Profiling the Mandarin Physical Contact verbs with ná 拿, wò 握, chí 持 and zhuā 抓 using collocational, syntactic and discourse features

Abstract. This study aims to provide a preliminary comparison of Mandarin Physical Contact verbs with ná 拿, wò 握, chí 持 and zhuā 抓 by adopting a behavior profiling approach. Based on previous theoretical studies, the four verbs are intensively examined in terms of collocational, syntactic and discourse features in section 2. Besides, the linguistic features are turned into categorical or binary features in section 3 to generate the high dimensional vectors of the chosen verbs to allow multifactorial analysis to compare the subtle differences in meanings of the four verbs. The results support that wò 握 and zhuā 抓 share more semantic-syntactic similarities and ná 拿 is more similar to wò 握 and zhuā 抓 cluster. Whereas chí 持 behaviors most differently from the remaining three. The study also finds out that wò 握 and zhuā 抓 cluster is differentiated from chí 持 and ná 拿 cluster mostly in its syntactic features.

Keywords: Mandarin Physical Contact verbs · Behavior profiling · Corpus-driven approach

1 Introduction

Physical Contact verbs have been generally viewed as an independent verbal class and intensively examined in terms of diathesis alternations [1], morpho-syntactic behaviors [2-3], semantic features [4-5] and syntactic-semantic interactions [6-7]. Among them, ná 拿, wò 握, chí 持, zhuā 抓 were detailed examined under the frame-based constructional approach [8-10] as four representative Mandarin Physical Contact (MPC) verbs [11]. It was found that these verbs display both similar and distinctive patterns in corpus, thus can be considered as near synonymous verbs which should be further distinguished based on corpus data.

1.1 Previous Studies on Near-synonymous Verbs

Numerous studies have investigated near-synonymous verbs in various approaches. For example, some scholars explored the grammatical function distributions and collocational features of near-synonymous verbs to reveal the subtle differences in their meanings. Major works include: i) Mandarin near-synonymous verbs: gàoxìng 高兴 vs. kuâilè 快乐 ‘be happy’ [12], jiàn 建 vs. zào 造 vs. gài 盖 ‘build’ [13], tâolùn 讨论 vs. shângliâng 商量 ‘discuss’ [14] and biânli 便利 vs. fânghiàn 方便 ‘to be convenient’ [15]; ii) near-synonymous verbs with cross-linguistic evidences:
verbs of Contact by Impact in English and Chinese [7], Do verbs in Taiwan and Mainland Mandarin [16], Cut verbs in English and Chinese [17].

Furthermore, the Module-Attribute Representation of Verbal Semantics (MARVS) theory was introduced to represent finer semantic properties of verbs by providing eventive information of the verb-related event structure, based on previous studies on more than 40 pairs of near synonyms and around 10 semantic fields [18-20]. Adopting this bottom-up approach, various studies have been conducted to further distinguish near-synonym pairs, such as [21] on verbs of Throwing, [22] on Force-compulsion verbs and [23] on verbs of Closing.

Following the same vein, the frame-based constructional approach was proposed as a top-down framework to classify near-synonymous verbs in terms of both semantic and syntactic features [8-10], on the basis of Frame Semantics [24-25] and Construction Grammar [26-28]. Various works on verbal classifications have been completed under this approach, such as [29] on verbs of Conversation, [8] on verbs of Statement, [11] on verbs of Physical Contact.

1.2 Previous Studies on Mandarin Physical Contact Verbs

A detailed classification of Mandarin Physical Contact verbs was conducted by [11] under the frame-based constructional approach, which proposed three sub-categories of MPC verbs: verbs of Contact by Impact (dǎ/qiāo/pāi/jī ‘hit/ knock/pat/ strike’), verbs of Surface Contact (cā/shì ‘wipe’) and verbs of Holding (wò/zhuā ‘hold’). Among them, verbs of Holding were defined as ‘(intentional) prolong contact without motion’ by collocating with stative or resultative markers. A former study focused on ná and wò [30] proposed that although sharing similar semantic-syntactic features as verbs of Holding, ná is more like a carry verb as it tends to collocate with directional markers while wò is a typical Hold verb.

On the other hand, previous studies held different opinions on the verbal classes of these four verbs. Basically, ná, wò, chí, zhā were generally accepted as physical or hand action verbs in traditional Mandarin verbal research [31-32], as they are sharing hand-radical components in the characters [33]. Some scholars further distinguish ná ‘carry’ and zhā ‘grasp’ as Take verbs [34]. Whereas, others viewed ná as a Carry verb yet wò, chí and zhā as typical Hold verbs [30].

