the meanings of any set of synonymous words, we may need to use more than one method.

3. Mental representations and conceptual knowledge of action verbs

The term "mental representation" is often used in cognitive linguistics in the discussion of a semantic-cognitive linkage observed as an activation of conceptual knowledge under a specific condition. The conceptual knowledge can be the content of a concept that is identifiable as the meaning of a lexical word. So, the semantic-cognitive linkage is the core of discussion when we try to understand how that linkage happens. We seem to have reached the understanding that abstract thinking is formed based on knowledge acquired through physical experiences but we do not know yet how the action system - the physical experience aspect of learning - is linked to language and perceptual areas for language processing in the brain. Any attempt to seek the answer to the question may only be approached with the consideration of specific tasks with the involvement of embodied cognition. A number of studies (Zhu & Bingham, 2008, 2010; Wilson & Golonka, 2013) reported that a specific task at a time can be identified with embodied cognition, as embodied cognition solutions rely on stable features of the task made possible for heuristics. Studies of synonymous action verbs, such as near-synonymous action words in this study, are an example of a specific task. This is because the experiences of language speakers' conceptualization of the near-synonyms have to be highly specific. We can assume that there is a mapping process of the physical experiences of similar actions to synonymous lexical terms in the cognitive processes, but how the mapping happens and the mental representations of the experiences arise is hardly known. One assumption we can give is that embodied cognition may use embodied semantics to activate the mental representations of the conceptual knowledge that is formed through life experience. A semantic-cognitive approach is supposedly plausible for the explorations of evidence in support such an assumption.

In a study of physical action verbs with a cognitive semantic approach, Gao (2001a) suggested that perceptual, motor, and affective experiences of the concrete world together formed the ground for the projection of mental representations of the lexical meanings of physical action verbs. A question that may arise immediately from the above statement is: How can mental representations of lexical meanings be identified? Gao (2001a) did not give a direct answer to this question in her study. However, a number of studies conducted by other researchers in recent years have provided convincing evidence of the existence of mental representations of this kind. For example, a study conducted by Bergen et al. (2010) on body part representations of verbal semantics demonstrated that the activation of modality-specific cognitive representations responsible for performing and perceiving the actions depicted by the action verbs was the condition for speakers to be able to have the access to the lexical meanings of the verbs.

In one of their experiments, they used a word-image matching task, where participants were shown an action verb and an image depicting an action. Participants were then asked to decide quickly whether the verb and the image depict the same action. What they focused on in their observation and analysis was the participants' response when the verb and image did not match. They found that it took significantly longer time for participants to reject a verb–image pair when the actions depicted by the image and denoted by the verb used the same effector than when they used different effectors. They conducted a series of four experiments, in each of which the design was changed slightly, such as the language that participants spoke and the order of the task. What they found from all the experiments was a similar effect. The consistent results showed that there was an activation of effector-specific neurocognitive representations during both picture perception and action word understanding.

Some fMRI findings related to embodied semantics for actions, such as Tranel, et al. (2003) and Willems, et al. (2010) also indicate that understanding action words involves mentally simulating one's own actions. In a test of the body-specificity hypothesis, Willems, et al. (2010) used fMRI to compare premotor activity correlated with action verb understanding in right- and left-handers. The results showed that the left premotor cortex of right-handers was activated preferentially during lexical decisions on manual-action verbs, whereas for the left-handers it was the right premotor areas that were preferentially activated. This finding further supports the assumption that there is a mental representation or mental simulation during language processing and on top of it, it could be body specific.

In another study in searching for brain functions in conceptual knowledge processing, Tranel, et al. (2003) used action concept retrieval tasks to understand the neural correlates of conceptual knowledge for actions. They evoked the concept of an action, activated collections of sensory and motor patterns in cerebral cortices appropriate to represent pertinent features of the concept, such as motion, sound, effort, and speed. One of the findings supported an earlier finding on action naming (Tranel et al., 2001). Both studies identified a region that includes the left frontal operculum as being associated with action concepts. To understand what this means and how it is related to our study of 'throw' verbs, let us first quote the words that

Tranel, et al. (2003) used for illustration: “To illustrate our interpretation, consider an example: when a stimulus depicting a particular action is shown to a subject and the visual properties of the stimulus are processed, a particular intermediary region becomes active and promotes the explicit sensorimotor representation of knowledge pertaining to the action, which occurs in the appropriate early sensory cortices and motor structures. The evocation of some part of the potentially large number of such images, over a brief lapse of time and in varied sensorimotor cortices, constitutes the conceptual evocation for the action.” Tranel, et al. (2003:425).

Based on the above description, our understanding is that (1) a mental representation of lexical knowledge for an action exists and can be identified regionally in the brain and that (2) a mental representation of an action concept becomes active when a stimulus, such as motion, sound, effort, or speed, is presented. This understanding makes us assume that for a discrimination task of near-synonyms of action verbs, an embodied cognition approach may enable a quick collection of the salient features of the actions possible to produce a mental representation of the semantic features for discrimination.

