

Article

Learning the Lexical Semantics of Mandarin Monomorphemic State-Change Verbs by English-Speaking Learners of Mandarin Chinese

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Abstract: Languages vary systematically in how semantic information is “packaged” in verbs and verb-related constructions. Mandarin Chinese contrasts typologically with English in its lexicalization of state change. Most Mandarin monomorphemic verbs are moot about or imply a state change, whereas many English monomorphemic verbs (e.g., *kill*, *break*) entail the fulfillment of a state change. Recent studies suggest that Mandarin monomorphemic verbs form a continuum in the strength of state-change implicature. State-change verbs have been found difficult for first language (L1) learners. This study reports two experiments that investigate the lexical semantic knowledge of Mandarin monomorphemic implied or moot state-change verbs by intermediate (N = 19, mean age 21) and advanced (N = 12, mean age 21) English-speaking second language (L2) learners of Mandarin Chinese. The results reveal L2 learners’ general preference for the state-change interpretation for the monomorphemic verbs and their limited sensitivity to the nuanced strength of state-change implicature in the Mandarin verbs. Typological differences in the lexicalization of state change are argued to contribute to the difficulties in L2 learning of the lexical semantics in the semantic domain of state change in Mandarin.

Keywords: lexicalization; lexical semantics; Mandarin Chinese; monomorphemic; verbs; state change; second language acquisition



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1. Introduction

Mandarin Chinese (henceforth Mandarin) is known as an isolating language, in which the morpheme-to-word ratio is very low, the function and the boundary of morphemes are relatively easy to ascertain, the morphological makeup of words is relatively clear, and long morphologically complex words consisting of series of affixes are rare (e.g., [Li and Thompson 1981](#); [Lyovin 1997](#)). Mandarin shows a distinct typological feature of having a large inventory of morphemes, for example, more than 13,000 morphemes in the latest 12th edition of *Xinhua Zidian* (New China Character Dictionary) ([Liu 2020](#)). The majority of Mandarin words are complex and formed by combining two or more morphemes via compounding or affixation. Compounding is the most productive morphological process in Mandarin and Mandarin is known as a language of compound words (e.g., [Arcodia and Basciano 2018](#)). Chinese compound words might represent up to 70% to 80% of the lexicon (e.g., [Duanmu 1999](#); [Xing 2006](#)). It is, therefore, crucial for language learners of Mandarin, either as a first (L1) or a second (L2) language, to understand the lexicalization and the distribution of meanings in morphemes and compound words to be able to use the target language properly and productively. This study focuses on the acquisition of the lexical semantics of Mandarin monomorphemic verbs that are typically used to describe events of state change, a basic type of events that human beings experience and talk about every day.

The meaning of a verb is generally assumed to be internally structured, and it is often represented as a set of semantic components combined in a certain configuration

(Gropen et al. 1989; Levin and Rappaport Hovav 1995; Pinker 1989; Talmy 1985, 2000). Across languages, there is variation in how this information is “packaged” (i.e., lexicalized) in verbs and verb-related constructions (e.g., Croft 2012; Langacker 2002, 2008; Talmy 2000). Learners of different languages thus have to discover how to pack or unpack the relevant information in a specific language, for example, to isolate the components within a combination and identify their contribution to the meaning of the whole, and to discover the regularities in how the forms and their meanings are combined (Bowerman 1982; Chen 2008, 2017; Clark 1993; Croft 2012; Pinker 1989; Tomasello 1992). This study aims to explore L2 learners’ acquisition of the language-specific lexicalization in the semantic domain of state change. Lexicalization is defined as the systematic association of particular components of meaning with particular morphemes or constructions (e.g., compounds, resultative constructions) (Talmy 1985, 2000). State-change verbs have been found difficult for first language (L1) learners (e.g., Gentner 1978; Wittek 2002). We extend the investigation of the acquisition of the lexical semantics of state-change meaning to L2 learners of Chinese whose first language (L1) is English. Mandarin contrasts typologically with English in its lexicalization of state change (e.g., Chen 2017, 2018; Talmy 2000). Most Mandarin monomorphemic verbs are moot about or imply a state change, whereas many English monomorphemic verbs (e.g., *kill*, *break*) entail the fulfillment of a state change. Recent studies suggest that Mandarin monomorphemic verbs form a continuum in the strength of state-change implicature (Chen 2017, 2018).

2. Background

A state-change event consists of a change in or the unchanging continuation of a certain property associated with a particular object or situation (e.g., Talmy 2000). Linguistic representations of these situations, for example, include *the door swung shut* or *he shut the door* (change) and *the door is shut* (stasis). The former indicates a resultant state (resultative) and the latter a non-dynamic state persistent at the reference time. A resultative typically denotes a state that was brought about by some action in the past and is semantically compatible with a predicate that indicates a change of state (Bybee et al. 1994; Dahl 1985; Nedjalkov and Jaxxonotov 1988). State-change events are typically composed of two subevents, namely a subevent of (causal, agentive, or non-agentive) action and a subevent of (caused) state change. Talmy (2000) regards ‘result’ as one of the core semantic categories and the main event of a causal interaction that accompanies a causal action or state, and that the lexicalization of ‘result’ can occur in verb roots, satellites, or inflections, respectively. Thus, in accordance with the general typology (Talmy 2000), the core schema of an event of state change appears in a satellite in satellite-framed languages, and in the main verb in verb-framed languages. For example, in the satellite-framed English construction *the door swung/creaked/slammed shut*, the state change is represented by the adjectival complement *shut* (i.e., a satellite), whereas the Manner in which the state change takes place is represented by the main verb. Similarly, in *He choked to death on a bone*, the state change ‘die’ is represented by the satellite *to death*, while the causal event is represented in the main verb *choke*. In verb-framed languages like Spanish, in contrast, the state change ‘die’ is expressed in the main verb, while the Manner or Cause is encoded in an adverbial phrase, as in *Murió atragantado por un hueso* ‘he died choked by a bone’.

2.1. State-Change Verbs in Mandarin and the Typology of State-Change Encoding

The typical way to encode state-change events in Mandarin is to use resultative verb compounds (RVCs) (e.g., 杀死 *sha-si* ‘do.killing-die’) (e.g., Bianca 2015; Chen 2008; Chen and Guo 2010; Gu 1992; Li and Thompson 1981; Li 1998; Lu 1977; Pan 1998; Shen 2003; Thompson 1973; Zou 1994). In an RVC the cause component is represented by the first verb of the compound, and the state-change component is represented by the second verb. The formation of RVCs is a very productive process, indicated by the diversity of verbs allowed as the component verbs of an RVC and the flexibility of creating new ones on the spot. This productivity is also revealed by the semantic possibility of combining verbs that specify

different (and even conflicting) semantic relations between the causal action and the caused result (Chen 2008). Given the productivity and importance of using RVCs to encode state change, extensive research has been devoted to the semantic and syntactic properties of RVCs (e.g., Chen 2008; Li and Thompson 1981; Li 1990, 1993; Lu 1977; Ma and Lu 1997).

RVC as a whole constitutes the semantic counterpart of an English monomorphemic state-change verb like *kill*. Mandarin monomorphemic counterparts of English verbs like *pick*, *break*, and *kill* do not entail a state change. This is illustrated by the feasibility of (1):

(1) 他杀了鸡，可是鸡没死。

Ta sha le ji, keshi ji mei si.

He do.killing PFV chicken but chicken not die

'He attempted to kill a chicken, but it did not die.'

(PFV = perfective aspect marker)

The RVC 杀死 *sha-si* 'do.killing-die' entails a state change of becoming dead, which clashes with the claim in the second clause that the chicken did not die, as illustrated by the semantic anomaly in (2) below.

(2) # 他杀死了鸡，可是鸡没死。

Ta sha-si le ji, keshi ji mei si.

He do.killing-die PFV chicken but chicken not die

'He killed the chicken, but it did not die.' (e.g., he shot it, but it did not die.)

(The symbol cross-hatch (#) is used to indicate semantic anomaly (as opposed to *, which indicates ungrammaticality).

