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# The Evolutionary Mechanisms of Transitivity in Mandarin VO Compounds: A Corpus-Driven Study of Competing Alternations

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## Abstract

This study investigates the evolutionary mechanisms of transitivity in Mandarin verb-object (VO) compounds, addressing the core question of why this change diffuses at uneven rates across different lexical items. Based on a large-scale corpus analysis of 102 VO compounds, we reveal a significant statistical pattern: the transitivity frequency of a VO compound is positively correlated with the presence of a competing Verb-Complement (VC) construction ([VO1 Prep O2]) and negatively correlated with an Adverbial-Verb (AV) construction ([Prep O2 VO1]). To explain these findings, this study proposes a cost-based evolutionary framework. We argue that these correlations reflect different evolutionary pathways, embodying different evolutionary costs. The VC pathway represents a low-cost, direct route driven by grammaticalization, where the reanalysis of a semantically bleached preposition facilitates rapid diffusion. In contrast, the AV pathway is a high-cost, indirect route inhibited by a dual cost: its output violates the “Dependency Length Minimization” (DLM) principle and neutralizes the source construction’s crucial information-structuring function. This framework provides a principled explanation for the observed statistical patterns, linking synchronic variation to diachronic mechanisms. It frames the uneven transitivity of VO compounds as a gradual lexical diffusion shaped by the competition between evolutionary pathways of differing cognitive and functional costs.

## 1 Introduction

The Verb-Object compound (hereafter ‘VO compound’) in Mandarin Chinese consists of two constituents with a syntactic/grammatical relation of a verb and its direct object (Li and Thompson, 1981), such as *touzi* ‘invest-capital’ ‘to invest’ and *qian* ‘sign-contract’ ‘to sign a contract’. These compounds usually function as verbs. For instance, the compound *touzi* is formed from *tou* ‘to invest’

and *zi* ‘capital’, and the entire unit means ‘to invest’. Previous studies (e.g., Huang, 1984; Li, 2012) proposed that because the verb in a VO compound already assigns case/theta roles to its object—such as *tou* ‘invest’ and *qian* ‘sign’ taking the objects *zi* ‘capital’ and *yue* ‘contract’—the compound cannot take an additional direct object. However, recent studies have observed that, although their numbers are relatively small to begin with, an increasing number of VO compounds can now take another external object and yield the [VO1+O2] construction (e.g., Diao, 1998; Wang, 1997). Attested examples include *touzi fangdichan* ‘invest-real estate’ ‘invest in real estate’. In this construction, O1 refers to the compound’s internal object (i.e. *zi* ‘capital’), while O2 is the new, external object (i.e. *fangdichan* ‘real estate’).

Notably, while an increasing number of VO compounds are showing a tendency toward transitivity, the diffusion of this grammatical change is highly uneven across lexical items. For instance, some verbs have a very high frequency of taking an object, such as *guanxin taren* ‘care about others’, while the transitive usage of other verbs is less common, such as *pimei Aozhou de Huangjin hai’an* ‘rival the Gold Coast of Australia’. Some transitive examples, like *guanguang Yidali* ‘sightsee Italy’, are almost exclusively found in specific registers like news headlines (Jiang and Huang, 2022, 2024).

Previous studies on the VO1+O2 construction have either focused on static descriptions of grammatical features or pointed out possible source structures (Rao, 1984; Xu, 1988; Liu, 1993; Liu, 1998; Liu and Li, 1998; Gao, 1998; Yang, 2001). However, a key ‘explanatory gap’ remains: few studies have yet been able to systematically explain the internal mechanisms behind the uneven diffusion of this grammatical change across different lexical items. This study aims to fill this gap through large-scale corpus analysis and theoretical framing to answer the core question: Why does the

transitivization of VO compounds spread at such uneven rates across different lexical items?

The central argument of this study is that the diffusion rate of transitivization for a given VO compound fundamentally depends on the syntactic and cognitive costs involved in the evolutionary pathway from its competing source constructions.

## 2 Theoretical Framework

This study integrates two theoretical perspectives: Lexical Diffusion Theory and Constructionalization Theory. Lexical Diffusion Theory (Wang, 1969, 1977, 1979) posits that language change proceeds gradually on an item-by-item basis and at different rates (Iyeiri, 2010; Yue-Hashimoto, 1993; Zhang, 2000; Cheng, 1990, 1998; Tottie, 1991; Nevalainen, 2006; Ogura, 1993). Synchronic variation observed at any given point in time is essentially a snapshot of a stage in the process of linguistic evolution (Wang, 1979). In language change, new and old forms coexist and compete for an extended period, with the new form eventually replacing the old one (Yue-Hashimoto, 1993).

