# *Covariation between temporal interlanguage features and nonverbal event categorisation*

DOI: https://doi.org/10.1515/iral-2017-0106

Norbert Vanek and Larry Selinker

**First and corresponding author**

Name: Norbert Vanek
Affiliation: University of York
E-mail: norbert.vanek@york.ac.uk
Telephone: 0044 1904 323951
Address: Centre for Research in Language Learning and Use, Department of Education, University of York, York, YO10 5DD, United Kingdom

**Second author**

Name: Larry Selinker
Affiliation: New York University, Research Production Associates
E-mail: ls110@nyu.edu
Website: http://www.researchproductionassociates.com/

**Keywords:** interlanguage, cognitive restructuring, grammatical aspect, event categorisation, linguistic relativity

## Abstract

This study investigates crosslinguistic influence and conceptual transfer in advanced Chinese learners of English on two levels: expression and categorisation. Specifically, it tests how patterns of temporal reference in learners' linguistic expression co-vary with their nonverbal event categorisation. The key structural difference between the target and the source language is that achievements are compatible with grammatical ongoingness marking in English (*the door is closing*) but not in Chinese (**men zai guan*). 42 learners were asked to retell videos with achievement-type events *(throw away a frisbee*) and activities (*push a piano*) in English. Before expression, the same learners judged which animation (action-biased vs. result-biased) looks most like the model clip (equidistant from event midpoints). Results from expression showed pronounced crosslinguistic influence in learners' infrequent combination of ongoingness with achievements, when compared with the English controls. Categorisation data signals that L1-modulated preferences also underlie learners' nonverbal judgements. Crucially, the main new finding is covariation between the frequency of combined forms in learners' retellings (*he is running with a frisbee and threw it away*) and how much their overall categorisation choices approximate to those in the target control group. Using a combined new methodology, the reported modulation of learners' nonverbal behaviour by interlanguage systems provides a hitherto unattested empirical contribution to our understanding of L2 learners' cognitive restructuring.

## Acknowledgement

Research reported in this article was funded from the ECF-2014-459 grant awarded to the first author by the Leverhulme Trust. We wish to thank the two anonymous reviewers for the time and diligence they spent on a previous draft. We feel fortunate in that, based on their detailed comments, they both clearly have excellent knowledge of research that is specific to linguistic relativity in SLA. It took us a while to address each of the issues they raised, but in our view the invested time was worth it, and we hope the current version is in many ways stronger than its predecessor and that they feel that their time was well spent. Many thanks also to Julie Lawrence for countless inspiring discussions on covariation.

## 1. Introduction

The level of detail and sophistication when adult speakers express time in their native language often differs from temporal reference in second language learner varieties (Carroll *et al.*, 2000; Flecken *et al.* 2013; Dietrich *et al.*, 1995). Even highly advanced L2 learners produce linguistic forms that may be structurally flawless but are not attested in native speakers' expression. Examples of temporal reference

unique to L2 English learners include combinations of punctuality-denoting time adverbs with imperfective verb forms, as in *the ground is suddenly opening* (von Stutterheim & Lambert, 2005: 226), or the use of temporal shifters to anchor ongoing events, as in *and then she's losing her temper* (Vanek & Hendriks, 2015:764). These types of learner-specific constructions, often observed in unscripted meaning-focused production, may sometimes appear as a messy mixture of source and target language preferences. However, closer analyses reveal that digressions from target-like patterns are rarely random form-function pairings, but in fact form systematic patterns that can serve as valuable indicators of an autonomous interlanguage system (Selinker, 1972, 1992, 2014), which in the domain of temporal reference is known as *interlanguage temporality* (Bardovi-Harlig, 2014).