Chen (2008) shows that English and Mandarin offer different lexicalization options in the conceptual domain of state change, where state-change realization (fulfillment) can be divided into a three-way distinction, that is, moot, implied, and entailed state change (Chen 2008; also cf. Talmy 2000). Germanic languages like English typically encode state change: (1) with monomorphemic verbs (e.g., *pick*, *break*, *crack*), which conflate both a causal action and resultant state change; (2) by combining a monomorphemic state-change verb with a particle or complement phrase, which adds further information about the state change encoded by the verb (e.g., *pick off*, *break into pieces*); and (3) by combining a verb that specifies only an action with a particle or a complement phrase that specifies the result state (e.g., *blow out (a candle)*). Mandarin, on the other hand, has very few monomorphemic state-change verbs like English *pick*, *break*, and *kill*, and RVCs as a whole constitute the semantic counterpart of an English monomorphemic state-change verb—the attainment of an endpoint is realized by the addition of the second verb of a resultative verb compound and is thus infeasible (e.g., 杀死 *sha-si* 'do.killing-die'). Mandarin RVCs, by their composition, neatly divide a state-change event into two subevents—the cause and the result, each encoded with a separate verb, that is, the first verb indicating the causal action and the second verb the resultant state change, and the action verbs of RVCs show varied degree of strength in the state-change implicature (Chen 2017, 2018). Talmy (2000) suggests that in the domain of state change, English exhibits a mixed system of conflation characteristic of both the satellite-framed pattern (i.e., using a satellite such as a particle to encode the result, e.g., *pick off*, *blow out*) and the verb-framed pattern (i.e., lexicalizing result in a root verb like *kill*), and both patterns are colloquial. Talmy treats Mandarin as a "far more a thoroughgoing exemplar of the satellite-framed type" (Talmy 2000, p. 241) since state change is consistently encoded in the satellite. Croft (2012) points out that cross-linguistically some languages (e.g., English) are more flexible in lexicalizing events in simple verbs than other languages that may require "overt morphological derivation of verb forms or complex or multiclausal verbalization of certain event types that English speakers readily lexicalize as simple verbs" (Croft 2012, p. 11).

In addition to the systematic differences in the lexicalization of state change as discussed above, languages differ in interesting ways on how implied fulfillment or moot

fulfillment is expressed. For example, English speakers must use an additional form to imply or ‘cancel’ an entailed realization of a state change, for example, the progressive aspect (e.g., *she is picking the apple*) or the conative construction (e.g., *she picked at the apple*) or using adverbs (e.g., *I almost picked the apple*) (Croft 2012; Talmy 2000). The progressive form indicates a runup process before the realization of the change of state, which may or may not be achieved (Croft 2012). Talmy (2000) notes that degree of realization is a core semantic category that can be expressed through adverbs (e.g., *almost, barely*) or particles near the verb, which “divides a referent action or state into a more central core of essential aspects and a periphery of commonly associated aspects and indicates that only one or the other of these is realized” (p. 155). Mandarin, in contrast, shows the opposite pattern: monomorphemic action verbs do not in themselves entail a state change and an additional form (i.e., a result verb) must be added to encode this meaning.

Mandarin RVCs are accomplishment or achievement verbs that denote telic events, and they frequently occur with the perfective aspect marker 了 *le*. When 了 *le* is used with a verb that encodes an event with a clear boundary (e.g., an RVC), it signals the completion of the event. However, when the verb encodes an event with no clear boundary, 了 *le* simply signals the termination of the action. The interaction between 了 *le* and the Aktionsart of the verb can be illustrated in the example (2): the use of the perfective aspect marker 了 *le* with the compound verb 杀死 *sha-si* ‘do.killing-die’ indicates that the state change has occurred—the chicken has been dead. However, when 了 *le* occurs with the atelic action verb 杀 *sha* ‘do.killing’ as in (1) indicates only that the action of killing has been performed, regardless of whether the chicken has become dead or not. In sum, 了 *le* only signifies termination, not state change. State change is entailed only with verbs with certain Aktionsart properties (e.g., an RVC) (Chao 1968; Li and Thompson 1981).

2.2. Learning State-Change Verbs and the Continuum of State-Change Implicature in Monomorphemic Verbs in Mandarin

Prior studies of L1 children’s acquisition of the meaning of state-change verbs (Chen 2008, 2017) reveal that Mandarin children as young as 2;6 years old (the age of children is conventionally notated as years;months) show adult-like interpretation of RVCs as entailing a state change from a young age, in sharp contrast to the difficulties that English and German children experience in figuring out the state-change meaning in state-change verbs. English and German children tend to treat state-change verbs as either encoding only an action or implying a state change. But Mandarin children even by the age of 6 years old have trouble distinguishing exactly where the state-change meaning is encoded inside the RVCs. They tend to treat the first verb (V1) of an RVC as entailing a state change and they also do not treat all V1s as equally entailing a state change (e.g., verbs like 关 *guan* ‘do.closing’ are more likely to be interpreted as entailing a state change than verbs like 倒 *dao* ‘pour’). Mandarin children’s misinterpretation of monomorphemic action verbs as state-change verbs has been attributed to the language-specific way to lexicalize state change and the varied interpretations of state-change entailment in different monomorphemic verbs reflect the input usage, that is, adult speakers’ semantic knowledge of the meanings of the monomorphemic verbs in Mandarin (Chen 2008, 2017). The verbs that children are most likely to treat incorrectly as entailing a state change are those that, for adults, have a relatively strong—although still defeasible—state-change implicature (such as 关 *guan* ‘do.closing’). Verbs that for adults have a weaker state-change implicature (e.g., 锤 *chui* ‘strike with a hammer’), children tend to treat correctly as entailing only an action. The term “implicature” is used to refer to the intended resultant state (goal) (cf. Tai 1984; Talmy 2000), different from “conversational (pragmatic) implicature” (e.g., Grice 1975; Krifka 2009), which is the implicit illocutionary speech acts of speakers’ utterances indirectly inferred from the conversation contexts.

Chen (2018) further investigates the strength of the implicature of state change across Mandarin monomorphemic verbs empirically with two online experiments with adult native Mandarin speakers, the semantic acceptability rating task and the multiple-choice of

verb meaning task. The rating task included 16 target sentences that contained eight verbs tested in [Chen \(2008, 2017\)](#) (i.e., 关 *guan* ‘do.closing’, 摘 *zhai* ‘do.picking’, 夹 *jia* ‘press from both sides (in order to crack)’, 倒 *dao* ‘do.filling, pour’, 锤 *chui* ‘strike with a hammer’, 闹 *nao* ‘make.noise (to wake someone)’, 打 *da* ‘strike or shoot (with a gun)’, and 吹 *chui* ‘blow (to extinguish)’ and eight common action verbs (i.e., 杀 *sha* ‘do.killing’, 撕 *si* ‘do.tearing’, 切 *qie* ‘do.cutting’, 掰 *bai* ‘bend.break.by.hand’, 烤 *kao* ‘bake’, 煮 *zhu* ‘boil, cook’, 吃 *chi* ‘eat’, and 洗 *xi* ‘wash’), which are often used to describe typical state-change events involving the destruction or creation of an object. The selection of the target verbs is based on the approximate English counterparts, which are typical verbs of state change, for example, verbs of killing (e.g., *kill, execute*), break verbs (e.g., *break, tear, crack*), bend verbs (e.g., *bend, crumple*), cooking verbs (e.g., *bake, cook*), verbs of creation and transformation (e.g., *build, write, attach*) ([Levin 1993](#)). In addition to the 16 verbs in the rating task, the multiple-choice verb meaning task also included four more target verbs (i.e., 买 *mai* ‘buy’, 写 *xie* ‘write’, 看 *kan* ‘watch’, and 去 *qu* ‘go’), which are often state-change predicates (accomplishments) when combined with an argument in English (e.g., *wrote a letter, bought a book*). The rating task asked the native speakers to rate their acceptance of sentences like example (1), where the first clause stated someone did an action, and the second clause stated the intended result did not occur. The multiple-choice task asked the native speakers to choose the default or preferred interpretation of a monomorphemic verb when the target verb is used with the perfective aspect marker 了 *le* (e.g., 他杀了一只鸡 *ta sha le yi zhi ji* ‘he killed a chicken’). Three choices were provided to elicit native speakers’ preference for the most likely result of the action: attainment, no attainment, and moot attainment of a state change. The results of the two experiments confirm the existence of a continuum of the nuanced state-change implicatures in the sampled Mandarin monomorphemic verbs. For example, verbs such as 摘 *zhai* ‘do.picking’, 关 *guan* ‘do.closing’, 杀 *sha* ‘do.killing’, 切 *qie* ‘do.cutting’, 撕 *si* ‘do.tearing’ are more likely to be interpreted by native speakers as entailing a state change than verbs such as 吹 *chui* ‘blow’, 洗 *wash*, and 倒 *dao* ‘pour, do.filling’. The former set of verbs thus shows a stronger state-change implicature (i.e., stronger state-change implicature verbs) and the latter set a weaker state-change implicature (i.e., weaker state-change implicature verbs). Native Mandarin speakers were found to show remarkable sensitivity to the strength of the state-change implicature.

Relevant second language acquisition (SLA) studies of Mandarin RVCs have focused on the production of RVCs (including directional verb compounds as a subtype of RVCs) in written essays ([Zhang 2011, 2014](#)) or elicited speech ([Chen and Ai 2010](#)) by intermediate to advanced American English learners of Mandarin. [Zhang \(2011, 2014\)](#) examined the frequency, accuracy, developmental changes, and lexical diversity of the uses of RVCs in learners’ written essays. She found that learners increased the uses of RVCs with the increase of proficiency and that different types of RVCs (e.g., directional verb compounds vs. RVCs) showed different trajectories of development. [Chen and Ai \(2010\)](#) found that intermediate learners were able to produce RVCs productively in the elicited production, but overgeneralization errors of compounding occurred due to incomplete knowledge of the semantic constraints on forming RVCs. Few studies have systematically explored the lexical semantics of monomorphemic verbs that are often used to encode state-change events in Mandarin. [Qiao \(2007\)](#) is the only study that has looked at the issue of the learning of the lexical semantics of the component verbs in RVCs and we, therefore, review it in detail below.