In our design of the study, we measure the event components of throwing actions, such as motion direction, force, and hand height, etc. We assume that they are able to identify from perceptual and behavioral perspectives the existence of the mental representations of the semantics of action verbs. We are tempted to believe that native speakers of a language can retrieve action-related knowledge based on their learning experiences and that a linguistic task, such as selecting a correct synonymous action word among a few, is performable only when mental representations are activated by either linguistic or non-linguistic stimuli. We also assume that the mapping of the action features to the semantic features of the ‘throw’ verbs is part of the retrieval of conceptual knowledge. In designing the experiments for the study presented in this article, we aimed at taking perceptual and behavioural approaches to reveal the retrieval process. The different action components decomposed from the participants’ enacting of the ‘throw’ verbs are assumed to be the multidimensional aspects of the specific knowledge necessary for the mental representation of a concept of a given action. For example, in our perceptual experiment, the enacting of the throw actions shown to the participants functioned as stimuli to activate the processing of action-related knowledge which enabled the participants' production of corresponding 'throw' verbs that can be regarded as convergent evidence of the existence of mental representations of the semantics of action verbs.

Based on our understandings of mental representations of lexical knowledge for action verbs, we predict that the same salient attributes of an action will extend to its lexical meaning conveying that concept to a speaker.

4. 'Throw' verbs in Chinese

According to Gao's (2001a) classification of physical action verbs in Chinese, 'throw' verbs are a sub-class of hand action verbs. There are altogether 10 of them, as listed below (also see Gao 2001a: 237).

diū 丢 'throw, cast, toss'
piē 撇 'throw, cast'
pāo 抛 'throw, toss, fling'
piě 撇 'throw, fling, cast'
rēng 扔 'throw, toss, cast'
sǎ 撒 'scatter, sprinkle, spread'
shuāi 摔 'cast; throw; fling'
shuǎi 甩 'throw, fling, toss'
tóu 投 'throw, fling, hurl, put in, drop'
zhì 掷 'throw, cast'

The ten verbs are near-synonymous transitive verbs that require a human subject agent and an animate or inanimate objective patient. The actions depicted by the verbs are different from each other from various aspects, such as manner, force, objective patient, and intention. By ranking the ten verbs by their frequency use,[1] we found that the following six of them were most commonly used: *rēng (扔), diū (丢), pāo (抛), tóu (投),*

[1] According to their word frequencies reported by National Committee for Chinese Language (2008).

shuāi (摔) and *shuǎi (甩)*. However, when we had a thorough search of dictionary definitions of the verbs, we came to realize that none of them was adequately defined or explained. This phenomenon cannot be simply interpreted as an indication of dictionary compilers’ failure. The fact is that the semantic features condensed in these words include more information of human understanding of bodily actions than a dictionary entry can handle. The information is multi-dimensional. The lexical semantics entails language speakers’ understanding of the physical capabilities of the verbs’ subjective agents and the qualities of their objective patients as well as the relations between them. A dictionary-based approach is not possible to discriminate them, and corpus-based methods are not adequate, either, though they can provide useful sources for clarification.

There are a number of semantic features by which ‘throw’ verbs might be differentiated (see Langacker, 1991). Based on corpus data, Liu and his colleagues (2000) specified the differences in Goal role and Resultative state among four ‘throw’ verbs in Chinese: *rēng (扔), diū (丢), tóu (投),* and *zhì (掷)*. Gao (2001b) built a useful specification system by combining the semantic features of the verbs collected from dictionaries, corpora, and native speakers to differentiate the meanings of nine ‘throw’ verbs in Chinese with respect to the verbs’ agent subjects (e.g., in terms of Manner, Path, Mental Effect, and Intention) and patient objects (e.g., in terms of Property and Result) involved in the verb meaning constructions.

The representations of ‘throw’ verbs are physical actions which are exerted by an agent’s body part, namely hand or hands; hence the features of bodily action are the core of their meaning. For ‘throw’ verbs, the Force of the action, the Path (e.g., vertical vs. horizontal, and the starting point of hand), and the Goal might be particularly important in discriminating the words. However, based on corpus data and interviews with native speakers, Gao (2001a) examined the degree of Force for nine ‘throw’ verbs in Chinese and found that it was not a distinguishing feature for discrimination. In addition, the Force of ‘throw’ verbs in Chinese was seldom explicitly used in dictionary definitions. In Table 1, we present the description of our targeted verbs from two dictionaries. We can see that Force was mentioned only for the verb *shuāi* (i.e., *yònglì* “strong force”). Note that the Path and Goal of ‘throw’ verbs are also rarely mentioned in dictionary definitions. In general, the descriptions were mainly based on circular definitions, using one member of the word class to describe another and the near-synonyms were not fully distinguished from each other.

Table 1. Dictionary explanations of Chinese 'throw' verbs

Verb	Explanation in Dictionaries		Action component specified		
	The Contemporary Chinese Dictionary[2]	The Commercial Press Guide to Chinese Synonyms[3]	Manner	Path	Goal
扔 rēng	挥动手臂，使拿着的东西离开手/ to swing the arm, and let an object leave the hand	挥着手臂抛 / to swing the arm and"pāo"	挥着手臂抛 / to swing the arm and"pāo" swing arm		
丢diū	扔 / "rēng"	扔 / "rēng"			
抛pāo	扔，投掷 / "rēng", "tóu" "zhi (tone)"	向上或向前扔（东西）/ "rēng" something up/ forward		upward/ forward	
投tóu	向一定目标扔 / "rēng" to a target	扔向（一定的目标）/ "rēng" to a target			Target
摔 shuāi	扔 / "rēng"	用力往下扔 / "rēng" downward with force	strong force	downward	
甩 shuǎi	用挥动、抡的动作往外扔 / to swing the arm, and "rēng" something aside	n.a.	swing arm	sideways	

[2] The Contemporary Chinese Dictionary (Chinese Academy of Social Sciences, 2008).
[3] The Commercial Press Guide to Chinese Synonyms (Zhao & Li, 2009).