In sum, previous studies have analyzed MPC verbs along with the representative ná, wò, chí, zhā in terms of both syntactic and semantic features, but the conclusion can be further verified by corpus-driven approach.

1.3 Behavioral Profiles: A Corpus-based Approach for Synonym Study

The present study uses behavior profiles to quantitatively study Mandarin physical contact verbs. The idea of behavior profiles (BP) originated from the research [35-36] and has recently been used by various linguistic studies [37-39]. The method is
advantageous in studying near synonyms, especially for the analysis of verb semantics since it offers a powerful representation of verbs that could possibly incorporate features from all linguistic levels, like the lexical level (e.g., collocational features), the syntactic level (e.g., agent, object or complement), and even the discourse level features. Obviously, this is an advantage that most previous theoretical linguistic studies could not rival given that they could not exhaust all these features of a given verb or a set of verbs all at once in one study. Given its power to present linguistic data in high dimensional space, the BP method is most appropriate in studying near synonyms overlapping in many senses but differ subtly in some. It makes it possible to offer a quantitative analysis towards the near synonym sets ná, wò, chí and zhuā by identifying their similarities and differences, which helps us describe these similarities and differences in a corpus-driven way. Additionally, this study adopted a frame-based constructional approach [40-42] as the theoretical support of the behavior profiling method, which not only provides preliminary comparison of the four verbs in terms of their semantic-syntactic behaviors but also contributes to the descriptive features used for clustering.

2 Preliminary Comparison of ná, wò, chí, zhuā

This section provides a preliminary comparison of the near synonym sets ná, wò, chí and zhuā in terms of collocational, syntactic and discourse features. Adopting a corpus-driven approach, we randomly selected 300 sentences of each verb from BCC corpus as the initial data set. Then, the initial data set was manually checked. After deleting some wrong sentences, we acquire the pretreated data set. Finally, we randomly selected 100 sentences of each verb from the pretreated data set as our final corpus with 400 sentences in total. All sentences were manually tagged from the perspective of collocational, syntactic and discourse features, in order to reveal the subtle distinctions of these verbs.

2.1 Collocational Features

In this section, ná, wò, chí and zhuā are preliminary compared in terms of collocational features such as aspectual markers, directional markers and time markers.

It is found that ná, wò and zhuā tend to collocate with aspectual markers (25%, 28%, 20% respectively) while only 7% of chí can co-occur with aspectual markers. More specifically, 28% of ná collocate with stative aspectual marker zhe and both ná and zhuā are used together with aspectual marker le 了 indicating change of state. Besides, ná, chí and zhuā may co-occur with directional markers (8%, 2%, 2% respectively) and thus connected with motion frame. It is also noticed that ná and zhuā are closely related to pre/post verb deictic markers, showing the dynamic character of its semantics.
Furthermore, both *ná* 拿 and *zhuā* 抓 tend to collocate with time markers (26% and 22% respectively) and temporal/frequency expressions (33% and 27% respectively), which means that these two verbs are more closely related to time and indicates ‘change of state’ rather than stative contact.

### 2.2 Syntactic Features

Distinctive syntactic features in this section mainly include four noun phrases: agent, object, complement and manner. Each feature is examined in terms of appearance and semantic types.

It is concluded that all verbs can omit the agent in sentences (31%, 24%, 17%, 40% respectively) and collocate with animate agents (39%, 61%, 55%, 55% respectively), which can be considered as the typical syntactic feature of MPC verbs. Except for *ná* 拿, other verbs may co-occur with body-part agent, namely *shǒu* 手 ‘hand’. Besides, *wò* 握 display as a pure *Hold* verb as it rejects inanimate agents. While *ná* 拿, *chí* 持 and *zhuā* 抓 experience semantic extension as they may have inanimate agents such as institutions (e.g., *gōngsī* 公司), teams (e.g., *běijīng àoshén* 北京奥神) and places (e.g., *hēběi* 河北). Correspondingly, *ná* 拿, *chí* 持 and *zhuā* 抓 tend to collocate with abstract objects (21%, 32%, 57% respectively) such as regulations (e.g., *zhāngfǎ* 章法), opinions (e.g., *guāndiǎn* 观点) and opportunities (e.g., *jīyù* 机遇).