[Qiao \(2007\)](#) examined the knowledge of the state-change meaning and the aspectual feature of telicity of RVCs and the atelic feature of the component action verb of the RVCs in Mandarin by L2 English-speaking learners. Three groups of L2 learners and a control group of native speakers ($N = 6$ per group) participated in a story comprehension task. The participants read 15 target short stories in English (eight state-change and seven failed state-change events) and afterward indicated the appropriateness of a pair of sentences in Chinese about each of the stories on a scale from 1 to 3 (3 being “most appropriate”). One sentence contains an RVC that described the realization of the action (e.g., 玛丽摘下

了苹果 *Mary zhai-xia le pingguo* ‘Mary picked-descend PFV the apple (Mary picked the apple)’, and the other sentence contained the first verb of the RVC that depicted only the action (e.g., 玛丽摘了苹果 *Mary zhai le pingguo* ‘Mary do.picking the apple’ (Mary did the picking action on the apple)). Perfective aspectual marker 了 *le* was used in both types of sentences to present the event as completed. The results show that for the state-change events the advanced and the intermediate groups of learners are similar to the native control group in their overall acceptance of the uses of the RVCs and the action verbs though the acceptance rates are lower for the action verbs than the RVCs across all the groups, whereas the beginner group accepts the uses of RVCs at a significantly lower rate and a slightly higher rate of the action verbs than the other groups. For the failed state-change events, only the advanced group of learners are similar to the native control in generally correctly rejecting the use of the RVCs and accepting the action verbs, whereas the intermediate and the beginner groups show higher acceptance rates of RVCs and lower acceptance of the action verbs. The results suggest that higher proficiency learners distinguish the telic RVCs from the atelic action verbs better than lower proficiency learners. It is argued that the telicity parameter operates in the initial state of L2 acquisition and that the lack of RVCs in learners’ L1 English contributes to the difficulty in learning the state-change meanings. This study has both theoretical and methodological issues. It adopts a nativist position in assuming that learners are equipped with innate parameters, but it is unclear what the values of the telicity parameter are and how the different parameter setting in English and Mandarin influences the L2 learning of the lexical semantics. The learning difficulty was attributed to the Mandarin-specific lexical aspect of the verbs, that is, the telicity of RVCs and atelicity of action verbs in Mandarin, without considering the interaction between the lexical aspect and the grammatical aspect, and the typological difference in the lexicalization of state change that may also affect the L2 acquisition of the state-change predicates (see §4 Discussion). The empirical study has very small samples of participants and the presentation of the target stories in English is problematic, which could have biased the learners to interpret the Mandarin verbs in the English way. It also does not consider the varied state-change implicature in the action verbs and does not address if L2 learners are sensitive to such a continuum.

2.3. Research Questions

This study aims to fill this gap in L2 acquisition and extend the findings in first language acquisition in [Chen \(2008, 2017\)](#) to the L2 acquisition of the lexical semantics of Mandarin monomorphemic verbs that often occur as a constituent first verb in RVCs (henceforth monomorphemic Mandarin verbs). Two main research questions are investigated:

1. How do L2 learners of Mandarin interpret Mandarin monomorphemic verbs that typically have implied or moot state-change meanings?
2. Are L2 learners of Mandarin sensitive to the nuanced state-change implicature lexicalized in Mandarin monomorphemic action verbs?

3. The Current Study

We adopted the two experiments in [Chen \(2018\)](#) with some adaptation of the procedure (see *procedure* below) to elicit the semantic knowledge of Mandarin monomorphemic verbs from L2 American English-speaking learners of Mandarin, including a rating survey task (Experiment 1) and a multiple-choice task (Experiment 2). The learner participants consisted of a total of 31 adult native English speakers of Mandarin (mean age = 21, range 17–26 years; 13 females and 18 males). They were recruited from an American university in Colorado and were divided into two proficiency groups, intermediate and advanced groups, based on the Chinese language program that they were in respectively at the time of the experiments. The intermediate group was in their sixth semester and the advanced group was in their eighth semester of the graduate program of Mandarin at this American university. All the learners reported English as the dominant language in daily use with a mean percentage of use of 85% or above based on our background survey

(see *procedure* below). The intermediate group had a mean length of study of Mandarin of about 44 months and the advanced group about 90 months. Two separate groups of native Mandarin adult control groups participated in Experiments 1 (84 native speakers, mean age 19.5 years, age range 18–23) and 2 (65 native speakers, mean age 20.5 years, age range 18–23) (Chen 2018). The results of the native Mandarin speaker data were reported in Chen (2018) and are cited here as the baseline for the comparison with the L2 learner groups. Table 1 summarizes the participants' background information.

Table 1. Background information of the participants.

Group	N	Gender (F:M)	Age (In Years)	Onset Age of Mandarin Learning (In Years)	Length of L2 Mandarin Learning (In Months)
Intermediate L2	19	9:10	$M = 21$ (17–26, $SD = 2.63$)	17 (13–22)	$M = 44$ (22–72)
Advanced L2	12	4:8	$M = 21$ (18–26, $SD = 1.97$)	13 (12–18)	$M = 90$ (60–144)
Native L1 (Ex. 1)	84	56:28	$M = 19.5$ (18–23, $SD = 1.97$)	birth	NA
Native L1 (Ex. 2)	65	29:36	$M = 20.5$ (18–23, $SD = 2.96$)	birth	NA

Note: F = females; M = males. Age = age at the time of the experiments. M = mean. Ex. = experiment; The native control group completed the task online via qualtrics.com (Chen 2018).

The procedure for the two experiments is as follows. Both groups of learners participated in the rating and the multiple-choice tasks during their regular Chinese class session as an in-class exercise. Each participant first completed a brief background survey, which gathered information about their age, gender, education level, and language background. Then they were given the rating survey and were instructed to read each sentence carefully, take as much time as they need, and rate the sentences on a five-point scale one by one, with 1 being “completely acceptable”, 2 “acceptable”, 3 “unsure”, 4 “unacceptable”, and 5 “completely unacceptable”. After they completed the rating survey, the learners were given the multiple-choice task and were instructed to take as much time as they need to answer each question carefully. To ensure that the learners actually knew the target verbs, we asked them to indicate the unknown ones by circling them on the survey. Each participant took about 20 to 25 min to complete the background questionnaire and the two surveys.

3.1. Experiment 1: Rating Task

A rating task was conducted to explore the acceptability of sentences that expressed a failure of the attainment of the state-change implicature of a target verb (e.g., 他杀了鸡。可是鸡没死 *ta sha le ji, ke shi ji mei si* ‘he killed a chicken, but it didn’t die’).

3.1.1. Stimuli

The rating task adopted the stimulus sentences and target verbs in Chen (2018) from her study of the Mandarin native speakers' knowledge about the state-change meaning in monomorphemic verbs. It consists of 16 target sentences in Chen (2018) (see all the target verbs and the stimulus sentences in Appendix A). The target verbs and the rationale for the selection of those verbs were reported in §2.2 and the verbs are repeated here for convenience: 关 *guan* ‘do.closing’, 摘 *zhai* ‘do.picking’, 夹 *jia* ‘press from both sides (in order to crack)’, 倒 *dao* ‘do.filling, pour’, 锤 *chui* ‘strike with a hammer’, 闹 *nao* ‘make.noise (to wake someone)’, 打 *da* ‘strike or shoot (with a gun)’, 吹 *chui* ‘blow (to extinguish)’, 杀 *sha* ‘do.killing’, 撕 *si* ‘do.tearing’, 切 *qie* ‘do.cutting’, 掰 *bai* ‘bend.break.by.hand’, 烤 *kao* ‘bake’, 煮 *zhu* ‘boil, cook’, 吃 *chi* ‘eat’, and 洗 *xi* ‘wash’. The instructor of the learners' groups checked the list of verbs to confirm that the learners had exposure to the uses of the target verbs. We also asked the learners to mark any target words that they were not familiar with (see aforementioned *procedure*). Each target sentence was composed of two clauses: the first clause stated someone did an action, and the second clause stated that the intended result did not occur. Table 2 shows four examples of the target sentences. Chinese characters are used to illustrate the actual sentences in the experiment and the target verbs are highlighted

in bold below the character line in Pinyin, the official system to transcribe Mandarin into the Roman alphabet in P. R. China.

Table 2. Sample target sentences in the rating task (target verbs in bold).