Table 2. Event components in the context of ‘throw’ verbs

Throw Verbs	Token	Force	Source	Path of Object	Goal	Object Height	Agent’s Mental Effect	Result of Action	Sound
rēng	224	3	8	51	113	1	24	5	8
diū	98	1	3	20	43	0	18	2	8
pāo	101	2	0	27	39	1	4	2	1
tóu	40	1	0	7	14	0	0	2	0
shuāi	112	16	3	12	47	0	35	15	8
shuǎi	15	3	0	4	7	0	1	0	1

As Table 2 shows, corpus data can be very helpful in providing rich data for classifications of the semantic and syntactic variations of the functional use of lexical words. For our study the data serve to identify the semantic features of near-synonyms. We extracted and analyzed all the verb tokens describing throwing actions and their contexts from Corpus Online.[4] Table 2 shows the number of event components that explicitly appeared in the context of ‘throw’ verbs in Chinese. The second column in Table 2 shows the number of tokens of the verbs found in the corpus. The numbers in the other columns indicate the number of times each type of action components for each of the six verbs found in the context where the verb was used. For example, under the “Source” component 8 sentences with the verb *rēng,* 3 sentences with the verb *diū*, and 3 sentences with the verb *shuāi* were found to have mentioned where the object was thrown from (e.g. *zhěntou cóng fángjiān lǐ rēng le chūlái* ‘a pillow was thrown out from the room. 枕头从房间里扔了出来’).

From Table 2 we can see that among all event components mentioned in the corpus, Force is the only but rarely mentioned dimension reflecting the physical feature of the throwing actions. Other physical features of throwing actions representing the ‘throw’ verbs are not reflected in the surface of the language use. The results accord with our view that the

[4] A contemporary Chinese corpus published by the Institute of Applied Linguistics, Ministry of Education in China, which comprises of 20 million Chinese characters.

core information of the lexical meanings of 'throw' verbs in Chinese (the features of the corresponding throwing actions) is hardly found in corpus data. The data from a language corpus are a good resource for capturing event components of throwing actions, but not adequate for the specification of verb semantics. Further, corpus-based methods seem to be ineffective for the discrimination of near-synonyms of action verbs in Chinese, particularly in the semantic domain of throwing. Therefore, we turn to another source of data for near-synonym distinction: native speakers of Mandarin Chinese. In Study 1, we attempted to elicit behaviours that indicate the subjects' understanding of these near-synonyms.

5. A behavioral approach: Experiment 1

In this experiment, we adopted the perspective of cognitive semantics: the mental representation of word meaning is embodied in the human mind (Lakoff, 1988; Talmy, 2000). Our aim was to elicit the representative actions for the 'throw' verbs in Chinese from native speakers of Chinese, and further to examine the meaning of these synonyms by analyzing the action properties.

Two research questions guided this experiment:

(1) What are the mental representations for *rēng, diū, pāo, tóu, shuāi* and *shuǎi* in native speakers?
(2) Do the six 'throw' verbs differ in their corresponding semantic features? If yes, how do they differ from each other?

5.1 Method

5.1.1 Participants

Thirty native speakers of Mandarin Chinese (Mean Age=20.15, SD=1.01) were selected from Northern China as participants of the study. They were all college students and monolinguals, with no experience of learning or speaking any dialects of Chinese.

5.1.2 Procedure

The participants were asked to take part in the experiment individually: they were not allowed to observe others' performance.

First, the experimenter showed the Chinese characters for the six 'throw' verbs to the participant, and then asked them to stand with the left side of their body next to a wall, holding a novel object (palm size, made from a Coke can, which was new to the participants) in their right hand. Two cameras were set in the front and to the right of the participant.

The participant was told to enact a verb according to the instructions given by the experimenter: *Qǐng V zhège dōngxi*. 'Please V it. 请V这个东西' ("V" is one of the six 'throw' verbs). When the participant completed the action, he or she got the object back and stood in the initial position.

In this way, each participant enacted all the six 'throw' verbs in a random order. To collect more data and to minimize any possible random errors, we repeated this procedure with each participant immediately after he or she completed the first round. That is to say, each participant performed two actions for each verb. All the actions were videotaped from both the front and side angles.

5.2 Data transcription

5.2.1 Coding criteria

We transcribed the recording data by coding the following observable components in the throwing events into numerical values: FORCE, ARM, HAND, Vertical Direction of Hand Movement, and Horizontal Direction of Hand Movement.

FORCE was coded on a five-point scale (5=very strong; 4=strong; 3=medium; 2=weak; 1=very weak).

ARM (initial arm shape) and HAND (initial hand height) are the features of the physical position before the action was performed. Gao (2001a) pointed out that hand contact with the object was a precondition for throwing actions, and the agent kept the position for a short while before the action began. Based on our observations during the experiment, ARM and HAND vary across participants and verbs. Therefore they might also be variables that distinguish the 'throw' verbs in the aspect of Manner. The initial arm shape is observable and objective (coded as 1=straight; 0=bent), but the absolute height of the hand is correlated to the absolute height of the participants. Thus we can use the relative height to code HAND (0=ground level; 10=participant height; 11=one unit[5] above the participant height; 12=two units above the participant height; etc.)

