

Machine Translation Constraints in Lexical Conversion in Classical Chinese and Implications for China's English Teaching

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Abstract: The study focuses on the lexical conversion in Classical Chinese and explores its semantic generalization, syntactic dependency, and cognitive mechanisms (metonymic and metaphoric mapping, and prominence principle). Sixteen samples from classical texts were selected, and their translations by three machine translation (MT) engines, DeepSeek, Doubao and Youdao, were tested against authoritative versions. Results show that MT exhibits gradient differences in accuracy when identifying lexical conversions, and fails in semantic reconstruction and cultural preservation. These limitations stem from MT's reliance on distributional statistics rather than human-like cognitive frames. The findings highlight the irreplaceability of core human capacities (contextual sensitivity, cultural metaphorical competence) and advocate transforming China's English teaching into a paradigm that combines language, digital, and humanity elements. This paradigm aims to foster the collaboration between human and machine, to cultivate students' higher-order thinking and humanistic values, and to provide theoretical and practical references for English teaching transformation in China in the digital age.

Keywords: Classical Chinese Lexical Conversion; Cognitive-linguistic Mechanisms; Machine Translation Constraints; English Teaching Transformation; Human-Machine Collaboration.

1. Introduction

A diachronic examination of Classical Chinese uncovers a sophisticated system of lexical conversion. Being logographic and morphologically inert, it encodes temporal and modal information almost exclusively through contextual cues and syntactic configurations. Word classes in Classical Chinese exhibit less rigidity than those in many analytic languages: a single word can function as a noun, verb, or adjective depending on its syntactic position and pragmatic role, or its grammatical function may be defined by co-occurring syntactic constituents, such as prepositional phrases. This syntax-driven characteristic is evident in idiomatic constructions and adverbial modifiers, which trigger semantic shifts in verbal or nominal elements.

Such conversion is not merely a rhetorical phenomenon; it is an operation that is lexically consequential and syntactically governed. It carries immediate practical value for computational linguistics and machine translation, where the accurately parsing of context-dependent part-of-speech shifts remains a critical bottleneck.

Lexical conversion in Classical Chinese demonstrates diverse morphological characteristics, with its core mechanism lying in the temporary shift of parts-of-speech to achieve semantic extension. Based on Zou L. Z.'s definition of the "lexical-grammatical" dual nature of Classical Chinese, it can be categorized into the following types and when combined with an analysis of typical linguistic data [1]:

(1) Transcendence of the Grammatical Category of Nouns

Nouns are converted into transitive verbs through zero derivation, forming a "subject-predicate-object" syntactic framework (a process termed transitivization). For example, in "tízhī" (蹄之) from *The Donkey of Qian*, the noun "tí" (蹄, meaning "hoof") achieves this conversion via "zero-derivation" (or "derivation by zero morpheme") as defined by

Deng, R. H. [1], with its semantics being projected from "a body part" (horse's hoof) to "an action" (kicking with the hoof) by virtue of the metonymic mechanism.

When nouns are flexibly used as verbs, they contain causative semantics, and the interpretation of such semantics depends on the delimitation of the syntactic context. Zou Lizhi highlights the "strong dependence of Classical Chinese word-class conversion on syntactic structures." Take "Pèi Gōng jūn Bāshàng" (沛公军霸上, "Duke of Pei stationing troops at Bashang") from *Records of the Grand Historian* as an example: when the noun "jūn" (军, literally "army") is used as a verb, the underlying semantics of "stationing troops" must be supplemented in light of the context to ensure accurate understanding.

Nouns are also recategorized as manner adverbials through orientational metaphor. For example, in "Páo Dīng Jiě Niú" (庖丁解牛, "Cook Ding dissecting the ox") from *Zhuangzi*, the lexeme "páo" (庖, "cook") is shifted from its original nominal designation to an adverbial function that specifies the instrumental manner of the action: "to butcher an ox with the techniques of a cook." The semantic trajectory follows a metaphorical mapping from the spatial-orientational source domain to the instrumental target domain, thereby encoding procedural expertise as a qualitative modifier of the verb.