Construction Grammar (CG) holds that the basic units of language are constructions, i.e., form-meaning pairings, which can cover linguistic phenomena at all levels from morphemes to complex sentence patterns (Goldberg, 2006). Constructionalization Theory, as a diachronic extension of Construction Grammar, specifically investigates the process by which new constructions emerge (Traugott and Trousdale, 2013, 2014).

Lexical Diffusion Theory and Constructionalization Theory are not mutually exclusive but complementary. The former describes the diffusion patterns and temporal trajectories of language change at the lexical level, while the latter explains the specific grammatical mechanisms of the change. In this integrated view, the emergence of the [VO1 O2] construction can be regarded as the emergence (constructionalization) of a new argument structure construction, with its origins in competing alternative forms. Through micro-steps such as reanalysis and analogy, [VO1 O2] gradually emerges from older constructions, completing the creation of a new one. Within this integrated framework, these synchronic competing alternations provide a window into the diffusion mechanisms of transitivization. Based on previous research and corpus observations, the main competing formats include (Zhang, 2010; Li and Wu, 2017):

(1) **Verb-complement construction with postverbal preposition (VC)**: This involves transforming structures like [VO1 + preposition + O2] into [VO1 O2]. For example, *zhili yu keyan* ‘devote to research’ evolves into *zhili keyan*.

(2) **Adverbial-Verb construction with preverbal preposition (AV)**: This involves reordering structures from [preposition + O2 + VO1] into [VO1 O2]. For example, *wei guojia jingji bamai* ‘check for the country’s economy’ changes into *bamai guojia jingji*.

(3) **Separation construction (SEP)**: This involves condensing structures from [V + O2 (DE) + O1] into [VO1 O2]. For instance, *hao yibaiwan de zi* ‘spend one million funds’ condenses to *haozi yibaiwan*.

(4) **No alternative construction (NO)**: Some VO compounds lack alternative forms and directly appear as [VO1 O2], such as *huozeng yi ben shu* ‘receive a book’.

The theoretical framework of this study is based on this integrated diffusion-constructionalization perspective: [VO1 O2], as a nascent argument structure construction, evolves from various source constructions (i.e., competing alternations) along different constructionalization pathways. The degree of syntactic restructuring and cognitive processing cost required for each pathway directly influences the differential diffusion rates of the construction across different VO compounds. In other words, the unevenness in the speed of transitivization diffusion among different VO compounds stems from the varying syntactic and cognitive costs of the constructionalization pathways they each undergo.

## 3 Methodology

This study investigates a set of 102 Mandarin VO compounds. This list was compiled by aggregating all compounds identified as capable of transitive usage in previous key studies, primarily Gao (1998) and Qian (2011).

The corpus data for this study were primarily drawn from the Annotated Chinese Gigaword corpus (Huang, 2009), which contains over 1.1 billion characters from formal news texts. To ensure a comprehensive identification of competing alternations, we also consulted several other large-scale corpora, such as the BCC Corpus and the CCL Corpus, to verify and supplement the annotation of possible patterns for each compound.

The annotation process involved two main stages. First, two experts, both native Mandarin speakers with linguistic training, manually annotated the presence or absence of the competing alternation patterns (VC, AV, SEP, NO) for each of the 102 compounds. A compound was marked as having a particular alternation if at least one clear instance of that pattern was found across the consulted corpora. Disagreements were resolved through discussion.

Second, to quantify the transitivity of each VO compound, we extracted a random sample of its occurrences from the Gigaword corpus. For each of the 102 VO compound, 1,000 tokens were extracted. We quantified the transitivity of each compound using its relative frequency. The transitivity frequency was calculated with the following formula: Transitivity Frequency = Number of transitive tokens/Total number of extracted tokens. For example, the transitivity frequency of *qianyue* sign-contract ‘to sign a contract’ in the corpus was calculated by dividing its number of transitive instances (13 tokens) by the total number of its extracted instances (1,000 tokens), yielding a frequency of 0.013.

The statistical analysis procedure included descriptive statistics to characterize the distribution of transitivity frequencies, Spearman rank correlation to assess the relationship between transitivity and alternation types, and the Kruskal-Wallis H test to compare group differences. Furthermore, a Beta regression analysis was conducted to validate the core findings, and a k-means clustering analysis was used to explore the typological patterns of the compounds.

## 4 Data Analysis

### 4.1 Descriptive Statistics

The analysis of 102 VO compounds shows that the mean transitivity frequency (0.303) is substantially higher than the median (0.182), and the distribution is highly right-skewed (see Figure 1). This indicates that the transitivization of most compounds is still in its early stages, a typical characteristic of uneven lexical diffusion.