Moreover, four verbs display distinctive complement choices: i) only 7% of *chí* 持 may collocate with complements and all of them are stative complements (e.g., *píng* 平); ii) *wò* 握 is more closely related to resultative (e.g., *zhù* 住, 22%) and impactive (e.g., *jǐn* 紧, 8%) complements, indicating intentional stative contact; iii) 64% of *zhuā* 抓 are co-occurred with resultative (e.g., *zhù* 住) complements, implying ‘change of state’; iv) *ná* 拿 displays a more dispersive complement types as 18% of which are collocating with resultative complements (e.g., *xià* 下) and 18% of which are co-occurring with directional complements (e.g., *chū* 出 and *kāi* 开), underlining the connection with both change of state and motion event. In the same vein, *wò* 握 and *zhuā* 抓 may collocate with impactive manners such as *jǐnjǐn* 紧紧, indicating the impactive feature in their verbal semantics.

### 2.3 Discourse Features

Discourse features in this section are mainly related to serial verb construction (SVC), a unique phenomenon in Mandarin which requires two semantically similar and syntactically equal verbs in one sentence. It is found that *ná* 拿 and *zhuā* 抓 tend to enter SVC construction together with emotion/judgement/perception verbs (18% and 29% respectively), indicating potential category transfers to these frames. Besides, four verbs are closely related to motion frame as all of them may co-occur with motion verbs in SVC construction. Furthermore, *ná* 拿, *wò* 握 and *zhuā* 抓 may be used as social-interaction verbs as all of them may collocate with social-related verbs in SVC construction (8%, 8% and 5% respectively).
3 Data and Method: Profiling ná 拿, wò 握, chí 持, zhuā 抓

3.1. Data Preparation

The present study chooses the BP approach to quantitatively profile the differences among the four Mandarin physical contact verbs ná 拿, wò 握, chí 持 and zhuā 抓. The BP approach is chosen because it is a multi-factorial method that could offer insight about characteristics of near synonyms by comparing different contextual features of words or constructions in a corpus [43]. Although the approach has been extensively used for revealing sets of near-synonyms in Indo-European languages such as Dutch [2], Russian [38], English [45], only few previous studies on Chinese have made such attempts in applying BP methods for near-synonym research. [46] is the first, to the author’s knowledge, to use BP method to examine Chinese near synonym causative verbs ràng (让), shǐ (使) and líng (令). Following [46], the present study adopts the BP method to research four Chinese near synonyms ná 拿 wò 握, chí 持 zhuā 抓 through a comprehensive analysis of 34 contextual features (see Appendix 1) characterizing the near synonyms sets from collocational, syntactic, and discourse level. By using behavior profile approach, all contextual features of interest are well-represented by the high-dimensional data and made comparable, calculable and verifiable, offers a convincing, trackable, repeatable, and objective analysis for the similarities and the dissimilarities for various contextual features of the four holding verbs.

First, a dataset of 400 observations is randomly extracted from BCC [47]. Each of the four Mandarin physical contact verbs were represented by 100 observations. The dataset is then manually annotated for the 28 contextual features yielding 79 ID tags to determine the collocational, syntactic, and discourse environment of the underlying words. The features are both binary and categorical. Usually, the current study allows no more than 6 categories. However, in one special circumstance, a categorical feature termed as ‘semantic_feature_of_the_other_VP’ was annotated 16 categories given the linguistic observation. The contextual features annotated in the current study are all important linguistic features that were mentioned in previous linguistic studies on Mandarin physical contact verbs. The data-annotation was done by three expert annotators, double-blind validation, and majority voting to solve any discrepancy. Overall speaking, after annotation, we get 31,600 (400*79) data points.

The resultative table incorporating all the annotated data contains all the 400 instances of sentences with ná 拿, wò 握, chí 持 and zhuā 抓 (rows) and 28 features (columns). We converted 28 features into 79 binary features and categorical features. The numeric BP vectors for the four verbs were then created. Then we computed the distance matrix between the BP vectors. And after the BP vector of the four Mandarin physical contact verbs are calculated, the study conducted a cluster analysis and identification of the optimal number of clusters for the four underlying verbs. Finally, the study interpreted the cluster solution and elaborates on some preliminary findings of the current study. The calculation was done in R and followed the approach adopted in [43].
3.2. Preliminary findings: Hierarchical cluster analysis