In anthropomorphic constructions, animal nouns evoke the cognitive schema of animal personification when they occupy adverbial slots. The line "hú míng hū yuē" (狐鸣呼曰, "Imitating a fox's cry, someone called out and said...") in *Strange Tales from a Chinese Studio* illustrates this process: the noun "hú" (狐, "fox") is syntactically reclassified as an adverbial that activates the personification frame, conveying an eerie narrative ambience in which the fox's vocalization is construed as human-like speech. This operation corroborates the contention that lexical conversion in Classical Chinese is heavily dependent on subjective image projection, wherein

the speaker's embodied imagination reconfigures lexical categorical boundaries [2].

(2) Semantic Function Expansion of Adjectives

Adjectives are converted into verbs via stress shifts to achieve action-oriented expression. For example, in “xián xián yì sè” (贤贤易色, “to honor the virtuous, and to discount beauty”) from *The Analects*, the first “xián” (贤) — “virtuous or worthy of respect” (an adjective) — bears sentential stress, thereby converting it to “to treat as worthy” and yielding the imperative “honor the worthy”.

The same adjectives may further develop into a causative predicate without derivational morphology. Context supplies the agent, while the adjective itself encapsulates the sense “to cause NP to become Adj.” As illustrated in “kǔ qí xīn zhì” (苦其心志, “make his mind bitter”) from *The Mencius*, the adjective “kǔ” (苦, “painful or distressing”) undergoes zero-derivation to “to embitter”. The surface form remains “kǔ”, but the (Object [syntactic function] + Adjective [word class]) construction elicits the causative interpretation: “the subject causes the object to experience bitterness”.

Besides, with their semantic focus shifting from objective attributes to the subject's cognition, adjectives are converted into conative predicates via epistemic modality markers to convey subjective judgments. In *The Mencius*, “xiǎo Lǔ” (小鲁, literally “small Lu”), is thus read as “to deem the state of Lu (to be) small”, the once-descriptive “xiǎo” (小) now functioning as a verb meaning “regard as petty/minor”. The shift is cued by the absence of any copular or comparative particle and by the pragmatic inference that the subject's cognitive judgment, rather than ontological size, is at issue.

(3) Functional Conversion between Verbs and Numerals

Zero-derivation converts verbs into nouns, freezing the dynamic features of an action and reifying the action as either a countable or mass entity. For example, the phrase “bǎifèi jùxīng” (百废具兴, “all abandoned undertakings were revived”) from Fan Zhongyan's works features the adjective “fèi” (废, “abandon”) used as a noun. Devoid of verbal morphological markers, it now denotes the static collective “abandoned undertakings”, with the plural reference inferred from the numeral “bǎi” (百, “hundred”). The same lexical root thus moves from event to entity, leaving no morphological trace.

Category shift also recruits numerals into verbal function, freeing them from the arithmetical domain to express abstract, intensive relational meanings. The line “sìhǎi yī” (四海一, literally “the four seas become one”; idiomatically “the four seas were unified”) from Du Mu's *Epic of the Efang Palace* illustrates this: the cardinal yī (一, “one”) is converted into a transitive verb whose semantic value is “to make one; to integrate politically”. The numeral thus takes on the causative meaning of “making (things) united” and moves beyond its original role of counting. This shows how Classical Chinese uses positional syntax to trade the numeral's counting function for a meaning related to geopolitical finality.

2. The Semantic Features, Syntactic Dependency, and Cognitive Mechanisms of Lexical Conversion in Classical Chinese

The lexical conversion in Classical Chinese is lexico-grammatical in essence[2]. Lexically, it reflects semantic augmentation through functional extension within the ancient

lexical system. Grammatically, this process is contingent on syntactic scaffolding: categorical shifts are enabled either by structural markers or by combinatorial reconfigurations (e.g., transforming a subject-predicate structure into a verb-object one).