For some 'throw' verbs, the object goes up and falls down if the hand movement is upward (underarm throw), and a downward hand movement (overarm throw) results in a downward object movement. Based on the video recordings from the front and side perspectives, we coded the value of Path in two dimensions, namely Vertical Direction of Hand Movement (henceforth VD, 1=downward; 0=upward), and Horizontal Direction of Hand Movement (henceforth HD, 1=forward; 0=sidewise).

Although the trajectory of the object is part of the throwing event, we did not code it as a variable in the transcription. This is because the object's trajectory can be predicted by HAND, VD, HD and FORCE, and it varies across objects of different weight.

5.2.2 Coders

Two native Mandarin speakers (Both are PhD students, one in Chinese linguistics, and the other in Psychology) were selected as coders for data transcription. Following the coding criteria, each coder coded all variables for all video recordings. The overall inter-coder reliability is high (Cohen's Kappa= 0.71), so we included all coded values for statistical analysis.

5.3 Results of data analysis

To address what the mental representations for Chinese 'throw' verbs are in native speakers, we attempted to characterize each throwing action by specifying the value of all variables concerned. Alternatively we might consider either 1) statistically comparing the first and second productions of the same verb or 2) including only the first production. However, if we

[5] One unit is equal to 1/10 of the participant's height.

only included the 1st production, it would seem to make no sense that we required the participants to perform the action twice. If we only included the second production, the first one would have to be considered as a warm-up-trial. In either case, the values of continuous variables as well as the parameters of the stimuli in the perceptual experiment could have been slightly changed, though the analysis would not affect the end results of the experiment.

5.3.1 Continuous Variables

Table 3 shows the means and standard deviations for all the continuous variables.

FORCE

The result of ANOVA shows that there is significant difference in Force among the performances of the six verbs ($p<.001$, partial eta-square=.892). And the result of Pairwise comparison (see Table 4) shows that except the pair “*pāo-tóu*” and “*pāo-rēng*”, any other two verbs significantly differ from each other in terms of FORCE.

HAND

The result of ANOVA shows that there is significant difference in HAND among the performances of the six verbs ($p<.001$, partial eta-square=.906). And the result of Pairwise comparison (see Table 5) shows that all verbs

Table 3. Mean (SD) for FORCE and HAND

	FORCE (1-5)	HAND (1-12)
rēng	3.00 (.56)	5.41 (1.80)
diū	2.55 (.75)	4.71 (1.25)
pāo	3.12 (.41)	6.75 (2.57)
tóu	3.31 (.46)	8.95 (1.03)
shuāi	4.48 (.57)	8.24 (1.04)
shuǎi	3.83 (.65)	6.34 (1.48)

Table 4. Pairwise comparison of FORCE among ‘throw’ verbs

Force	*Rēng*	*diū*	*pāo*	*tóu*	*shuāi*
diū	**				
pāo		***			
tóu	*	***			
shuāi	***	***	***	***	
shuǎi	***	***	***	***	***

Note. *p<.05; **p<.01; ***p<.001; SPSS Bonferroni adjusted p-values are quoted.

Table 5. Pairwise comparison of HAND among ‘throw’ verbs

Force	*Rēng*	*diū*	*pāo*	*tóu*	*shuāi*
diū	*				
pāo	**	***			
tóu	***	***	***		
shuāi	***	***	**	**	
shuǎi	**	***		***	***

Note. *p<.05; **p<.01; ***p<.001; SPSS Bonferroni adjusted p-values are quoted.

significantly differed from each other in HAND except the pair “*shuǎi-pāo*”. However, with more detailed analysis of the raw data, we found that the HAND values of *pāo* (SD=2.57) were either very low (4) or very high (around 9), and there were very few performances of *pāo* with medium starting height.[6] Therefore the mean value of HAND for *pāo* could not reflect the true action. But in general, HAND is a differentiating variable for Chinese ‘throw’ verbs.

5.3.2 Binomial variables

The number of actions with different features performed by the participants is summarized in Table 6.

We applied one-way Chi-square to binomial variables (VD, HD and ARM). The results are shown in Table 7.

Table 6. The frequency of actions with different values of three binomial variables

	Vertical Direction		Horizontal Direction		Initial Arm Shape	
	Upward	Downward	Forward	Sidewise	Straight	Bent
rēng	40	19	41	18	37	22
diū	48	12	38	22	47	13
pāo	60	0	59	1	29	31
tóu	58	2	60	0	1	59
shuāi	0	59	47	12	0	59
shuǎi	25	34	14	45	12	47

Table 7. Chi Square results for VD, HD and ARM for 'throw' verbs

	VD (Upward v.s. Downwards)		HD (Forward v.s. Sidewise)		ARM (Bent v.s. Straight)	
	Sig.	Effect Size (Φ)	Sig.	Effect Size (Φ)	Sig.	Effect Size (Φ)
rēng	*	.390	**	.390		
diū	***	.600	*	.267	***	.567
pāo			***	.967		
tóu	***	.933			***	.967
shuāi			***	.593		
shuǎi			**	.356	***	.593

Note. *p<.05; **p<.01; ***p<.001

Vertical Direction

The chi-square analysis of VD examines whether the frequency of upward hand movements for a certain verb is significantly different than the frequency of downward ones. The results show that even though the Path information was not given in the instructions, a strong tendency of selective direction of hand movement was observed in VD in native speakers' performance. For example, the frequency (48) of upward hand movements for *diū* is significantly different than the frequency (12) of downward ones ($p<.001$). However, the tendency differed across verbs.