Form-function pairings in L2 learners' interlanguage often indicate crosslinguistic influence from their native language (Alonso, 2016). It is much less straightforward how form-function pairings unique to learners relate to the representations of temporal concepts, i.e. it is debatable whether specific ways of speaking about time co-vary with thinking about time in general. Under one view, interlanguage temporality can be classed as speech-specific phenomena that do not characterise event categorisation in nonverbal contexts (Papafragou *et al.*, 2008; Gennari *et al.*, 2002) because the explanatory potential of verbal features is limited solely to the process of generating and organising information for expression. The view adopted here, on the contrary, is that each linguistic system, including learner interlanguage systems, is closely associated with conceptual representations and therefore substantially influences thought beyond speech (Gumperz & Levinson, 1996; Lucy, 2016), a view also known as *linguistic relativity* (Whorf, 1941). Speaking a specific language can influence cognitive processing generally, not just when we are attempting to convert thought to speech. If this view holds, we should find evidence for language-specificity outside of overt verbalisation as well. Language-specific effects in nonverbal behaviour can be explained as due to drawing on knowledge from routinised verbal co-occurrence patterns to solve a categorisation task (Langacker, 2008). Another possible theoretical explanation is the *label-feedback hypothesis* (Lupyan, 2012), which proposes that linguistic labels can modulate perceptual processing because they highlight language-specific features that can assist with a categorisation task. Under this view, the impact of linguistic labels on categorisation is context-dependent, stronger in contexts where covert verbalisation is available, and *down-regulated* in dual-task contexts where there is verbal interference such as number or pseudoword repetition (Perry & Lupyan, 2013).

In any case, nonverbal tasks with the possibility of covert verbalisation or with verbal interference have become a methodological prerequisite for studies testing relativistic claims (Bylund & Athanasopoulos, 2014). This has been reflected in recent research, and the number of studies that report cognitive reorganisation under the influence of L2 is on the rise (see e.g. Kurinski & Sera, 2011, for object

categorisation influenced by the L2 gender system; Park & Ziegler, 2014, for L2-modulated categorisation of spatial concepts). L2 effects on perceptual processing have also been documented in the temporality domain (see e.g. Athanasopoulos *et al.*, 2015, for shifts in phase categorisation of motion events), but it is not yet known whether, and if so, to what extent, learner-specific temporal expressions in the L2 are indicative of cognitive restructuring. This is the gap addressed here through examining the relationship between descriptions of achievement-type events and nonverbal event categorisation in Chinese learners of English.

The key notions this study builds on are crosslinguistic influence, conceptual transfer, cognitive restructuring and interlanguage temporality. Although related, it is important to keep these notions analytically separate so that potential theoretical unclarity (e.g. in distinguishing which effects of L1 transfer qualify as relativity, and vice versa) can be minimised.

*Crosslinguistic influence* is defined here as the interaction between languages in the mind of a bilingual (including language learners) (Alonso, 2016) due to which bilinguals' metalinguistic judgements, conceptual representations, word associations, language processing rates (Pavlenko, 2014) as well as linguistic expression may differ from that of monolingual speakers. In relation to the present study, the crosslinguistic contrast under scrutiny is the availability of grammatical ongoingness marking for achievement-type resultative events[1] in English (*Zhangsan is finishing eating that meal*) but not in Chinese (**Zhangsan zai chi-wan nei-dun fan*) (Klein *et al.*, 2000). Given that Chinese L1 speakers express this event type almost exclusively as completed (Xiao & McEnery, 2004), crosslinguistic influence can be expected to surface in Chinese learners of English, whose expression would be characterised by a strong dispreference to mark resultative events as ongoing. If L2 learners differed from L1 speakers only on the level of expression, this effect would demonstrate L1-specific crosslinguistic influence in temporal reference (Dietrich *et al.* 1995).

*Conceptual transfer* is defined here as 'those cases of linguistic relativity involving, most typically, a second language' (Odlin; 2005:5). If L1 influence was also evident in the nonverbal domain[2], for instance in the form of Chinese learners' bias to categorise ongoing resultative events as completed in a silent similarity judgment task, this effect would qualify as conceptual transfer (Jarvis, 2011; Odlin, 2005). Conceptual transfer can thus be viewed as crosslinguistic influence that necessarily involves a relativistic component. In the case of Chinese learners of English, this could be exhibited as completion-biased categorisation of ongoing achievement-type

[1] *Achievements* and *activities* in this work follow the Vendlerian classification of verbs based on their inherent temporal qualities (Vendler, 1957: 143-160). Achievements are defined here as verbs which are inherently dynamic, telic, and instantaneous (e.g. *arrive*), and activities are dynamic, atelic and durative, (e.g. *walk*).