In terms of alternation patterns, 74.5% of the compounds exhibit a VC format, and 76.5% exhibit an AV format, while fewer have SEP and NO formats (See Figure 2).

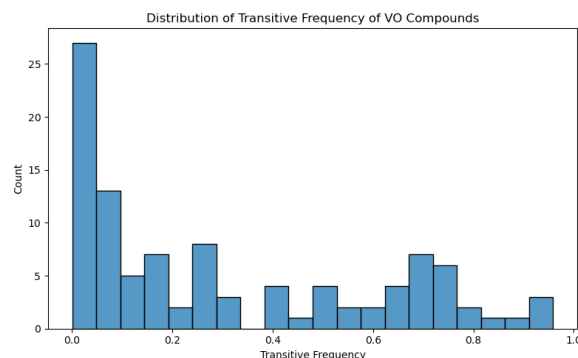


Figure 1: Distribution of Transitive Frequency of VO Compounds.

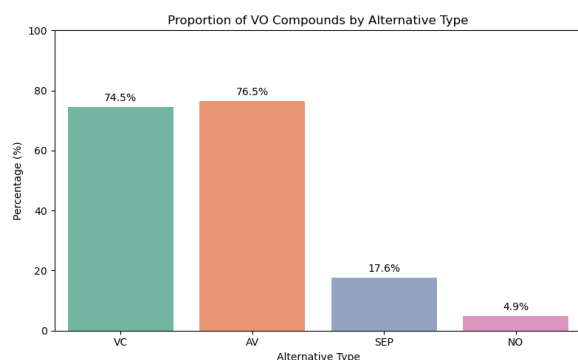


Figure 2: Proportion of VO Compounds by Alternative Type.

### 4.2 Core Relationship Findings

Spearman rank correlation analysis reveals a clear pattern of association (see Figure 3): VO compounds that possess a VC alternation exhibit significantly higher transitivity frequencies ( $r = 0.233$ ,  $p < 0.05$ ). In contrast, those with an AV alternation show significantly lower transitivity frequencies ( $r = -0.361$ ,  $p < 0.001$ ). There was no significant correlation between word frequency and transitivity frequency ( $p = 0.18$ ), suggesting that the transitivization tendency of VO compounds is not driven by usage frequency but is more likely constrained by their internal syntactic features.

While the correlation analysis revealed general trends across the dataset, it does not isolate the effects of these competing alternations, especially since many compounds exhibit both VC and AV patterns. To more directly test our hypothesis of opposing evolutionary forces—a “pull” from the low-cost VC pathway and an “anchoring effect” from the high-cost AV pathway—we conducted a targeted group difference test.

For this purpose, we categorized the compounds into discrete groups based on their specific combi-

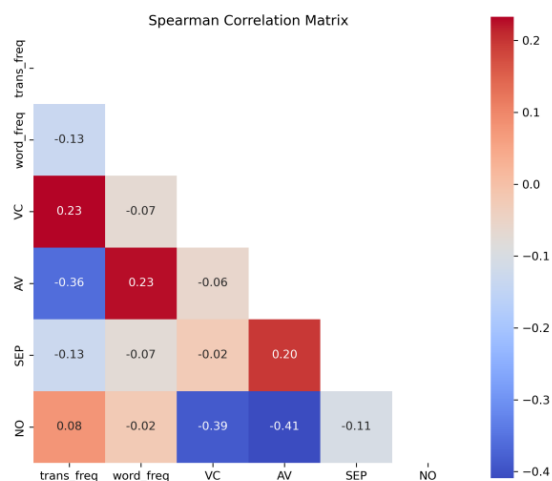


Figure 3: Proportion of VO Compounds by Alternative Type.

nation of alternation patterns (e.g., ‘VC-only’, ‘AV-only’, ‘VC+AV’, etc.). This grouping strategy allows for a crucial comparison: the ‘VC-only’ group represents a “pure” promoting pathway, while the ‘AV-only’ group represents a “pure” inhibitory one. If our cost-based framework is correct, we would expect to see the highest transitivity frequency in the ‘VC-only’ group and the lowest in the ‘AV-only’ group.

The Kruskal-Wallis H test confirmed a significant difference in transitivity frequency among these groups ( $H = 19.27$ ,  $p < 0.01$ ). As predicted, a post-hoc Dunn’s test revealed that the median transitivity of the ‘VC-only’ group was indeed significantly higher than that of the ‘AV-only’ group ( $p = 0.00094$ ), a result clearly visualized in Figure 4. This finding provides strong, direct support for the opposing roles of the VC and AV constructions in the transitivity process.