(1) Neologistic Function and Semantic Generalization of lexical conversion

The essential attributes of lexical conversion in Classical Chinese need to be examined from the diachronic perspective of Chinese language history. It operated as a productive word-formation device: in eras when the lexicon was still expanding, nouns and adjectives augmented their semantic load by shifting word classes, a process best described as a variant of the phonetic loan strategy for word-coining[1]. An example is the verbalization of “Yǔ” (雨, rainwater) in “Yǔ wǒ gōng tián” (雨我公田, “Let it rain upon our lord's fields”) from *The Book of Songs*·Minor Odes. Here the concrete noun “rainwater” is recast as the verb “to rain”, a transformation that turns a physical association into a grammatical one through phonological metonymy, forming a cross-categorical semantic mapping.

This mechanism differs from zero-derivation in English, which realizes part-of-speech conversion through morphological markers (such as the suffixes -en/-ize). Chinese, however, relies on context-sensitive grammatical metonymy and is realized through phonological word-formation process, a tonal differentiation mechanism already attested in oracle bone script and bronze inscriptions.

At the level of semantic generalization, the conversion unfolds as prototype-based category extension. The causative usage of adjectives, illustrated by “kǔ” (苦) in “kǔ qí xīn zhì” (苦其心志, “to make his heart and will suffer”) from *Mencius*, is a metaphorical projection from the concrete to the abstract. Similarly, the adverbial use of nouns is seen in “xí juǎn tiān xià” (席卷天下, “to sweep across the empire”, lit. “mat-roll the realm”) in *Records of the Grand Historian*. It materializes a spatial metaphor, which maps spatial relations onto action modes through orientational schemas. This mechanism differs from the English causative construction, which relies on overt morphological inflections (e.g., “soft” to “soften”) to convert an adjective into a verb. Classical Chinese completes the same semantic augmentation through zero conversion alone.

Notably, the grammaticalization of flexible word-class use in classical Chinese shows a dynamic, evolutionary arc. Early cases were mostly context-bound variants; over time, the sporadic flexibility evolved into institutionalized constructions. A telling example is the noun “qīng” (卿) in the idiom “qīng qīng wǒ wǒ” (卿卿我我, “to show affectionate intimacy”). The collocation appears recurrently in *A New Account of the Tales of the World*, eventually crystallizing into a disyllabic bound morpheme.

(2) Syntactic Dependency in Word Conversion in Classical Chinese

The non-discrete word-class division in classical Chinese manifests syntactic dependency, whose defining property is summarized as “A word's class is fixed only within a sentence; outside of a sentence, no class is assignable[3].” This arises from the intrinsic dynamism of early Chinese grammar: without stable case or category markers, lexical categories are negotiated online, with their class emerging from the syntactic slots they temporarily occupy.

Such syntactic dependency operates within two distinct yet

complementary dimensions. The first is a licensing mechanism for nouns to function as verbs. This needs strict syntactic conditions: e.g., the “Noun + Pronoun” frame in “zhōu zhī” (肘之, literally “to elbow him”) in *Strategies of the Warring States*, where the pronominal object reclassifies the noun as a verb and imposes a transitive meaning.

The second is the syntactic frame itself, a primary determinant of lexical categorization. Since Classical Chinese lacks morphological inflections, its word classes are entirely position-dependent. Examples include the verbs “gū” (沽, purchase) and “shì” (市, purchase) in “gū jiǔ shì fū” (沽酒市脯, “to purchase wine and dried meat”) from *The Analects*. These verbs acquire verbal valence the instant they occupy the V-slot in the V+NP schema.

(3) Cognitive Mechanisms of lexical conversion in Classical Chinese

From a cognitive-linguistic lens, Classical Chinese lexical conversion is a product of human cognitive capacities. The core mechanisms include the synergistic interaction of metonymic mapping, metaphoric mapping, and the principle of prominence – tools that language users spontaneously use to extend lexicon across categories [2].