Although many cluster analysis methods are available, the current study uses hierarchical agglomerative clustering (HAC). All objects are represented as leaves or branches of a clustering tree. This tree is called a dendrogram. One thing is particularly noteworthy is that this tree grows from the branches to the root. In the current study, each verb profile vector of \texttt{ná 拿}, \texttt{wò 握}, \texttt{chí 持} and \texttt{zhuā 抓} represents its own cluster at the very beginning as `leaf’ and the statistics start to merge from there. Next, the ones yielding the smallest distances will be firstly merged since the algorithm considers the two most similar to each other. This procedure is repeated again and again until all leaves and branches are merged into one tree. The lower two elements emerge on the tree, the more similarities the two elements have. The higher two elements emerge on the tree, the more differences exist between the two elements. The lowest emerge in our case are \texttt{wò 握} and \texttt{zhuā 抓}, which have the smallest distance. Then \texttt{ná 拿} emerges with \texttt{wò 握} and \texttt{zhuā 抓}, showing that they yield smaller distance and closer to each other when compared with \texttt{chí 持}. Finally, \texttt{chí 持} forms the cluster with the remaining three. Therefore, according to our preliminary findings, \texttt{zhuā 抓} and \texttt{wò 握} are more similar to each other, as shown in Figure 1. Secondly, \texttt{ná 拿} behaviors more similar to \texttt{zhuā 抓} and \texttt{wò 握} cluster in terms of the three levels of contextual features annotated in the present study. Finally, \texttt{chí 持} yield the biggest difference from the remaining three. Therefore, the data will be divided into two clusters, \texttt{zhuā 抓} and \texttt{wò 握} and the remaining. This because \texttt{zhuā 抓} and \texttt{wò 握} form the smallest cluster and behavior differently from the remaining two verbs of \texttt{ná 拿} and \texttt{chí 持}.

![Cluster Dendrogram](image)

Fig. 1. Hierarchical cluster dendrogram of the four Mandarin physical contact verbs.
The current study then go a step further to study how these contextual features make *zhua* 抓 and *wò* 握 different from *ná* 拿 and *chí* 持 cluster. To make such a comparison, the present study calculates the effect size of each of the 79 ID tags and draws a snake plot after computing the differences between the average values in both clusters. The factors are sorted in ascending order and the result is shown in Figure 2.

**Figure 2.** Overview of contextual features in na & chi cluster and wo & zhua cluster, ranked by effect size of each contextual feature.
The snake plot clearly shows the distinctive features distinguishing zhuā 抓 and wò 握 cluster and ná 拿 and chí 持 cluster.

Moreover, the Table 1 lists the top 9 contextual features that distinguishes ná 拿 and chí 持 cluster, measured by effect sizes.

Table 1. Overview of top 9 contextual features that distinguish the na & chi cluster from wo & zhua cluster; based on total effect size and Cramer’s V test.

<table>
<thead>
<tr>
<th>Contextual Feature Type</th>
<th>Contextual feature</th>
<th>Effective size rank (total)</th>
<th>Cramer’s V</th>
</tr>
</thead>
<tbody>
<tr>
<td>na &amp; chi cluster</td>
<td>complement semantic type</td>
<td>no complement</td>
<td>0.25 (1)</td>
</tr>
<tr>
<td></td>
<td>complement</td>
<td>no complement</td>
<td>0.25 (2)</td>
</tr>
<tr>
<td></td>
<td>quantitative</td>
<td>quantitative marker</td>
<td>0.22 (3)</td>
</tr>
<tr>
<td></td>
<td>object semantic type</td>
<td>animate</td>
<td>0.215 (4)</td>
</tr>
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<td></td>
<td>object semantic type</td>
<td>bodypart</td>
<td>0.165 (5)</td>
</tr>
<tr>
<td></td>
<td>order in SVC</td>
<td>first</td>
<td>0.12 (6)</td>
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<tr>
<td></td>
<td>for_to</td>
<td>yes</td>
<td>0.10 (7)</td>
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<tr>
<td></td>
<td>aspectual marker</td>
<td>zhe</td>
<td>0.095 (8)</td>
</tr>
<tr>
<td></td>
<td>semantic_type_of_the_other_VP</td>
<td>possession</td>
<td>0.090 (9)</td>
</tr>
<tr>
<td></td>
<td>complement semantic type</td>
<td>directional</td>
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</tr>
<tr>
<td></td>
<td>mannerSemantic type</td>
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<td>0.090 (9)</td>
</tr>
<tr>
<td></td>
<td>manner</td>
<td>no manner</td>
<td>0.090 (9)</td>
</tr>
</tbody>
</table>

Four contextual features ranked 9 have the same effect size. Therefore, there are a total of 13 features listed in the Table 1. Each feature in the list tends to occur with ná 拿 and chí 持, but not with zhuā 抓 and wò 握. That means the features listed in the table are where the two clusters of verbs behavior most differently. In our corpus, ná 拿 and chí 持 attract these features while zhuā 抓 and wò 握 repel then.