For *rēng, diū, pāo,* and *tóu*, the performances using an upward hand movement were significantly greater than the ones with a downward hand movement. In contrast, all performances for *shuāi* uniformly used a downward hand movement. As for *shuǎi,* there is no significant difference between the frequencies of upward and downward hand movements.

Horizontal Direction

The tendency of selective direction was also found in the HD of performances. For *rēng, diū ,pāo, tóu* and *shuāi*, a forward hand movements were significantly more common than sideways ones, but the effect size (ϕ=.267) for *diū* was not high enough to support the difference. As a comparison, the HD for *shuǎi* is typically sideways.

Initial Arm Shape

The results for ARM show that the performances for *tóu, shuāi* and *shuǎi* typically began with a bent arm, but the majority of native speakers performed *diū* using a straight-arm. As for *rēng* and *pāo*, both bent- and straight-arm positions seemed acceptable to native Mandarin speakers.

5.3.3 Summary of Data Analysis

Based on the results of data analysis, the performances for the six verbs differ in all the event features concerned, to varying degrees. All of the features we analysed were significant in participants' discrimination of at least some of the 'throw' verbs in Chinese: FORCE, starting position (HAND and ARM), and directionality (both Vertical and Horizontal). These could be important features to mention in dictionary definitions to avoid the circularity often used in defining near-synonyms.

Another important result is that some of the 'throw' verbs showed systematic variability in their features. Based on the analysis of native speakers' performance, we preliminarily described the six 'throw' verbs with acceptable representations (see Table 8), which we believe are the increasing range of their semantics. The value of each action component for these representations was decided separately for binomial and continuous variables. For FORCE and HAND, we took the mean as the feature value for the typical representation for each verb. However, for *shuǎi*, HAND is correlated with VD, so we took two mean values of HAND, corresponding to upward and downward VD, respectively. And for *pāo*, HAND is correlated with ARM, so we took two values of HAND, corresponding to bent and straight arm shapes, respectively. The case for *rēng* is more complicated. ARM and VD are predictors for each other, which means that an upward hand movement must start from a straight-arm position, and vice versa. In addition, HAND is correlated with both ARM and VD. So we took two HAND values, corresponding to “straight-upward” and “bent-downward”, respectively. For VD, HD and ARM, if the frequency differences between two values was highly significant (to be cautious, the cut-off point for the significance level was set as $p<.001$), we took the value given by the majority of participants (e.g. Forward HD for *pāo*). Otherwise, both values were considered acceptable (upward and downward VD for *rēng*).

5.4 Discussion

Recall that two research questions guided this experiment:

(1) What are the mental representations for *rēng, diū, pāo, tóu, shuāi* and *shuǎi* in native speakers?
(2) How do the six ‘throw’ verbs differ in their corresponding semantic features?

Table 8 summarizes the results of this experiment. We can see from Table 8 that the representative actions for *tóu* and *shuāi* are clear-cut, but there is more than one acceptable representation for the other verbs, and it is difficult to decide the ‘throw’ verb membership of some representations (notably, compare *rēng3* with *pāo1*, as well as *pāo2* and *tóu* in Table 8). Even though the two representations in both pairs differ in FORCE and HAND value, none of the differences is significant.

In general, based on the performance by native speakers, we detected

Table 8. The meaning specification of Chinese 'throw' verbs

Verb	Action representation	FORCE	HAND	ARM	VD	HD
rēng	*rēng 1*	3.00	7.50	Bent	Downward	Forward
	rēng 2	3.00	7.50	Bent	Downward	Sideways
	rēng 3	3.00	4.16	Straight	Upward	Forward
	rēng 4	3.00	4.16	Straight	Upward	Sideways
diū	*diū1*	2.55	4.71	Straight	Upward	Forward
	diū2	2.55	4.71	Straight	Upward	Sideways
pāo	*pāo1*	3.12	4.17	Straight	Upward	Forward
	pāo2	3.12	9.06	Bent	Upward	Forward
tóu	*tóu1*	3.31	8.95	Bent	Upward	Forward
shuāi	*shuāi*	4.48	8.24	Bent	Downward	Forward
shuăi	*shuăi1*	3.83	5.44	Bent	Upward	Sideways
	shuăi2	3.83	7.00	Bent	Downward	Sideways

the semantic range of each verb, although boundaries are vague between some of the verbs. That is to say, the second research question is not fully answered. Therefore, we need to further our study with another experiment.

6. A perceptual approach: Experiment 2

In Experiment 1 we successfully identified the multiple feature representations of the six near-synonymous 'throw' verbs, but we were not able to divide all of them into unique categories. To make clear the vague boundaries detected between the verbs, we decided to adopt a prototype-theory approach, which was introduced by Rosch (1973) and has been applied to the specification of lexical semantics (Coleman & Kay, 1981; Kay & McDaniel, 1978) and the discrimination of near-synonyms (Lakoff, 1987). This approach is expected to be able to delineate the semantic domain of throwing in Chinese. Specifically, the main question to be addressed in Experiment 2 is: For a particular representation of a throwing action, is there any ‘throw’ verb that is particularly likely to be associated with it?