张三 关 了门, 可是门还开着。 <i>Zhangsan guan le men, keshi men hai kai zhe.</i> 'Zhangsan closed the door, but the door was still open.'	
李四用枪 打 了张三, 可是张三没死。 <i>Lisi yong qiang da le Zhangsan, keshi Zhangsan mei si.</i> 'Lisi shot Zhangsan, but Zhangsan didn't die.'	
李四 吹 了蜡烛, 可是蜡烛没灭。 <i>Lisi chui le lazhu, keshi lazhu mei mie.</i> 'Lisi blew at the candle, but the candle didn't go out.'	
张三 摘 了树上的苹果, 可是苹果还在树上。 <i>Zhangsan zhai le shu shang de pinguo, keshi pingguo hai zai shu shang.</i> 'Zhangsan picked the apple on the tree, but the apple was still on the tree.'	
The translations are approximate since the semantics of the target verbs do not correspond exactly to the English counterpart verbs.	

Acceptance of the target sentences suggests that the resultant state change is not crucial to the meaning of the target verb and thus can be canceled. Rejection of these sentences, on the other hand, indicates the opposite. Three warm-ups were included to familiarize the participants with the task and 10 filler trials were interspersed with the target trials. The order of the test sentences was randomized into two different orders and participants received one of the orders randomly.

3.1.2. Analysis and Results

The rating score for each target sentence by each participant was recorded and analyzed. The total number of responses from the intermediate group was 301 (19 participants $\times$ 16 target sentences – 3 missing responses), 192 from the advanced group (12 participants $\times$ 16 target sentences), and 1344 from the native group (84 participants $\times$ 16 target sentences) responses (cf. Chen 2018). We further removed the target trials in which the learners indicated the verbs as being unknown, which included 93 target trials for the intermediate and 47 for the advanced groups, respectively. The final valid responses end up being 208 (70% of the original responses) for the intermediate group and 145 (76% of the original responses). Our analyses below are based on the valid responses.

We tabulated both the mean rating scores for each target sentence and the frequency counts of the choice of different ratings (1 to 5) in Table 3. The target verbs are ordered by the rating means from the highest to the lowest for each learner group. To see if the participating groups differ significantly in their rating scores for the target verbs, we ran a two-way ANOVA to test the effects of *proficiency* (i.e., native, intermediate, and advanced) and *specific verb* on the rating scores for each sentence. The result shows a significant effect of proficiency ($F(2, 1649) = 23.25, p < 0.001$) and verb specificity ($F(15, 1649) = 6.03, p < 0.001$). Post-hoc pair-wise comparisons of the effect of proficiency using the Turkey HSD test reveal significant differences between L1 and intermediate L2 ($p < 0.001$), and L1 and advanced L2 ($p < 0.001$), but no significant difference between the intermediate and advanced L2 groups ($p = 0.06$). The statistical result reveals that the learners are more likely than the native speakers to reject the cancellation of a resultant state when the causal action has occurred, that is, they are more likely to treat the target verbs as entailing a state change. In contrast, the native speakers tend to treat most target verbs as implying a state change and allow the cancellation of a state change. This difference is also reflected in the descriptive mean proportions of choice of acceptance (i.e., choices of 1 and 2) by group, 45% mean acceptance rate for both the advanced and the intermediate groups (see Table 3), and 65% mean acceptance rate for the native group (cf. Chen 2018). Even though the two learner groups only differ marginally significantly ($p = 0.06$), the intermediate learners

are more likely to reject the cancelation of the state-change meanings than the advanced learners, indicated by the more “unacceptable” choices, that is, choices 4 and 5 (29.81% and 12.02%, respectively), than the advanced learners (20% and 8.97% respectively). They also chose fewer “completely acceptable” choices, that is, choice 1, than the advanced learners (9.62% vs. 15.86%, respectively), revealing a lower acceptance of the cancelation of the state-change meanings. This suggests that higher proficiency might lead to the more native-like performance of the advanced learners.

Table 3. Frequency counts, rating means, and standard derivations of the ratings by verb and learner group.

Intermediate Learners			Rating Frequency Counts					
Verb\Rating	Mean	SD	1	2	3	4	5	Total
杀 <i>sha</i> ‘do.killing’	3.81	1.28	0	4	2	3	7	16
切 <i>qie</i> ‘do.cutting’	3.79	1.42	2	1	0	6	5	14
夹 <i>jia</i> ‘press from both sides (to crack)’	3.55	1.13	0	3	1	5	2	11
关 <i>guan</i> ‘do.closing’	3.50	1.15	1	3	3	8	3	18
煮 <i>zhu</i> ‘boil, cook’	3.44	1.24	1	1	1	5	1	9
锤 <i>chui</i> ‘strike with a hammer’	3.22	1.30	0	4	1	2	2	9
掰 <i>bai</i> ‘bend.by.hand (to break)’	3.00	1.00	0	2	1	2	0	5
闹 <i>nao</i> ‘make.noise (to wake)’	3.00	0.93	1	3	6	5	0	15
撕 <i>si</i> ‘do.tearing’	2.75	0.96	0	2	1	1	0	4
吹 <i>chui</i> ‘blow’	2.73	0.96	1	6	4	4	0	15
摘 <i>zhai</i> ‘do.picking’	2.71	0.95	0	4	1	2	0	7
烤 <i>kao</i> ‘bake’	2.71	1.07	1	7	1	5	0	14
倒 <i>dao</i> ‘pour’	2.69	1.20	2	7	2	4	1	16
打 <i>da</i> ‘strike or shoot (with a gun)’	2.58	1.17	2	10	3	2	2	19
吃 <i>chi</i> ‘eat’	2.50	1.25	4	7	2	4	1	18
洗 <i>xi</i> ‘wash’	2.44	1.29	5	6	2	4	1	18
Total counts (proportions)	3.03	1.14	20 (9.62%)	70 (33.65%)	31 (14.9%)	62 (29.81%)	25 (12.02%)	208
Advanced Learners			Rating Frequency Counts					
Verb\Rating	Mean	SD	1	2	3	4	5	Total
闹 <i>nao</i> ‘make.noise (to wake)’	3.63	0.92	0	1	2	4	1	8
烤 <i>kao</i> ‘bake’	3.45	1.44	2	0	3	3	3	11
关 <i>guan</i> ‘do.closing’	3.30	1.34	1	2	2	3	2	10
撕 <i>si</i> ‘do.tearing’	3.17	1.17	0	2	2	1	1	6
锤 <i>chui</i> ‘strike with a hammer’	3.14	0.90	0	2	2	3	0	7
切 <i>qie</i> ‘do.cutting’	3.00	1.25	1	3	2	3	1	10
杀 <i>sha</i> ‘do.killing’	3.00	1.48	3	1	1	5	1	11
倒 <i>dao</i> ‘pour’	2.83	0.94	0	5	5	1	1	12
煮 <i>zhu</i> ‘boil, cook’	2.75	1.29	2	3	5	0	2	12
吹 <i>chui</i> ‘blow’	2.73	0.65	0	4	6	1	0	11
打 <i>da</i> ‘strike or shoot (with a gun)’	2.67	1.30	2	5	1	3	1	12
夹 <i>jia</i> ‘press from both sides (to crack)’	2.60	0.55	0	2	3	0	0	5
摘 <i>zhai</i> ‘do.picking’	2.25	0.96	1	1	2	0	0	4
洗 <i>xi</i> ‘wash’	1.92	1.08	5	5	0	2	0	12
吃 <i>chi</i> ‘eat’	1.75	0.75	5	5	2	0	0	12
掰 <i>bai</i> ‘bend.by.hand (to break)’	1.50	0.71	1	1	0	0	0	2
Total counts (proportions)	2.73	1.04	23 (15.86%)	42 (28.97%)	38 (26.21%)	29 (20%)	13 (8.97%)	145

To examine the effect of verb specificity on participants’ mean rating scores, we further conducted post-hoc pairwise comparisons between the target verbs using the Turkey HSD test for the intermediate and the advanced learner groups. No significant differences were found between the rating scores between the target verbs in the two learners’ groups ($F(2, 15) = 24.64, p = 0.25$). This result contrasts sharply with the findings with the native speakers, where significant differences were found in the ratings between four subsets of the target verbs at the $p < 0.05$ level (cf. [Chen 2018](#)). The first group of verbs, 摘 *zhai* ‘do.picking’

and 关 *guan* ‘do.closing’, received a significantly highest rejection rate among the 16 verbs—if the state change did not occur, native speakers tended to treat them as unacceptable, suggesting an association with a strong state-change implicature. The second group of verbs, 杀 *sha* ‘do.killing’, 切 *qie* ‘do.cutting’, and 闹 *nao* ‘make.noise (to wake someone)’ received a significantly higher rejection rate than the rest of the verbs, but a lower rejection rate than that for 摘 *zhai* ‘do.picking’, and 关 *guan* ‘do.closing’. The third group of verbs, 撕 *si* ‘do.tearing’, 吃 *chi* ‘eat’, 掰 *bai* ‘bend.break.by.hand’, 烤 *kao* ‘bake’, and 煮 *zhu* ‘boil, cook’ received significantly lower rejection rates than the first two groups, but significantly higher than the last group of verbs, 锤 *chui* ‘strike with a hammer’, 倒 *dao* ‘pour, do.filling’, 吹 *chui* ‘blow (to extinguish)’, 打 *da* ‘strike or shoot (with a gun)’, 洗 *xi* ‘wash’, and 夹 *jia* ‘press from both sides (in order to crack)’. The last group of verbs received a significantly lowest rejection rate, suggesting speakers are more likely to accept the cancelation of the state change. The result from the native speakers thus forms a continuum of state-change implicature among the Mandarin verbs, with verbs like 摘 *zhai* ‘do.picking’ and 关 *guan* ‘do.closing’, on the stronger state-change implicature end, and verbs like 吹 *chui* ‘blow (to extinguish)’ and 洗 *xi* ‘wash’, on the weaker end of this continuum. Even though varied ratings were given to each target verb by each learner group (i.e., the mean rating score for each verb varied as shown in Table 3), the ratings are not statistically significant. Therefore, the L2 learners do not seem to have developed native-like implicit knowledge and sensitivity to the varying degree of the state-change implicature in the target verbs. We will discuss this lack of acquisition in the discussion section.