First, metonymy is one of the primary cognitive mechanisms underlying word-class flexibility. It licenses dynamic categorial shifts through conceptual contiguity. In Classical Chinese, for example, the noun “rèn” (刃, “blade”) is converted to a verb in the clause “zuǒ yòu yù rèn Xiàngǒu” (左右欲刃相如, “the attendants wanted to ‘blade’ Xiangǒu”) from *Records of the Grand Historian: Biography of Lian Po and Lin Xiangru*. Via the metonymic path, “blade” temporarily assumes a verbal function and thus is interpreted as “stab with a blade”. This is highly consistent with the cognitive schemas (such as “part for whole” and “instrument for action”) documented in contemporary cognitive linguistics. Such metonymic shortcuts allow speakers to extend meaning by foregrounding a typical attribute or functional association of an entity [4].

Second, metaphor drives categorial flexibility by mapping meaning across conceptual domains. In *Memorial on Sending Out the Troops*, the adjectives “qīn” (亲, “intimate”) and “yuǎn” (远, “distant”) are recast as verbs – “be close to virtuous ministers and distance yourself from petty men (亲贤臣, 远小人)” – through the metaphor of “state to action” (mapping “the state of intimacy/estrangement” onto “the action of making intimate/estranging”). Such shifts exemplify how speakers recruit concrete experiential schemas to reconfigure abstract relations, compressing a perceptual state into a directive action via metaphorical projection [5].

Third, the principle of prominence dictates that linguistic expressions prioritize attention to the most attention-worthy facet of a situation. In the Classical Chinese sentence “Xiàng Bó shā rén, chén huó zhī.” (项伯杀人, 臣活之, “Xiàng Bó killed a man; your servant kept him alive”) from *Records of the Grand Historian: Biography of Xiang Yu*, the adjective “huó” (活, “alive”) is categorially shifted to a verb whose profile is narrowed to its causative outcome: “cause to survive”. This reflects the speaker’s focus on the result of the action over the description of the state. By spotlighting the resultant state rather than the stative quality itself, the speaker re-figures “huó” as the causal agent of survival, a perfect illustration of the cognitive-linguistic figure-ground reversal that re-aligns attention from ground (state) to figure (caused

result) [6].

3. Capability of Machine Translation for Lexical Conversion in Classical Chinese

(1) Accuracy Levels of Part-of-Speech Conversion Recognition by Three Machine Translation Systems

This study assembles 16 canonical word-class flexibility instances from *The Analects*, *Records of the Grand Historian*, and *Zhuangzi*. The sentences were submitted to three mainstream MT engines (DeepSeek, Doubao, and Youdao), with the outputs compared to English translations by authoritative translators (James Legge, Herbert Giles, and Yang Xianyi and his wife). Quantitative and qualitative analysis reveals sharp divergences in three areas: (i) detecting word-class shifts, (ii) reconstructing semantics, and (iii) preserving the cultural load. Their performance is constrained by both algorithm designs and the interplay of Classical Chinese’s grammar-free flexibility and culture-bound expressiveness.

The three MT engines exhibit a clear gradient in recognizing noun/adjective-to-verb conversions.

Table 1. The accuracy of MT in recognizing the conversions

MT engine	Accuracy	Key Gap
DeepSeek	 87.5 %	_____
Doubao	 62.5 %	weakens the process of adj-to-V conversion
Youdao	 56.2 %	blinded to lexical conversion at the grammatical level

DeepSeek achieves the highest accuracy rate of 87.5%, being able to accurately identify “tí” in “tízhī” (蹄之, a noun converted to a verb) and translate it as “lashed out with hooves”, and translate “huó zhī” (活之, a causative usage) as “spared his life”. Its advantages are mainly reflected in the following aspects: making the instrumental relationship explicit through verb phrases (such as “drew blades”) and using causative structures (such as “make them prosperous”) to correspond to causative usages.

Doubao performs at a medium level with an accuracy rate of 62.5%. This system tends to use literal translation but easily loses the characteristics of part-of-speech conversion. For example, translating “xián xián yìsè” (贤贤易色) as “value virtue... regard appearance as secondary”, although the semantic expression is correct, weakens the grammatical process of the conversion from an adjective to a verb.