The data from Experiment 2 provided converging evidence for identifying the semantic features identified in Experiment 1. If the action representations derived from the behavioural experiment (Experiment 1) can successfully activate the corresponding verbs in native speakers, then we assume the performances elicited from native speakers reflect their understanding of Chinese ‘throw’ verbs, and thus their specification of meaning is reliable.

6.1 Method

6.1.1 Participants

Thirty adult native Mandarin speakers (Mean Age=18, SD=0.33) were recruited from high schools in Northern China. None of these subjects had participated in Experiment 1.

6.1.2 Instrument

We prepared video clips for all twelve acceptable representations of the six verbs (Table 8). The length of each clip was around three seconds. The action performances were recorded from the right side of a male adult performer throwing a novel object (the same one used in Experiment 1) with his right hand. The value of all action components was controlled as shown in Table 8. As the Goal-specific meaning of *tóu* is well established in the literature (Liu, et al., 2000; Zhao & Li, 2009), we added one clip for *tóu*, with Goal information included (a novel object was thrown into a basket), and labelled as *tóu2*. So in total there were thirteen video clips for Experiment 2.

6.1.3 Procedure

Participants participated in the experiment separately. After a participant was seated in a quiet room, facing the laptop screen, he or she was asked to complete two tasks. The whole session was videotaped with audio using a built-in webcam in the laptop. The responses of participants were transcribed for data analysis.

Task 1: Action Description

In this task all the participants were tested separately. First, one video clip was played three times to an individual participant, and then they were asked to describe what the person in the video clip was doing.

Task 2: Verb Mapping

All the participants were tested separately. First, a video clip was played three times to the participant, and then they were asked to choose one verb from the verb list[7] to map the action shown in the video. All six verbs were shown on the laptop screen throughout the session.

The two tasks were done in two consecutive sessions. In both tasks each participant responded to all thirteen video clips played in random order.

6.2 Results of Data Analysis

Figure 1 summarizes the participants' performance in both tasks. Compared with the result in Task 1, the action representations derived from Experiment 1 were found to have activated more corresponding verbs in native speakers in Task 2. This is true, except for the verb *rēng*. The results indicate that participants might not intentionally or carefully choose a verb

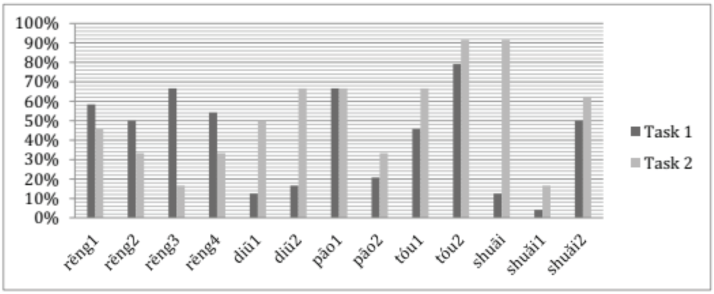

Figure 1. The percentage of matched responses[8] in Tasks 1 and 2

[7] The order of the verbs in the list differed among participants.

[8] (the number of the corresponding verb produced by all participants)/(the number of responses to the clip by all participants)×100%.

Table 9. The results of One-way Chi-Square analysis on matched responses in Task 2

verb / clips	*Rēng*	*Diū*	*Pāo*	*Tóu*	*Shuāi*	*Shuǎi*
rēng1	***					
rēng2	*					
rēng3		***				
rēng4	*					
diū1		***				
diū2		***				
pāo1			***			
pāo2			*			
tóu1				***		
tóu2				***		
shuāi					***	
shuǎi1					***	
shuǎi2						***

Note. *p<.05; **p<.01; ***p<.001

to match the action in their free description, but they seemed able to pick out the corresponding verb when they were asked to label the actions (see more results analysis for Task 2 later in this section).

Having noted the differences in the pattern of verb production between the two tasks, we move on to find out whether the targeted verbs could be elicited by their corresponding actions, if yes, the method of data collection in Experiment 1 can be considered valid for elicit native speakers understanding of the targeted verbs.

We examined the verbs produced by participants in Task 2 using chi-

[9] Since the participants were asked to choose one from the six verbs to describe the action in each clip, the chance for choosing the verb corresponding to the clip is 1/6=16.7%.

square analysis. If the matched responses were significantly higher than chance level,[9] the verb was considered to have been successfully elicited by the action.

Due to the low match rate for *rēng3* and *shuǎi2*, we suspected that participants might have used other verbs, instead of the corresponding verbs, to map the action clips. Hence, to have a more comprehensive understanding of participants' verb production in Task 2, we included all responses, matched and non-matched ones, in the One-way Chi-Square Analysis. The results are shown in Table 9.

Except for *rēng3* and *shuǎi2*, the match rate for all other clips are significantly higher than chance level, indicating the actions in these clips can successfully elicit the verb production in participants in Task 2. It seems contradict that native Mandarin speakers act out *rēng3* and *shuǎi2* in Task 1, but the two actions could not activate the corresponding verb in another group of native speakers. Our interpretation is that participants would considered *rēng3* and *shuǎi1* as acceptable representations of the corresponding verbs, but in the task condition of categorizing actions, they would not label them with corresponding verbs which had perfect action representations already (*rēng1* and *shuǎi2*), and turned to other verbs whose action representations were similar to *rēng3* and *shuǎi1* in certain dimensions. These results actually reflect the fact that the semantic boundaries among the 'throw' verbs may not be clear-cut, but there are typical representations for each of the verbs. As seen in Table 9, there was at least one video clip successfully activated the corresponding verb in the participants, and we believe the typical action representations for the verbs were among them.