Synthesizing the above analyses, the core empirical finding of this study is: the Verb-Complement (VC) structure significantly promotes the transitivity of VO compounds, whereas the Adverbial-Verb (AV) structure significantly inhibits this process.

### 4.3 Supplementary Analysis

Subsequent statistical modeling provided further validation for these findings. We first conducted a Beta regression analysis, which is specifically designed for proportional data, to model transitivity frequency. The analysis confirms that the presence of an AV alternation is a significant negative predictor of a compound’s transitivity frequency ( $\beta =$

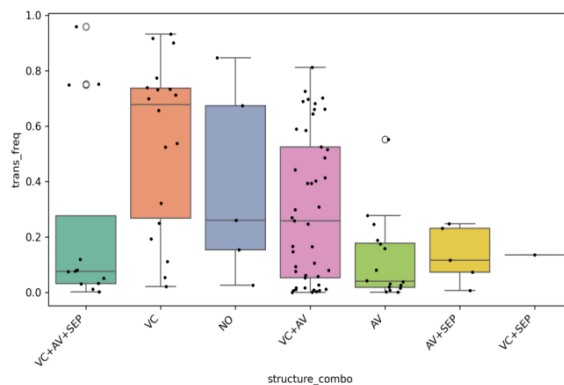


Figure 4: Proportion of VO Compounds by Alternative Type.

$-1.041$ ,  $p = 0.039$ ). The model also indicated a positive trend for the VC alternation, which aligns with our hypothesis, although this effect did not reach the conventional level of statistical significance ( $p = 0.117$ ). For completeness, a standard linear regression was also performed, which found the effects of both AV ( $p < 0.001$ ) and VC ( $p = 0.010$ ) to be significant.

Furthermore, exploratory clustering and classification analyses supported this general pattern. K-means clustering identified three types of VO compounds with different “structure-use” characteristics: a “VC-dominant” cluster showed a high tendency for transitivity, while an “AV-dominant” cluster showed the opposite, as shown in Table 1. A supplementary classification model analysis clarified the role of word frequency: while syntactic structure (VC/AV) is the core mechanism, word frequency itself can serve as an effective but non-mechanistic heuristic for distinguishing between high and low transitivity tendencies.

## 5 Discussion

This section aims to integrate the theoretical framework and statistical findings to propose a model that explains the divergent transitivity tendencies among VO compounds. The core idea of the model is that different competing alternation constructions represent different evolutionary starting points, and the pathways leading from these sources to the transitive construction [VO1 O2] involve varying syntactic and cognitive costs. These differences in cost ultimately determine the diffusion rate of the change.

Cluster	VC	AV	SEP	NO	T. Freq	W. Freq
0	0.6441	0.9831	0.2881	0.00	0.1213	27.9192
1	0.0000	0.0000	0.0000	1.00	0.3922	32.4420
2	1.0000	0.5263	0.0263	0.00	0.5734	18.5489

Table 1: K-means Cluster Centroids. T. Freq and W. Freq refer to transitivity frequency and word frequency, respectively.

### 5.1 Direct pathway: Low-cost grammaticalization based on the [VO1 [Prep O2]] construction

VO compounds with VC alternation patterns exhibit the highest degree of transitivity because they follow a low-cost grammaticalization pathway, with the core mechanism being a reanalysis of constituent boundaries driven by high-frequency usage. This pathway has a low cognitive cost, thus a high diffusion rate. The evolution begins with a syntactic structure containing a post-verbal prepositional phrase, [VO1 Prep O2], as in “*zhili* (VO1) *yu* (Prep) *keyan* (the external object O2)” (‘devote to research’). The post-verbal preposition (such as *yu*) undergoes semantic bleaching and phonological weakening, its function gradually shifting from an independent contentful preposition to a functional word marking the object (Zhang, 2010).

As the preposition becomes grammaticalized, speakers cognitively reinterpret the syntactic structure: the original [VO1[Prep O2]] structure is re-analyzed as [VO1 O2], with the preposition such as *yu* being omitted. This step represents a typical micro-change described in constructionalization theory (Traugott and Trousdale, 2013, 2014).

Since this evolution only involves deleting a semantically bleached element and does not alter the core word order, it aligns with the principle of linguistic economy and prosodic requirements, thus being low-cost. The low-cost pathway greatly facilitates the diffusion of the new transitive construction. This also explains why the VO compounds in the VC group statistically exhibit the highest transitivity frequency.