Youdao has a high mistranslation rate of 43.8% and, more seriously, a problem of systematic mis-analysis. A telling case is its rendering of “rèn Xiàngǒu” (刃相如) as “were as sharp as each other”, betraying complete insensitivity to the noun-to-verb conversion of “rèn” (刃, “to stab with a blade”) and revealing a blind spot for part-of-speech flexibility at the grammatical level.

Typical weaknesses emerge when MT engines confront intentional predicates. Xiǎo Lǔ (小鲁), literally “regard Lu as

small”, is a case in point. DeepSeek renders it “saw Lu shrink”, a tolerable approximation; Youdao, however, outputs “felt smaller than Lu”, inverting the experience-target relation and exposing the system’s inability to recover the subjective cognitive logic encoded in such intentional constructions.

(2) Cognitive Differences in Semantic Conversion Strategies

Human translators and machine-translation systems differ in semantic reconstruction in principle. At the methodological level, human translation is embodied in context-aware strategies and characterized by cultural adaptability. Human translators can resort to an embodied strategy: they draw on their own bodily experiences, sensory perception, and motor cognition to convert abstract or idiosyncratic source-language material into target-language forms that match everyday perceptual routines [7]. When culture-bound items appear, human translators turn to a cultural compensation strategy. Instead of forcing a formal match, they insert a gloss, recast the reference, or select a cultural analogue so that target readers can grasp the underlying cultural connotations. James Legge’s rendering of “xiāngxù” (庠序) as “village schools” is typical: the added modifier “village” supplies the historical context that the single English term “school” would lack, compensating for the missing knowledge and letting an English audience recognize the local, community-based character of early Chinese education.

4. Analysis of the Causes of Machine Translation Failure Based on Cognitive Principles

Machine Translation (MT) engines operate with inherent cognitive constraints that distinguish them fundamentally from human linguistic processing. These limitations stem from MT’s overreliance on data-driven patterns rather than the embodied, context-rich cognition that underpins human language comprehension.

The cognitive constraints manifest across three key dimensions.

First and foremost, MT engines struggle with the interpretation of action verbs, a challenge rooted in their disconnection from embodied sensorimotor experience. Drawing on embodied cognition theory, human understanding of action verbs (e.g., “grasp,” “twist,” or “stretch”) is grounded in sensorimotor re-enactment: when processing such verbs, individuals implicitly activate neural pathways associated with the physical actions they describe (e.g., simulating the hand movement of “grasping” when reading the word).

In contrast, MT engines lack the capacity to resonate with such verbs as they rely exclusively on distributional statistical patterns derived from large textdistributional corpora – reducing action verbs to vectors of co-occurrence frequencies (e.g., associating “grasp” primarily with nouns like “object” or “idea” based on how often they appear together in training data) rather than representations of potential physical movement[8]. This disembodiment strips verbs of their experiential meaning, leading to inaccuracies in contexts where action semantics depend on real-world motor knowledge.

Another critical cognitive constraint emerges in the translation of culture-loaded items (e.g., idioms, cultural symbols, or domain-specific concepts tied to a particular society), again driven by MT’s overreliance on surface-level

statistical patterns.

The translatability of such items is constrained by two interrelated factors: the inherent semantic scope of linguistic signs, and the ability to bridge divergent cultural cognitive frames. Humans store culture-specific concepts within structured cognitive frames. For instance, Chinese associate “dragon” with prosperity and power, whereas Westerners link it to danger and malevolence – both associations are rooted in their respective cultural cognitive frames, and via these frames, translations are adapted to target cultural contexts (e.g., adding explanatory notes or selecting equivalent symbols when direct translation fails).

MT engines, however, lack such structured, context-sensitive representations. Instead, they capture only surface-level lexical co-occurrences without accessing the cultural connotations that give the term meaning. For example, In Western contexts, “dragon” is linked to “mythical creature” when co-occurs with terms like “mythology”, “fantasy”, or “folklore”; in Chinese contexts, it is tied to “mythical creature” when paired with “mythic narrative” or “dragon king”, and to “imperial authority” when alongside “imperial robe” or “dragon throne”. When the cultural “weight” of an item exceeds what can be captured by distributional statistics or literal lexical equivalence, MT engines often produce literal, nonsensical outputs that fail to convey the idiom’s cultural and pragmatic intent.