According to the results in Table 9, three action representations of *rēng* successfully activated the corresponding verb, and a higher significance level was observed for clip *rēng1* ($p<.001$), suggesting *rēng1* was the best representation for native speakers.

As for *diū*, both the representations elicited the verb with an equal significance level ($p<.001$). Therefore, at this point, we are not able to tell which one of them is more typical for *diū*. Given that the only difference between *diū1* and *diū2* is the value of HD, to find out whether there is a typical action for *diū*, we need to examine whether the differences in HD influence the production of *diū*. We return to this point below.

The typical representation for *pāo, shuāi* and *shuǎi* were obvious. Both representations for *pāo* and *shuǎi* elicited the respective verb, and a higher significance level was observed for *pāo1* ($p<.001$) and *shuǎi2* ($p<.001$). The only representation for *shuāi* elicited the verb ($p<.001$), too. Therefore, we consider *pāo1, shuāi, shuǎi2* as the typical representations for the three verbs, respectively. Both representations for *tóu* successfully activated the verb with an equal significance level ($p<.001$). This result could mean that Goal information did not affect the production of *tóu*.

To further examine whether HD and GOAL affected the production of *diū* and *tóu*, respectively, we next took all responses for *diū* and *tóu*, including matched and mismatched ones, into consideration. To be specific, a participant may name clip *rēng1* as *diū*, and this mismatched response was not considered in the Chi-square test above. But in the following test, to get a full picture of native speakers' perception to all event components, this kind of mismatched response and the corresponding parameters of mismatched clips were both considered.

Logistic Regression was used to examine whether HD and Goal as IVs can predict the production of *diū* and *tóu*, respectively. Forward was set as the reference category for HD, and Absent for GOAL. The results (see Table 10) showed that HD and GOAL significantly influenced the production of *diū* and *tóu*, respectively, and the predictability of these IVs is stronger in Task 2 than in Task 1. Further, according to the exponential values, in Task 1, when native speakers watched a throwing action with a sideways hand movement, the odds of producing *diū* is 1.8 times higher than when the hand movement was forward, controlling all other variables (VD, HAND, etc.). The value for Task 2 ($Exp(\beta)=1.93$) is slightly higher than the one for Task 1. In Task 1, when native speakers watched a throwing action with the

Table 10. The predictability of HD and GOAL for correct classification

DV	IV	Task1		Task2	
		Sig.	Exp(β)	Sig.	Exp(β)
Diū	HD	*	1.80	***	1.93
Tóu	GOAL	*	38.39	**	121.63

presence of GOAL, the odds of producing *tóu* was 38.39 times higher than when the GOAL was absent, controlling all other variables. The value for Task 2 ((Exp(β)=121.63) is about three times higher than the value for Task 1.

In summary, HD and GOAL are strong influencing factors for producing *diū* and *tóu*, respectively. Native speakers were sensitive to sideways hand movements when producing *diū*, and they were sensitive to the presence of GOAL when producing *tóu*. Therefore, we consider that *diū2* with sideways HD is more typical for *diū*, and GOAL information plays an important role for identifying *tóu*, especially in the Verb Matching Task.

6.3 Discussion

The purpose of Experiment 2 was to test whether Chinese speakers associated particular action representations (derived from Experiment 1) with particular 'throw' verbs. The results of this experiment show that, in general, the action representations can successfully elicit the corresponding 'throw' verbs. There was only one exception: *shuǎi1*. The validity of action performance as a paradigm for verb meaning specification is therefore verified.

The main findings in the perceptual experiment are that the typical actions for Chinese near-synonymous 'throw' verbs could be specified and that their differences in five dimensions became clear and could be used as features of the verbs (see Table 11).

Table 11. The action components of typical representations for Chinese 'throw' verbs

	FORCE	HAND	ARM	VD	HD
rēng	3.00	7.50	Bent	Downward	Forward
diū	2.55	4.71	Straight	Upward	Sideways
pāo	3.12	4.17	Straight	Upward	Forward
tóu	3.31	8.95	Bent	Upward	Forward
shuāi	4.48	8.24	Bent	Downward	Forward
shuǎi	3.83	6.34	Bent	Upward	Sideways

As the realizations of throwing actions could be infinite in the physical world, and the verbs for representing those actions are limited in language, it is reasonable that native speakers of a certain language only focus on the action components which are salient to them and essential for expression. A consequence of long term and collective emphasis on those components is to lexicalize them into verbs, which cover the most perceived and expressed information in the semantic domain. The representations located farther from the focus are relatively ignored in the process of lexicalization, as they are less salient to native speakers, and hence less often/less likely to be expressed by them.

Therefore, we argue that there is no fine-cut boundary between ‘throw’ verbs used by Chinese native speakers, and the ideal way to discriminate between near-synonyms in the semantic domain of throwing is to characterize the typical actions for each verb.