[2] We agree with the reviewer's point that conceptual transfer is also testable in verbal tasks, e.g. when attention allocation is measured via eye-fixations of L1 and L2 groups during information uptake in preparation for an event description (e.g. Flecken et al., 2015).

events in comparison with English native speakers. This example would qualify as L1-based conceptual transfer, which is viewed here as a subprocess of cognitive restructuring (Pavlenko, 2014).

*Cognitive restructuring* is defined here as a process of conceptual change, which occurs in bilinguals' verbal and nonverbal performance whenever it diverges from the L1 pattern, and begins to resemble, albeit not necessarily fully, that of the L2 speakers (Pavlenko, 2011: 247). Verbal and nonverbal performance of L2 learners does not need to be guided solely by the L1 linguistic categories, and divergence from the L1 pattern in both linguistic and nonlinguistic[3] behaviour has been documented especially in advanced learner varieties (Athanasopoulos, 2011). To illustrate this process, if Chinese learners of English integrated the *V+ing* element into their previously L1-based conceptualisation of achievement-type events as completed, the result could be a change from completion-biased to more action-oriented categorisation. Importantly, L2-modulated cognitive restructuring is gradient and can reflect various degrees of crosslinguistic influence, including coexistence of L1 and L2-based concepts, L1-based conceptual transfer, convergence, shift to L2-based concepts, or conceptual attrition (Pavlenko, 2014). Different stages of cognitive restructuring of temporal categories in the learner's mind manifest themselves in the changing balance of L2 linguistic means of expression, known as *interlanguage temporality* (Bardovi-Harlig, 2014). Expression data reveal which aspects of time gain prominence when learners encode temporal relations in speech. For instance, when a Chinese learner of English verbalises a watermelon-squashing event as '*the man is jumping and smashed a watermelon into pieces*', segmenting the event into two components and marking the first as ongoing and the second as completed shows that the learner focused on dynamicity in the first component and on the result in the achievement part. This example can also demonstrate crosslinguistic influence from L1 Chinese, namely how the incompatibility of Chinese ongoingness markers *zai* and *zhe* with resultative verbs (Xiao & McEnery, 2004) transfers into L2 English as an inclination to digress from the target-like *V+ing* use in the expression of ongoingness in an achievement-type event[4].

Whether patterns found in interlanguage development also reliably signal cognitive restructuring is still enigmatic. Previous research has identified a number of factors

[3] The term 'nonlinguistic' in this work signifies those tasks and contexts where overt verbalisation is not necessary but covert verbalisation may be possible (Kersten *et al.* 2010).

[4] With relation to marking ongoingness in achievements, we acknowledge that many L2 acquisition studies were conducted to test the *Aspect Hypothesis* (AH; Shirai & Andersen, 1995; Andersen & Shirai, 1996), which predicts that perfective marking appears first in achievements and then in activities, and vice versa, imperfect marking appears first in activities then in achievements. This study tests predictions linked to cognitive restructuring in advanced learner varieties, which differ from AH's predictions about the order of emergence of aspect markers at early acquisitional stages.

that can predict cognitive restructuring[5], which include the age of L2 acquisition (Malt & Sloman, 2003), intensity of recent exposure to the target language (Bylund & Athanasopoulos, 2015), and degree of L2 proficiency (Park & Ziegler, 2014), however, alongside these factors, the diagnostic potential of learner-specific temporal expressions for cognitive restructuring has so far remained underexplored. Here we aim to test the extent to which learner-specific expressions of temporality in achievements co-vary with nonverbal categorisation preferences. The hypothesis is that there will be recurring interlanguage patterns of form-function associations that learners' event categorisation is able to draw on. Alternatively, it may be that temporal interlanguage features exhibit a great degree of variation unsuitable as a tool to distinguish event phases in a categorical manner. Absence of covariation between combined forms in descriptions and target-like choices in categorisation would confirm the null hypothesis.