A methodological concern with Experiment 1 is that it might be quite rare to encounter sentences that contain a second clause encoding a failed state-change event, not to mention in the input to L2 learners. It is also unclear how frequently a failed state-change event may even occur and be talked about in real life. How do speakers interpret those verbs without a conflicting cancelation of the state-change result? A multiple-choice task was designed and conducted to elicit the preferred interpretation of the monomorphemic action verbs in Mandarin by the L2 learners, compared with the baseline of the native speakers in Chen (2018).

3.2. Experiment 2: Multiple-Choice Task

3.2.1. Stimuli

We adopted the stimulus sentences and the target verbs sampled in Chen’s (2018) study of the Mandarin native Mandarin speakers’ knowledge about the state-change meaning in monomorphemic verbs. The multiple-choice task contained a total of 20 target sentences that included the same 16 verbs in the first experiment and four common action verbs, that is, 买 *mai* ‘buy’, 写 *xie* ‘write’, 看 *kan* ‘watch’, and 去 *qu* ‘go’, which are among the first-semester vocabulary of Mandarin for foreign language learners (Liu et al. 2008). Each test sentence was composed of a simple clause, in which the target verb was used with the perfective aspect marker 了 *le* to describe that someone has completed a causal action, which may imply (e.g., verbs like 杀 *sha* ‘do.killing’) or be moot about the resultant state change (e.g., verbs like 洗 *xi* ‘wash’). Three choices were provided to tap participants’ preference for the most likely result of the action: attainment, no attainment, and moot attainment of a state change. Two sample survey questions are illustrated below (PFV = perfective aspect marker, CLF = classifier):

- | | |
|----------------------|--|
| (3) 张三杀了一只鸡。 | (Zhangsan kill PFV one CLF chicken) |
| a. 鸡死了。 | (chicken die PFV) |
| b. 鸡可能死了，也可能没死。 | (chicken may die PFV, may not die PFV) |
| c. 鸡没死。 | (chicken no die) |
| (4) 张三洗了衣服。 | (Zhangsan wash PFV clothes) |
| a. 衣服洗干净了。 | (Clothes clean PFV) |
| b. 衣服可能洗干净了，也可能没洗干净。 | (Clothes may clean PFV, may not clean) |
| c. 衣服没洗干净。 | (Clothes not wash clean) |

In (3) and (4), for example, choice a is considered attainment of a state change (i.e., the resultant state change of death has been realized), choice b moot attainment (i.e., the resultant state change of death may or may not have occurred), and choice c no attainment (i.e., the resultant state change of death did not occur). Note that verbs like 洗 *xi* ‘wash’ is moot about the resultant state change, that is, no certain state change is entailed or implied; the clothes may end up being clean or being broken (e.g., 洗破 *xi-po* ‘wash-be.broken’) or even being dirty (e.g., 洗脏 *xi-zang* ‘wash-dirty’). It may also be that all the clothes are washed (e.g., 洗完 *xi-wan* ‘wash-finish’). For verbs like 洗 *xi* ‘wash’ in our stimulus set, we used the most common resultant state as the attainment choice (e.g., 洗干净 *xi-ganjing* ‘wash-clean’). Eight filler trials were also included and interspersed randomly between the target trials. The order of the choices in each trial and the order of the trials were randomized into four different orders. The learners were randomly assigned to one of the four versions of the survey.

3.2.2. Analysis and Results

The choices for each target sentence were coded into one of the three categories, that is, attainment, no attainment, or moot attainment. The total number of responses is 378 (19 participants $\times$ 20 target sentences – 2 missing responses) from the intermediate group, 239 from the advanced group (12 participants $\times$ 20 target sentences – 1 missing response), and 1300 from the native group (65 participants $\times$ 20 target sentences) responses (cf. [Chen 2018](#)). We further removed the target trials containing the verbs that the learners indicated as being unknown, which included 88 target trials for the intermediate and 48 for the advanced groups, respectively. The final valid responses are 290 (76% of the original responses) for the intermediate group and 191 (80% of the original responses) for the advanced group. Our analyses below are based on the valid responses.

Figure 1 shows the mean proportions of choices for each of the groups. We ran a logistic regression analysis with *proficiency* (intermediate, advanced, and native) as the predictor variable and *choice* (i.e., attainment, no attainment, vs. moot attainment) as the outcome variable. The result (see Table 4) shows significant differences in the choices: all the groups are more likely to choose attainment ($\beta = 0.595$, $z = 102.11$, $p < 0.000$) than moot attainment, confirming a significant preference for interpreting the verbs as entailing a state change by all the groups. In addition, no significant difference was found between the two L2 and the native groups in the attainment choice (intermediate: $\beta = 0.28$, $p = 0.056$; advanced: $\beta = 0.14$, $p = 0.41$), suggesting that the learners are similar to the native speakers in preferring attainment or realization of a state change in the target verbs. The statistical result also shows that all the groups chose no attainment significantly less than moot attainment ($\beta = -2.42$, $z = 214.33$, $p < 0.000$), indicating that both the learners and the native speakers are more likely to interpret the verbs as being moot (i.e., saying nothing) about any state change (action only) than no attainment of any potential state change. Furthermore, the learners chose no attainment significantly more than the native speakers (intermediate: $\beta = 1.52$, $p < 0.000$; advanced: $\beta = 1.61$, $p < 0.000$), suggesting that the L2 learners are more likely than the native speakers to favor the non-realization of the implied or potential state change.

Table 4. Significant differences in choice of attainment and proficiency.

Choice ^a		Estimate	Std. Error	z Value	Sig.	
1—attainment	Intercept	0.595	0.059	102.110	0.000	***
	L2-Int	0.284	0.149	3.653	0.056	
	L2-Adv	0.144	0.176	0.670	0.413	
	L1	0 ^b				
2—no attainment	Intercept	−2.416	0.165	214.329	0.000	***
	L2-Int	1.519	0.270	37.768	0.000	***
	L2-Adv	1.605	0.296	29.468	0.000	***
	L1	0 ^b				

Note: ^a The reference category is *moot attainment*. ^b This parameter is set to zero because it is redundant. L2-Int = Intermediate L2, L2-Adv = Advanced L2. Asterisk is used conventionally to indicate degree of significance: *** means $p < 0.001$.

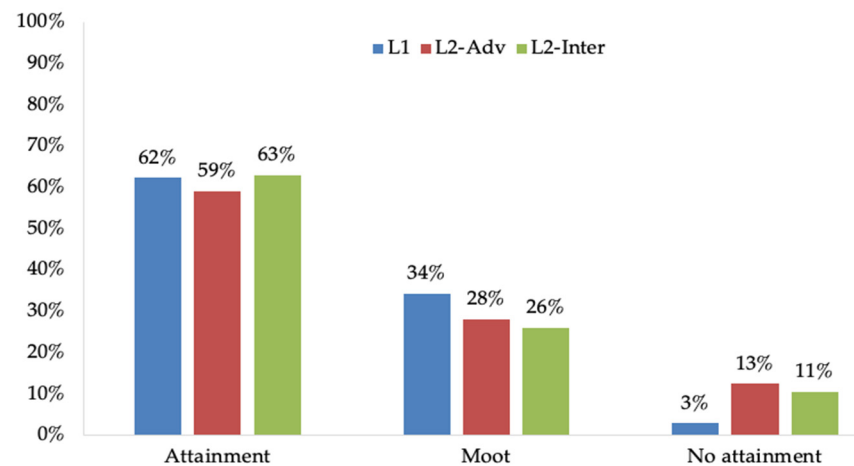


Figure 1. Proportions of choice of state-change attainment by proficiency (L2-Adv: Advanced L2 group; L2-Inter: Intermediate L2 group).