Finally, MT engines are incapable of processing conceptual metaphors, a core component of human language that enables abstract thinking by mapping knowledge from concrete domains to abstract ones. Humans effortlessly engage in cross-domain metaphorical mapping[9]. For example, humans understand the metaphor, “Time is money.”, by projecting concepts such as “saving”, “wasting” or “investing”, which are drawn from the concrete domain of finance onto the abstract domain of time. This is an ability supported by higher-order cognitive processes. Psycholinguistic experiments confirm that metaphor comprehension activates the prefrontal cortex, regions in the brain associated with abstract reasoning, executive function, and the integration of domain-specific knowledge.

MT systems, by contrast, lack this capacity for abstract cross-domain mapping. Powered by neural networks trained on statistical patterns, they may recognize that “time” and “money” frequently co-occur in metaphorical expressions but cannot grasp the underlying conceptual link between the two domains. As a result, metaphorical words are frequently mistranslated by MT engines.

In summary, the above cognitive constraints highlight the gap between MT’s data-driven approach and the embodied, context-rich nature of human cognition. Addressing these limitations will require integrating insights from cognitive science into MT development, moving beyond pure statistical modeling toward more human-like linguistic processing.

5. Implications for the Transformation of English Teaching in China

MT’s consistent struggle to process lexical conversion underscores the irreplaceability of human cognitive capacities. The cognitive divide between MT systems and human linguistic processing compels English language education to transcend narrow, skill-centric training and to embrace an integrated paradigm that combines language, digital, and humanity elements. This framework synthesizes

technological literacy with profound cultural and linguistic competence, thus addressing the limitations of traditional approaches that prioritize decontextualized language forms over meaning-making process that is rooted in human cognition.

At its core, this paradigm redefines the philosophy of English teaching from “form mastery” to “meaning negotiation”[10]. Instead of treating language as a fixed set of rules, it guides learners to construct semantic sense by analyzing how context, culture, and discourse shape linguistic meaning. Technology, in this framework, functions as a cognitive scaffold rather than a replacement: it handles routine linguistic tasks to free up cognitive space for learners to engage in higher-order thinking, such as critiquing MT’s misclassifications of lexical conversion, or exploring the cultural roots of functional shifts. The goal is not to train learners to “compete with machines” but to equip them with the ability to use technology while retaining control over meaning-making, which is essential to ensure humans remain central to language education amid the rise of machine translation and generative AI.

To operationalize the paradigm, English education must reshape its ecological structure by establishing a clear human-machine division of labor. MT engines are optimally suited for routine linguistic tasks with low cognitive load. These tasks, which rely on pattern recognition rather than meaning construction, are precisely where MT excels and where it can reduce educators’ administrative and mechanical workload.

Teachers, by contrast, should focus on tasks of high cognitive value that draw on the unique cognitive capacities of humans: guiding learners to engage in creative inference to resolve lexical ambiguities; fostering cultural metaphorical competence by unpacking the cultural frames underlying lexical conversions; and nurturing humanistic values by connecting linguistic analysis to broader discussions of culture, history, and identity. In this ecology, teachers act as facilitators of critical thinking (not just knowledge transmitters) and mediators of cross-cultural meaning-making (not just language instructors).

In an era where generative AI is increasingly penetrating education, the core mission of English teaching is not to reject technological tools but to reassert human subjectivity in the humanities. Language education should reframe technology as a tool that serves humanistic goals. By entrusting surface-level linguistic tasks to algorithms, educators can redirect their energy toward nurturing what machines cannot replicate: the ability to engage with language as a vehicle of human thought, culture, and emotion; the capacity to negotiate

meaning across cultural boundaries; and the willingness to critique and adapt technology to human needs.

In essence, MT’s limitations in Classical Chinese lexical conversion serve as a theoretical touchstone for redefining English education in the digital age. They remind us that linguistic competence is not merely a set of technical skills but a synthesis of cognitive, cultural, and critical capacities, which are inherently human, and which must remain at the center of English teaching.

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