The snake plot shows that only a few factors have the most distinctive power in differentiating the two clusters. The most distinctive feature, in the dataset, is the semantic type of the complement. Some of the factors listed have the same Cramer’s V statistics since they are different tags for the same feature. It is shown that ná 拿 and chí 持 cluster usually appears with no complement. Example (1) illustrates this pattern.

(1) a. 他又 冲回 房内 拿 了碗 清水

Tā yòu chōng huí wū nèi ná le wǎn qīng shuǐ
He again rushed house inside take LE a bowl water
‘He rushed back to the house to take a bowl of water.’
b. 雪峰神尼持剑环顾
Xuěfēng shénní chí jiàn huán gù.
The nun in snow mountain holds sword and looks around.

The third most prominent feature appearing with a quantitative marker in the context. The data indicate that in the context that ná 拿 and chí 持 cluster usually appears with a quantitative marker. For example:

(2) a. 靓柔拿出一支口红
Liàng róu ná chū yī zhī kǒu hóng
Liangrou takes out a lipstick.

b. 每人手持一块一汽大众佛山工厂的版面
Měi rén shǒu chí yī kuài yīqìdàzhòng fōshān gōngchǎng de bǎn miàn
Each person hand hold a piece of FAW-Volkswagen Foshan factory layout
‘Each holds in hand a piece of layout from the FAW-Volkswagen Foshan factory.’

Another prominent feature will be the semantic type of the object, it is shown that abstract object usually collocates with ná 拿 and chí 持, as shown in example (3).

(3) a. 拿 他的话讲
Ná tā de huà jiǎng
‘Use his word.’

b. 虽然 现在 仍有一些人持否定论的观点
Suīrán xiànzài réng yǒu yīxiē rén chí fǒudìnglùn de guān diǎn
Although now still some people hold negativism point
‘Although there are still some people who hold a negative view.’

The dataset also annotated the order in SVC, which indicates that ná 拿 and chí 持 usually appears in the first place if it is a serial verb construction. As illustrated below:

(4) a. 他拿出一片消炎剂和着水吞下
Tā ná chū yī piàn xiāo yán jì hé zhe shuǐ tūn xià
He take out a tablet anti-inflammatory together with water swallowed down
‘He takes out an anti-inflammatory tablet and swallows it with water.’

b. 那两个道人持剑追来,
Nà liǎng gè dào rén chí jiàn zhuī lái
That two Taoist hold swords chase after
‘The two Taoists hold their swords and chased after them.’
The eighth feature the cluster occurs with for to. It also noteworthy that the semantic type of the other VP tends to be possession when collocates with ná 拿 and chí 持, which is mainly conveyed by the postverbal yǒu 有 ‘have’. Finally, ná 拿 and chí 持 favors directional complement such as lái 来 and píng 平 but has no preference for manner words. Among the 13 features, most of the features are syntactic whereas discourse features and collocational features are relatively less. Therefore, it could be inferred most of the difference of the two clusters of verbs occur at the syntactic level. Example (1) indicates the most prominent feature ná 拿 and chí 持 cluster usually appears with no complement.

4 Conclusion

This study provides a quantitative perspective towards Chinese near-synonym study by comparing the four Mandarin physical contact verbs ná 拿, wò 握, chí 持 and zhuā 抓. Unlike most theoretical linguistic studies on verbs that only draw on one sub-senses of the meaning of ná 拿, wò 握, chí 持 and zhuā 抓, this study uses the behavior profile approach and calculated the BP vectors of the four verbs in order to compare its similarities and differences from the collocational, syntactic, and discourse level. The hierarchical cluster analysis shows that by incorporating all the three levels of factors together, wò 握 and zhuā 抓 are similar to each other, whereas ná 拿 is more similar to wò 握 and zhuā 抓 cluster. Finally, chí 持 behaviors most differently from the remaining three. There study also investigates how wò 握 and zhuā 抓 cluster is differentiated from chí 持 and ná 拿 cluster. The result shows that the two clusters behavior more differently in terms of the syntactic features, like the occurrence with a complement or not. The study adds some quantitative perspectives to the study of the four Mandarin physical contact verbs ná 拿, wò 握, chí 持 and zhuā 抓.

References

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Appendix:

Table 2. Overview of feature types and number of categories of each feature.

<table>
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<tr>
<th>Feature level</th>
<th>Feature Type</th>
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</table>