We also found no significant differences between the L2 groups in the attainment choice ($\beta = 0.41$, $p = 0.51$), the no-attainment choice ($\beta = -0.09$, $p = 0.79$), and the moot-attainment choice ($\beta = 0.23$, $p = 0.45$) in the logistic regression analysis. Therefore, the two groups were collapsed into one L2 group in the following analysis. Table 5 shows the mean proportions of the choices (attainment, no attainment, and moot attainment) by verb from the L2 learners and the L1 speakers.

Table 5. Mean proportions of choices of state-change attainment by verb and group.

Verb	Attainment		Moot		No Attainment	
	L1	L2	L1	L2	L1	L2
买 <i>mai</i> 'buy'	95%	90%	2%	6%	3%	3%
杀 <i>sha</i> 'do.killing'	92%	89%	8%	7%	0%	4%
撕 <i>si</i> 'do.tearing'	91%	80%	6%	10%	3%	10%
写 <i>xie</i> 'write'	91%	78%	9%	9%	0%	13%
关 <i>guan</i> 'do.closing'	91%	64%	6%	21%	3%	14%
摘 <i>zhai</i> 'do.picking'	89%	33%	3%	22%	8%	44%
切 <i>qie</i> 'do.cutting'	88%	79%	11%	17%	2%	4%
看 <i>kan</i> 'watch'	80%	53%	20%	37%	0%	10%
吹 <i>chui</i> 'blow'	68%	52%	32%	41%	0%	7%
掰 <i>bai</i> 'bend.by.hand (to break)'	65%	86%	34%	14%	2%	0%
烤 <i>kao</i> 'bake'	60%	64%	37%	24%	3%	12%
吃 <i>chi</i> 'eat'	58%	48%	38%	45%	3%	6%
去 <i>qu</i> 'go'	54%	65%	45%	23%	2%	13%
洗 <i>xi</i> 'wash'	49%	63%	48%	27%	3%	10%
锤 <i>chui</i> 'strike with a hammer'	48%	50%	51%	38%	2%	13%
煮 <i>zhu</i> 'boil, cook'	45%	55%	54%	23%	2%	23%
夹 <i>jia</i> 'press from both sides (to crack)'	37%	63%	60%	31%	3%	6%
闹 <i>nao</i> 'make.noise (to wake)'	26%	63%	71%	30%	3%	7%
倒 <i>dao</i> 'pour'	14%	44%	74%	37%	12%	19%
打 <i>da</i> 'strike or shoot (with a gun)'	9%	19%	82%	58%	9%	23%
Mean	62%	62%	34%	26%	3%	12%

To see if learners are sensitive to the state-change implicature in their choice of state-change attainment, we performed another logistic regression analysis to examine the effects of two predictor variables, *verb* and *proficiency* (L2 vs. L1), on the outcome variable *choice*. The statistical result confirms a significant preference for the attainment choice ($\beta = 2.64$, $z = 13$, $p < 0.000$), but no significant difference between the groups in the attainment choice ($\beta = 1.49$, $z = 1.43$, $p = 0.23$) and the no-attainment choice ($\beta = -0.69$, $z = 0.64$, $p = 0.57$). It also confirms the effect of verb types on the preferred interpretation of the verb meanings

(see Appendix B). Specifically, on the attainment choice, two groups of verbs are significantly different (see details in Appendix B): the verbs 买 *mai* 'buy', 杀 *sha* 'do.killing', 撕 *si* 'do.tearing', 写 *xie* 'write', 关 *guan* 'do.closing', 摘 *zhai* 'do.picking', 切 *qie* 'do.cutting', 掰 *bai* 'bend.break.by.hand', 烤 *kao* 'bake', 去 *qu* 'go', and 煮 *zhu* 'boil, cook' received significantly more attainment choices than the verbs 打 *da* 'strike or shoot (with a gun)', 吃 *chi* 'eat', 倒 *dao* 'pour, do.filling', 吹 *chui* 'blow (to extinguish)', 看 *kan* 'watch', 锤 *chui* 'strike with a hammer', 闹 *nao* 'make.noise (to wake someone)', 夹 *jia* 'press from both sides (in order to crack)', and 洗 *xi* 'wash'. The former group of verbs is among the stronger state-change implicature verbs, and the latter group of verbs is among the weaker implicature verbs based on the native speakers' data (see Table 5; cf. Chen 2018). The L2 learners are similar to the L1 speakers in giving more choices of attainment to the stronger state-change implicature verbs and are more likely to treat the weaker state-change implicature as being moot to the realization of state change. For example, strong state-change implicature verbs like 买 *mai* 'buy', 杀 *sha* 'kill', 撕 *si* 'do.tearing', and 写 *xie* 'write' received about 78% or above the choice of attainment from both the learner and the native groups, whereas weak state-change implicature verbs like 打 *da* 'shoot' and 倒 *dao* 'pour' received only 40% or 19% respectively the choice of attainment in the learner group.

To sum up, the results indicate that when no explicit cancelation of state change is mentioned, both the L2 learners and the L1 speakers favor the attainment of state change and disprefer moot or no attainment of the state change. L2 learners also seem to show some sensitivity to the nuanced strength of state-change implicature in Mandarin verbs.

4. Discussion

This study investigates how L2 English-speaking learners interpret Mandarin monomorphemic verbs that are typically used to describe caused (agentive) state-change events. These monomorphemic verbs can often combine with a second verb that typically indicates a state to form an RVC to encode the two subevents of a caused state-change event (i.e., a subevent of causal action and a subevent of caused state change). Prior studies have shown that these verbs form a continuum of nuanced state-change implicature lexicalized in Mandarin monomorphemic verbs and L1 speakers of Mandarin are sensitive to such a continuum (Chen 2017, 2018). Our study extends the acquisition to English-speaking L2 learners of Mandarin and asks specifically (1) how learners interpret the monomorphemic verbs that have implied or moot state-change meanings, and (2) if they are sensitive to the nuanced state-change implicature continuum. Two surveys, the semantic acceptability rating task (Experiment 1) and the multiple-choice verb meaning task (Experiment 2), were conducted to address these questions.

4.1. Summary of Findings

The results from the rating task reveal that English-speaking L2 learners are generally less likely to accept the cancelation of the state-change meaning in the monomorphemic verbs than the L1 speakers, who generally accept such cancelation and interpret Mandarin monomorphemic verbs as only implying or being moot about a state change. They also differ from the L1 speakers in that they do not show fine-grained distinctions of subtle strength of state-change implicature in different verbs as in the continuum found with the L1 speakers. The multiple-choice verb meaning task, on the other hand, reveals that the learners, similar to the L1 speakers, prefer a state-change interpretation when no explicit cancelation of a state change is mentioned. They also seem to show some sensitivity to the strength of the state-change implicature of a verb in their preference for the attainment of state change. The stronger the implicature is, the more likely the learners tend to favor a state change in the interpretation and disfavor a cancelation of a state change.

The results, taken together, indicate that the learners' preference for a default state-change interpretation, that is, when no cancelation of a state change is explicitly mentioned (Experiment 2), seems to lead to less acceptance of the explicit cancelation of a state change (Experiment 1). The L1 speakers, who also prefer the default state-change interpretation,

are sensitive to the strength of the state-change implicature in individual verbs in their acceptance or rejection of the cancelation of a state change (cf. [Chen 2018](#)). However, the learners do not seem to have fully developed native-like sensitivity to the continuum of the state-change implicature in interpreting the verb meanings when an explicit state change is canceled. In addition, the results also show a proficiency effect: the advanced L2 learners are more target-like than the intermediate learners in their acceptance of the cancelation of a state change and the preference for a state-change reading when no explicit cancelation of state change is mentioned. We will discuss below the possible factors that may have led to the observed performance in the L2 learners.

4.2. Influence of L1 Lexicalization on L2 Learning of State-Change Implicature Verbs

Why do the learners show a default preference for the state-change attainment interpretation in monomorphemic Mandarin verbs when no explicit cancelation of state change is mentioned (Experiment 2)? This apparent target-like performance may have resulted from the typological differences in the lexicalization of state change in their L1 English. As discussed earlier, prior research has shown that Mandarin contrasts with English in the lexicalization of state change (e.g., [Chen 2008, 2017, 2018](#); see review in §2). Mandarin has very few monomorphemic state-change verbs like English *pick*, *break*, and *kill*, and the attainment of a state change is typically realized by the addition of the second verb of an RVC (e.g., 杀死 *sha-si* 'do.killing-die'), which as a whole forms a semantic counterpart of the English monomorphemic state-change verb. English, on the contrary, has many monomorphemic state-change verbs such as *kill*, *break*, *cut*, *tear*, *bake*, etc., which compactly encode both the causal action and the resultant state change with one morpheme. As [Croft \(2012\)](#) notes that cross-linguistically some languages (e.g., English) are more flexible in lexicalizing events in simple verbs than other languages. L2 learners may have treated the Mandarin monomorphemic state-change implicature or action verbs as their state-change English counterparts. So the learners' default preference for state-change attainment interpretation may reflect the L1 influence of the large number of monomorphemic state-change verbs in English.