7. Conclusion

This study provided an account of embodied semantics based on speakers’ behavorable and perceptual production of the verb semantics of six. We attempted to distinguish between six near-synonymous ‘throw’ verbs in Chinese using behavioural and perceptual data. In the behavioural experiment (Experiment 1), acceptable representations for the verbs were elicited from native speakers by their performance of the verb. By analysing the features of the action, we identified informative features encoded in Chinese ‘throw’ verbs. In the perceptual experiment (Experiment 2), asking Chinese speakers to label throwing actions derived from the behavioural experiment, we identified a prototypical action for each verb. Our detailed analysis of the action components of the ‘throw’ verbs demonstrated that the phenomenon of near-synonymy in ‘throw’ verbs in Chinese can be effectively delineated under a cognitive linguistic framework. The cognitively-oriented analysis of the semantic components of ‘throw’ verbs was effectively achieved with a usage-based approach.

Relying on the verb knowledge elicited from native speakers’ performance, we specified several important semantic features that discriminate between near-synonymous Chinese ‘throw’ verbs. Notably, the force of throwing, the position of the hand at the start of the action, and the path of movement are features that native speakers use to discriminate between these verbs. Recall that these are features that are rarely explicitly mentioned in dictionaries (see Table 2).

A thorough analysis of the elicited data on the enacting of the 'throw' verbs is assumed to have provided a verifiable solution to the delineation and discrimination of the group of near-synonyms. The graded scale of the action components of the 'throw' verbs reveals the coarse-grained meaning contours of the verb group. For example, in terms of force, we found that all six verbs fall into five levels of degree of force, with *shuāi* at the top using the most force (which is consistent with the explanation in the dictionary) and *diū* at the bottom, associated with the least force. The preparation positions for the different verbs differed in the height of hand and the shape of arms. These initial positions were related to the trajectory of the throwing motion to a large degree. Chinese 'throw' verbs imply the direction of the action movement, even though 'throw' verbs might be thought to emphasize the manner of motion.

With regard to how the distinctive semantic features of near-synonyms are acquired by language learners, one possibility is that learners hear the various 'throw' verbs in the context of seeing throwing actions. Since even young children may assume that there are no exact synonyms within a language (Markman, Wasow, & Hansen, 2003), language learners may seek the features that are salient in those contexts to justify the choice of the verbs they use. Chinese verbs are highly specific in semantics (Tardif, 2006), so Chinese learners may quickly come to understand that they should pay attention to the semantic features that could discriminate between near-synonyms. The discriminations that speakers make between near-synonyms are not absolute, but rather probabilistic (see Section 4.3.3). Therefore, the acquisition of synonyms is a difficult task for language learners in general. It may take a long time for children to perceive the subtle differences among a class of near-synonyms and distinguish them effectively. Indeed, a previous study (Gao & Wang, 2012) showed that although children started to produce all six 'throw' verbs in Chinese as early as six years old, they tended to rely only on certain salient action features to map the corresponding verbs. They couldn't successfully identify the typical actions and mental representations of all six verbs until 14 years of age. These results are consistent with the argument that language learners need some particular kind of input in order to learn the distinctions between near-synonyms, perhaps word-action pairings. The results can be regarded as being consistent with what is generally known about human cognition, or “cognitive commitment”, to use Lakoff’s term (Lakoff, 1990).

Our studies included exclusively Chinese speakers. Chinese is sometimes described as a language in which manner verbs are highly salient whilst the lexicalization of path plays a more minor role (Talmy, 1985, 2000). One important avenue of future research is to replicate the present results in a verb-framed language such as Spanish or Turkish to see if default lexicalization patterns affect the semantic features used by speakers to discriminate between near-synonyms.

The research methods we used in the two experiments are based on the understanding of the properties of the targeted verbs in the study. The representations of ‘throw’ verbs are concrete physical actions, but corpus-based methods were not able to characterize the representations for each ‘throw’ verb in Chinese, nor discriminate between the near-synonyms on a conceptual level. Therefore, we relied on the linguistic intuition of native speakers to detect the subtle differences implicitly located in the root of verb meaning, which are not observable from the context. The results of the two experiments showed that fine-grained semantic distinctions between near-synonyms can be identified using data from people’s behaviour and perception. However, the validity of methodology adopted in the two experiments need to be further tested with verbs of other semantic domains and verbs in other languages.

The application of prototype theory to near-synonyms was based on the fact that the semantic boundary between the verbs was vague to native speakers. By specifying the typical actions for those near-synonyms, the semantic focus of the verbs was highlighted, and hence the semantic domain of throwing is optimally defined.

The results show that to examine the semantic properties of the targeted words before choosing the methods and theoretical framework for the discrimination between near-synonyms is a workable approach. Even though the data from corpus are reliable and correct, they are not always sufficient to differentiate near-synonyms on their own.

In this study, we took a cognitively inspired approach to elicit participants' conceptual knowledge. That is, we created a new paradigm which elicited linguistic intuition from native speakers in terms of behaviour and perception. Physical actions were activated by verbs and vice versa, which indicates the reliability of behavior as the output of verb knowledge. Even though further study is necessary to see if this paradigm can be readily applied to other semantic categories and other languages, it provides a new perspective for relying on human cognition in linguistic studies. However, we need to emphasize that, in the study of near-synonyms, a single approach or method cannot be effective enough. Combining the behavioral analysis with other data analyses including corpus examination, as we did in this study, has generated more reliable results.

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