## 2. Aims of the present study

Building on the extant knowledge of crosslinguistic influence and linguistic relativity in L2 acquisition, the main aim of this study is to examine the interplay between interlanguage temporality and nonverbal event categorisation in Chinese learners of English. Linguistic relativity in L2 acquisition in this context means learning a new way in which to express achievements and also, relative to patterns of expression, changing the way in which achievements are categorised. The general question to be considered here is: To what extent are interlanguage features in speech indicative of a changing conceptual system in the mind of an L2 learner when verbalisation patterns are tested alongside nonlinguistic categorisation preferences? This leads to two complex sets of related questions that will be studied in sequence. The first set of research questions to be considered is: What characterises learner interlanguage temporality and nonverbal event categorisation, and how do these L2 patterns compare to those typical of native speakers? The second question is: To what extent are interlanguage features in speech indicative of a changing conceptual system in the mind of an L2 learner when verbalisation patterns are tested alongside nonlinguistic categorisation preferences? To address the first set of questions, crosslinguistic influence in event expression is measured in learners whose source language (L1) seldom grammatically marks ongoingness in achievements, whilst this is not the case in the target language (L2). The prediction that learners' temporal concepts are L1-modulated is tested via a nonverbal categorisation task. To address the second question, we investigate if crosslinguistic influence in expression correlates with choices in a categorisation task without overt verbalisation. Using the same materials in both expression and categorisation task allows us to validate that approximations to target-like form-function pairings in the interlanguage can serve as

[5] The term cognitive restructuring in the long run implies a longitudinal design, but here to begin with our combined methodology we employed a cross-sectional paradigm and compared data from more vs. less experienced learners, similarly to Malt & Sloman (2003) and Park & Ziegler (2014).

an indicator of conceptual shifts towards the target pattern. This prediction builds on the idea that frequent structural co-activation of source and target patterns when learners construe events in speech highlights the source-target distinction between source and target phases, unlike simple form uses do (e.g. *he throws away a frisbee*). The use of combined forms (*V+ing* combined with *V+ed* as in *he is running with a frisbee and threw it away*) may thus weaken L1-routinsed form-function associations, which could make shifts to L2-like categorisation easier. Association strength between interlanguage features and nonverbal categorisation is compared between a categorisation context where covert verbalisation is available and where it is reduced by verbal interference. We predict that in comparison with a single task context, a dual task context with pseudoword repetition will weaken the association between interlanguage features and categorisation choices. The analyses will also consider other factors previously attested to be relevant for conceptual restructuring, namely L2 proficiency, amount of L2 use and onset of L2 learning.

## 3. Method

### *3.1 Participants*

44 advanced Mandarin Chinese learners of English were recruited at the University of York. These participants were right-handed postgraduate students with normal or corrected-to-normal visual acuity and with no knowledge of languages other than Chinese and English. They had comparable age and time spent in an English-speaking environment, intensity of daily English use, age of onset of acquiring English, and level of English proficiency at the time of testing (Table 1). Two participants dropped out during the experiments, so the analyses were based on data from 42 participants (39 female), who completed both tasks. In the nonverbal task, 50% of the participants were randomly allocated to complete version 1 (single task paradigm, silent categorisation without distraction), and 50% completed version 2 (dual task paradigm, categorisation with pseudoword repetition).

*Table 1* Participants' background information

| **Measure** | **Single task group (silent categorisation)** Mean (SD) | **Dual task group (categorisation with pseudowords)** Mean (SD) |
|---|---|---|
| Age (years) | **23.26** (0.75) | **22.46** (0.91) |
| Time in UK (months) | **4.83** (1.86) | **4.56** (0.25) |
| Daily use of ENG (%) | **21.04** (12.75) | **27.77** (16.24) |
| Onset of learning ENG | **9.43** (2.25) | **9.73** (2.23) |
| OPT score (100 max.) | **76.27** (6.3) | **75.18** (5.59) |

Note: OPT; Oxford placement Test 2, Allan (2004)

Expression and categorisation data was also collected from age-matched native speaker controls, who reported very limited knowledge of any foreign language. 42 Chinese native speakers (21 female) were tested at the China University of Petroleum in Qingdao, and 42 English native speakers (29 female) completed the tasks at the University York. Each participant was asked to do the expression task, before which 50% of participants in the native groups were randomly selected to complete either the silent categorisation task or the categorisation with pseudowords.