An additional potential factor may also have contributed to learners' preference for the default attainment reading, that is, learner's incomplete knowledge of the perfective aspect marker 了 *le*. Different from English perfective marking, 了 *le* with a monomorphemic verb such as 杀 *sha* 'do.killing' indicates only that the killing action has been performed, regardless of whether the affected theme has died. Thus, 了 *le* only signifies the termination of an action, not state change (e.g., [Chen 2018](#); [Chen and Shirai 2010](#)). Only when 了 *le* is used with an entailed state-change predicate such as RVCs (e.g., 杀死 *sha-si* 'do.killing-die'), the state change has occurred (resultative and completive aspect). [Bybee et al. \(1994\)](#) show that the use of the perfective aspectual marking with an action verb or a predicate that indicates a state change can lead to a resultative and completive meaning cross-linguistically. Completive is defined as "to do something thoroughly and completely" ([Bybee et al. 1994](#), p. 57) (e.g., *eat up*). Mandarin contrasts sharply with languages such as Nakanai ([Bybee et al. 1994](#)), where action verbs with a perfective aspect marker indicate completion or accomplishment of the resultant state, for example, an action verb like *eat* with the perfective marker *ti* means *eat up* in Nakanai. The L2 learners may have simply treated 了 *le* as a marker for completive and resultative aspect without realizing the interaction between lexical and grammatical aspects in Mandarin. It is therefore important for the learners to make a distinction between atelicity, telicity, implied end point, and entailed end point, and tease apart completive/resultative aspects from termination of actions.

The learning task is also complicated by the systematic difference between English and Mandarin in the conflation of causal action and resultant state change ([Talmy 2000](#)): English represents a mixed system of conflation characteristic of both the verb-framed pattern (i.e., lexicalizing results in a root verb like *kill*) and the satellite-framed pattern (i.e., using a satellite such as a particle to encode the result and has the causal action encoded in the main verb that may entail (e.g., *pick* in *pick it off*) or imply (e.g., *wash* in *wash it clean*) or

say nothing about the result (e.g., *beat in beat it into pieces*). Mandarin consistently encodes a state change in the satellite (i.e., the second verb of an RVC) and the first/main verbs do not in themselves entail a state change. English-speaking L2 learners of Mandarin, therefore, have to figure out such systematic differences and reorganize their semantic knowledge to properly understand the meanings of Mandarin monomorphemic verbs that are often used to encode the causal action. That is, they have to realize that those monomorphemic verbs in Mandarin only imply or are moot about the resultant state change. As English monomorphemic verbs are composed of not only state-change verbs (e.g., *kill*) but also implied state-change verbs (e.g., *choke*), and action verbs (e.g., *hit*), they form a superset to their Mandarin counterparts, which only imply or are moot about state change. In such a scenario, negative evidence (direct or indirect) is often necessary to help L2 learners to unlearn the entailed state-change meaning in their L1 state-change verbs and attend to the typological differences. Unfortunately, in formal classroom instruction of Mandarin, there is usually no explicit explanation of the lexicalization of meaning in verbal semantics. Direct or indirect negative evidence is also rare (e.g., it is rare for learners to encounter sentences that cancel the state change as those in Experiment 1). The lack of exposure to the correct interpretations and explicit instruction on state-change implicature in Mandarin monomorphemic verbs poses tremendous difficulty in learning. As seen in Experiment 1, all the learners differ significantly from the native speakers in being more likely to reject the cancellation of a resultant state when the causal action has occurred, that is, they are more likely to treat the target verbs as entailing a state change. However, the results also show that overall higher proficiency leads to a more native-like performance: the advanced learners tend to reject the cancellation of state change significantly less than the intermediate learners even without explicit instruction or direct or indirect negative evidence.

To sum up, the learners' interpretation of the monomorphemic verbs in the rating and the choice tasks suggests an influence of the L1 English lexicalization rooted in the typological difference in the lexicalization of state change between the L1 and the target language. This influence can be seen as twofold: it helps learners to select the preferred state-change interpretations to be target-like when no explicit cancellation of state change is mentioned, but it also seems to hinder them from unlearning the entailed state-change meaning to arrive at the implied or moot state-change meaning encoded in Mandarin monomorphemic verbs.

4.3. L2 Learning of State-Change Implicature Continuum

The results from the two experiments reveal that the L2 learners have limited sensitivity to the continuum of the strength of the state-change implicature of individual verbs. In the rating task, the two learner groups did not rate individual verbs significantly differently based on the strength of the state-change implicature as seen in the L1 speakers. The lack of the differential rating of individual verbs in the rating task suggests that the learners have not developed native-like sensitivity to the fine-grained subtle strength of state-change implicature in Mandarin monomorphemic verbs. This difficulty may result from a lack of exposure to a large number of sentences with different monomorphemic verbs that reveal the possibility of the cancellation of implied result or state change.

In the choice task, the learners are similar to the L1 speakers in broadly distinguishing two groups of verbs that are significantly different in their choice of attainment: stronger state-change implicature predicates (i.e., 买 *mai* 'buy', 杀 *sha* 'do.killing', 撕 *si* 'do.tearing', 写 *xie* 'write', 关 *guan* 'do.closing', 摘 *zhai* 'do.picking', 切 *qie* 'do.cutting', 掰 *bai* 'bend.break.by.hand', 烤 *kao* 'bake', 去 *qu* 'go', and 煮 *zhu* 'boil, cook') tend to receive significantly more choices of attainment than the weak state-change implicature verbs (i.e., 打 *da* 'strike or shoot (with a gun)', 吃 *chi* 'eat', 倒 *dao* 'pour, do.filling', 吹 *chui* 'blow (to extinguish)', 看 *kan* 'watch', 锤 *chui* 'strike with a hammer', 闹 *nao* 'make.noise (to wake someone)', 夹 *jia* 'press from both sides (in order to crack)', and 洗 *xi* 'wash').

Such apparent paradoxical performance in the two tasks may be attributed to the influence of the L1 lexical semantics. In the choice task, the English translation counterparts of the stronger state-change implicature predicates are all telic accomplishment or achievement predicates in terms of their lexical aspect, which encode an endpoint semantically. For example, the event of “*bought two books*” or “*killed a chicken*” entails the possession of the two books or the death of a chicken as an endpoint. The English translation counterparts of the weaker state-change predicates are mostly atelic, without an entailed endpoint. For example, the event of “*he poured water*” does not entail the cup ends up being full and the event of “*he blew at the candle*” does not entail the candle ends up being extinguished. The learners may have applied their L1 lexical semantic knowledge in their L2 interpretation of the stronger vs. the weaker state-change implicature verbs in Mandarin.

Another possible confounding factor for the learners’ apparent sensitivity to the continuum of the state-change implicature in the choice task may be their implicit knowledge about the state-change continuum in their L1 English. Talmy (2000) notes that the existence of a continuum in the lexicalization of state change in a language is not unique to Mandarin and that the implicature associated with English implied-fulfillment verbs also follows a cline. For example, the verbs in the sentence *He choked/stabbed/strangled/drowned him* show an increasingly strong implicature of the realization of the state change from alive to dead: *choke* and *stab* imply death only weakly; *strangle* entails death for some speakers but not for others; and *drown* clearly entails death and is considered an “attained fulfillment verb” by Talmy. Mandarin monomorphemic action verbs, that is, implied-state-change verbs and moot-fulfillment verbs, follow a similar cline.

5. Conclusions

Our study has revealed interesting learning patterns and challenges for English-speaking L2 learners of Mandarin in learning the lexical semantics of state-change predicates. Similar to the L1 speakers, they show a general preference for the state-change interpretation for Mandarin monomorphemic verbs of implied/moot state change, but they are not target-like and more likely to treat the implied/moot state-change verbs/predicates as entailing a state change. Our study is the first to also show that the learners have difficulties in developing native-like sensitivity to the continuum of state-change implicature encoded in individual verbs, though they show some sensitivity to such a continuum possibly due to their L1 transfer. We argue that L2 learners are influenced by their L1 English lexicalization in learning the semantics of state-change verbs. With the increase in overall proficiency, the learners show more target-like interpretations, suggesting the learnability of the subtle state-change implicature. It may still be hard for learners to figure out the systematic difference in the lexicalization of state-change implicature between the L1 and target language as the advanced learners still differ significantly from the L1 speakers in the rejection of the cancelation of state change. Direct or indirect negative evidence is necessary to facilitate such semantic learning. This study has pedagogical implications for classroom instruction of Mandarin in that explicit instructions on the typological differences of semantic packaging in verbs/predicates are highly recommended.