### 5.2 Indirect pathway: Dual high cost based on the [Prep O2 VO1] construction

VO compounds with AV alternation patterns show a significantly lower degree of transitivity because their evolutionary pathway is inhibited by a dual high cost. The transformation from [Prep O2 VO1] (e.g., *wei guojia jingji bamai* ‘feel the pulse for the national economy’) to [VO1 O2] (*bamai guo-*

*jia jingji*) must overcome two major obstacles: (1) According to the DLM principle, language users tend to minimize the linear distance between syntactically dependent elements to reduce working memory load (Gibson, 1998, 2000; Temperley, 2007). This principle is supported by large-scale, cross-linguistic corpus evidence showing that dependency lengths in natural languages are universally shorter than would be expected by chance (Futrell et al., 2015). The transitive construction evolved from the AV structure has a high cost under this measure because it forces a non-local dependency: the logical object of the core verb (V) is separated from it by its internal object (O1), lengthening their dependency distance and thus increasing the cognitive processing load for the listener/reader. (2) Functional cost: The source construction [Prep O2 VO1] is not pragmatically neutral in Chinese; it is a specialized information structure construction for topic or focus fronting. The shift to [VO1 O2] abandons this specialized pragmatic function, constituting a ‘functional cost’.

This dual high cost, composed of both processing and functional pressures, forms a strong ‘evolutionary resistance’ that suppresses the occurrence and diffusion of the change.

### 5.3 Hybrid pathway: Dynamic competition between low-cost and high-cost

When a VO compound possesses both VC and AV alternation patterns, its degree of transitivity tends to be intermediate. This is because such compounds are simultaneously influenced by two evolutionary pathways with divergent costs: the low-cost VC pathway provides a “pull” that promotes transitivity, while the high-cost but functionally entrenched AV pathway provides an “anchoring effect” that slows the diffusion of the change.

### 5.4 Lexicalization pathway

For VO compounds without any prepositional alternation patterns (i.e., the NO group), especially those exhibiting strong transitivity, their transitivity arises not from a syntactic pathway but through

lexicalization. This pathway mainly applies to two types of VO compounds: (1) O1 is a verbal morpheme: e.g., *huozeng* ‘receive-gift’, where the internal object O1 is itself a transitive verbal morpheme. The transitivity of O1 is thus transferred to the entire compound, naturally equipping it with the ability to govern an external object. (2) O1 is a metaphorical or bleached morpheme: e.g., *chuxi* appear-seat ‘attend’ *jieshou* take-hand ‘take over’), where the meaning of the internal object O1 is highly metaphorical or bleached. This leads to a high degree of semantic integration for the entire VO compound, causing it to be processed by users as an indivisible, single transitive verb [V-O]. Once VO1 is reanalyzed as a single verb at the lexical level, it can directly govern the object O2 without needing an intermediate prepositional construction phase. This is a form of lexical constructionalization, rather than a syntactic one.

## 6 Conclusion

Through systematic statistical analysis of a large-scale corpus, this study demonstrates that the transitivity tendency of modern Mandarin VO compounds is not random but is closely related to the types of competing alternation constructions these compounds can participate in. Specifically, the presence of a post-verbal preposition (VC) construction is a strong promoting factor for the transitivity of VO compounds, while the presence of a pre-verbal preposition (AV) construction significantly inhibits it.

To explain this core finding, this study proposes a model containing four evolutionary pathways. This model posits that the transitivity process of VO compounds is in fact the emergence of the new [VO1 O2] construction evolving from its respective competing source constructions through different constructionalization pathways. The syntactic and cognitive costs involved in each pathway determine the ease or difficulty of the change, thereby affecting the rate at which transitivity diffuses across different lexical items. It is these differences that ultimately lead to the statistical patterns and typological clustering patterns observed in the corpus.

Future research can be further deepened in the following aspects: (1) Diachronic analysis: Utilize diachronic corpora to trace the emergence and developmental trajectories of different evolutionary pathways, directly testing the evolutionary model proposed in this study and verifying the evolu-

tionary processes and relative speed differences of each pathway from a historical perspective. (2) Psycholinguistic experiments: Directly measure the cognitive processing cost differences of various alternation constructions through sentence acceptability judgments, eye-tracking, or ERP experiments, to provide evidence for the psychological reality of the hypothesis in this model that the level of ‘cost’ affects the difficulty of evolution. (3) Comparison with other syntactic structures: Investigate whether similar evolutionary pathways and cost-constraint mechanisms exist in other similar compound structures to test the explanatory power of the model. (4) Multi-factor model: Future research could integrate the structural factors found in this study with other known factors into a more comprehensive multi-factor model. This would allow for exploring the interaction of various factors in the transitivity process of VO compounds, thereby more accurately describing and predicting their transitivity trends.

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