As the first study to show learners lexical semantic knowledge of state-change predicates, our study has obvious limitations in having examined only a small number of verbs in a limited number of trials (one target verb per trial) with a small group of L2 learners whose L1 is English. Future studies are needed to employ a data-driven approach to a comprehensive semantic analysis of a larger number of common Mandarin monomorphemic verbs and related constructions (e.g., verb compounds, resultative constructions, conative constructions) that encode and cancel state change cross-linguistically. It is also important to explore how contextual factors may affect speakers’ interpretations of state-change realization of specific verbs/predicates (e.g., [Esposito 2021](#)). Empirical studies, using novel flexible tools, are also necessary to test L2 learners’ implicit intuitions about lexical semantics, including lexical aspects, and the lexicalization of state change. Pedagogic studies

are required to investigate optimal input that facilitates the acquisition of the semantics of verbs and related constructions in event encoding.

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Appendix A. Target Mandarin Verbs and Sentences in Experiments 1 and 2

	Verbs	Glosses	Target Sentences	Translations
1	关 <i>guan</i>	‘do.closing’	张三关了门，可是门还开着。	Zhangsan closed the door, but it was still open.
2	摘 <i>zhai</i>	‘do.picking’	张三摘了树上的苹果，可是苹果还在树上。	Zhangsan picked the apple on the tree, but it was still on the tree.
3	杀 <i>sha</i>	‘do.killing’	张三杀了一只鸡，可是鸡没死。	Zhangsan killed a chicken, but it didn’t die.
4	撕 <i>si</i>	‘do.tearing’	李四撕了那块布，可是布没烂。	Zhangsan tore that piece of cloth, but it did not get torn.
5	切 <i>qie</i>	‘do.cutting’	李四切了西瓜，可是西瓜没开。	Zhangsan cut the watermelon, but it was not open.
6	吹 <i>chui</i>	‘blow’	李四吹了蜡烛，可是蜡烛没灭。	Zhangsan blew at the candle, but it didn’t extinguish.
7	掰 <i>bai</i>	‘bend.by.hand (to break)’	李四掰了那根树枝，可是树枝没断。	Lishi bent the twig to break, but it didn’t get broken.
8	烤 <i>kao</i>	‘bake’	李四烤了蛋糕，可是蛋糕没熟。	Lisi baked a cake, but it was not fully baked.
9	吃 <i>chi</i>	‘eat’	张三吃了饭，可是没吃完。	Zhangsan ate the food, but didn’t finish.
10	洗 <i>xi</i>	‘wash’	李四洗了衣服，可是衣服还是脏的。	Lisi washed the clothes, but they were still dirty.
11	锤 <i>chui</i>	‘strike with a hammer’	张三用锤子锤了那个盘子，可是盘子没碎。	Zhangsan used a hammer to break the plate, but it didn’t break.
12	煮 <i>zhu</i>	‘boil, cook’	张三煮了饭，可是饭没熟。	Zhangsan cooked the rice, but it wasn’t fully cooked.

	Verbs	Glosses	Target Sentences	Translations
13	夹 <i>jia</i>	‘press from both sides (to crack)’	张三用钳子夹了那个核桃，可是核桃没开。	Zhangsan used a nutcracker to crack the walnut, but it didn’t crack break.
14	闹 <i>nao</i>	‘make.noise (to wake)’	张三用闹钟闹了李四，可是李四没醒。	Zhangsan used an alarm clock to wake Lisi, but he didn’t wake up.
15	倒 <i>dao</i>	‘do.filling, pour’	张三在杯子里倒了水，可是杯子里的水没满。	Zhangsan poured water into the cup, but the cup was not full.
16	打 <i>da</i>	‘strike or shoot (with a gun)’	李四用枪打了张三，可是张三没死。	Lisi shot Lisi, but Zhangsan didn’t die.
17	买 <i>mai</i>	‘buy’	张三昨天在学校书店买了两本书。	Zhangsan bought two books at the school bookstore.
18	写 <i>xie</i>	‘write’	张三给李四写了一封长信。	Zhangsan wrote a long letter to Lisi.
18	看 <i>kan</i>	‘watch’	李四前天跟朋友去看了电影。	Zhangsan went to see a film with Lisi the day before yesterday.
20	去 <i>qu</i>	‘go, travel’	李四坐飞机去了北京。	Zhangsan flew to Beijing.

Note: Experiment 1 included verbs 1 to 16 and Experiment 2 included verbs 1 to 20. The translations are approximate since the semantics of the target verbs do not correspond exactly to the English counterpart verbs.

Appendix B. Effects of Verb and Proficiency on the Choice of State-Change Attainment

	Choice ^a	Estimate	Std Error	z Value	Sig.	
1— attainment	Intercept	2.639	0.732	13.001	0.000	***
	L1	1.488	1.246	1.427	0.232	
	L2	0 ^b				
	打 <i>da</i> ‘strike or shoot (with a gun)’	−3.738	0.871	18.432	0.000	***
	吃 <i>chi</i> ‘eat’	−2.570	0.821	9.803	0.002	**
	倒 <i>dao</i> ‘pour’	−2.457	0.848	8.394	0.004	**
	吹 <i>chui</i> ‘blow’	−2.398	0.835	8.237	0.004	**
	看 <i>kan</i> ‘watch’	−2.264	0.830	7.440	0.006	**
	锤 <i>chui</i> ‘strike with a hammer’	−2.351	0.910	6.682	0.010	*
	闹 <i>nao</i> ‘make.noise (to wake)’	−1.885	0.848	4.940	0.026	*
	夹 <i>jia</i> ‘press from both sides (to crack)’	−1.946	0.914	4.531	0.033	*
	洗 <i>xi</i> ‘wash’	−1.774	0.845	4.412	0.036	*
	煮 <i>zhu</i> ‘boil, cook’	−1.764	0.905	3.797	0.051	
	摘 <i>zhai</i> ‘do.picking’	−2.234	1.170	3.644	0.056	
	烤 <i>kao</i> ‘bake’	−1.658	0.875	3.595	0.058	
	去 <i>qu</i> ‘go’	−1.589	0.854	3.467	0.063	
	关 <i>guan</i> ‘do.closing’	−1.540	0.871	3.131	0.077	
	切 <i>qie</i> ‘do.cutting’	−1.081	0.916	1.394	0.238	
	掰 <i>bai</i> ‘bend.by.hand (to break)’	−0.847	1.305	0.422	0.516	
	写 <i>xie</i> ‘write’	−0.519	0.953	0.296	0.586	
	撕 <i>si</i> ‘do.tearing’	−0.560	1.289	0.189	0.664	
	杀 <i>sha</i> ‘do.killing’	−0.154	1.038	0.022	0.882	
	买 <i>mai</i> ‘buy’	0 ^b				

	Choice ^a	Estimate	Std Error	z Value	Sig.
	Intercept	−0.693	1.225	0.320	0.571
	L1	1.386	1.732	0.641	0.423
	L2	0 ^b			
	掰 <i>bai</i> ‘bend.by.hand (to break)’	−18.281	1.595	131.288	0.000 ***
	摘 <i>zhai</i> ‘do.picking’	1.386	1.500	0.854	0.355
	吃 <i>chi</i> ‘eat’	−1.253	1.439	0.758	0.384
	吹 <i>chui</i> ‘blow’	−1.012	1.446	0.489	0.484
	写 <i>xie</i> ‘write’	0.981	1.443	0.462	0.497
	夹 <i>jia</i> ‘press from both sides (to crack)’	−0.916	1.643	0.311	0.577
	煮 <i>zhu</i> ‘boil, cook’	0.693	1.378	0.253	0.615
	闹 <i>nao</i> ‘make.noise (to wake)’	−0.693	1.458	0.226	0.634
2—no attainment	看 <i>kan</i> ‘watch’	−0.606	1.387	0.191	0.662
	切 <i>qie</i> ‘do.cutting’	−0.693	1.658	0.175	0.676
	撕 <i>si</i> ‘do.tearing’	0.693	1.871	0.137	0.711
	锤 <i>chui</i> ‘strike with a hammer’	−0.405	1.472	0.076	0.783
	关 <i>guan</i> ‘do.closing’	0.288	1.384	0.043	0.835
	洗 <i>xi</i> ‘wash’	−0.288	1.399	0.042	0.837
	打 <i>da</i> ‘strike or shoot (with a gun)’	−0.251	1.303	0.037	0.847
	去 <i>qu</i> ‘go’	0.134	1.376	0.009	0.923
	倒 <i>dao</i> ‘pour’	0.000	1.342	0.000	1.000
	烤 <i>kao</i> ‘bake’	0.000	1.414	0.000	1.000
	杀 <i>sha</i> ‘do.killing’	0.000	1.732	0.000	1.000
	买 <i>mai</i> ‘buy’	0 ^b			

Note: ^a The reference category is *moot attainment*. ^b This parameter is set to zero because it is redundant. Asterisk is used conventionally to indicate degree of significance: * means $p < 0.05$, ** means $p < 0.01$; and *** means $p < 0.001$.

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