### *3.2 Stimuli and procedure*

Participant were shown 22 animations, each of which was 4 seconds long and featured the same protagonist performing two different types of actions. The critical items were 11 animations that showed achievement-type actions such as *hanging a hat on a hook*. Each clip of this type was sequenced the same way, starting with 2 seconds in the source phase (e.g. *the man moves a hat towards a hook*, frames 1-49), followed by a transition point at 2.00 seconds (*the hat contacts the hook*, frame 50), and concluding with 2 seconds in the target phase (*the man moves away from the hooked hat*, frames 51-100). The control items were 11 animations that showed activity-type actions such as *riding a bicycle*. In these clips, there was no culmination or transition point, the protagonist performed the action at a steady pace throughout the full length of the clip.

The initial step during each individually run experiment was a questionnaire on the participant's language background and a form explaining ethical matters including anonymity and the right to withdraw at any stage. Then, in the second step, participants completed one version of the categorisation task, silent categorisation or categorisation with pseudowords. In silent categorisation, the task was to carefully watch 22 video trials, each of which consisted of a model clip and a corresponding source-phase and target-phase clip (Figure 1).

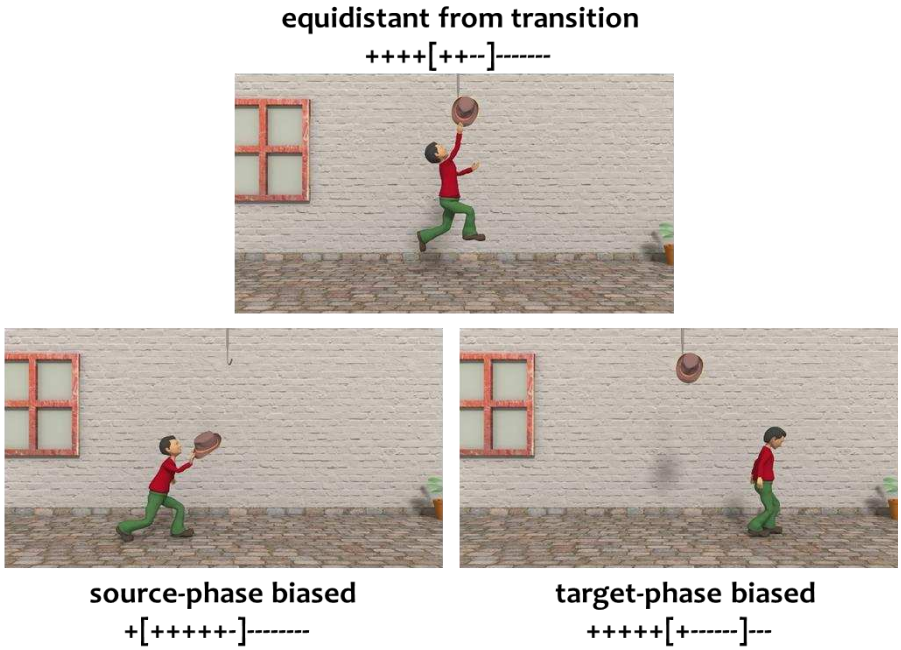



*Figure 1* An example of stills from a triad of animated videos to demonstrate the categorisation task.

First, a model clip (2.5 seconds) showing the middle phase of events was played three times in a row in the top half of the screen. After that, the corresponding source-phase and target-phase clips (also 2.5 seconds each) appeared in the bottom half of the screen and were played three times, together with the model clip. Participants were asked to judge which of the clips in the bottom looked most similar to the model clip above them. To indicate their preferences, they had to press the left or the right arrow key as fast as possible after the beep at the end of the clips. Trial order was semi-randomised for each participant (not more than two critical items could appear in a row), and the source-phase and target-phase clip positions were counterbalanced (50% of source-phase clips appeared on the left). There were two training items, one activity-type [PUSH A PIANO] and one achievement-type event [KICK A BALL AWAY].

In categorisation with pseudowords, the same steps from the silent categorisation task were repeated with one addition. During the model clip, participants heard trisyllabic pseudowords[6], which they had to repeat until they made a similarity judgement after the beep. The rationale of adding pseudowords was to examine whether categorisation preferences change when possible subvocal verbalisation is minimised (Perry & Lupyan, 2013). Finally, in the third step, all participants completed an expression task. This step involved watching 22 animations one at a

[6] The pseudowords for all three groups of participants were fi-lo-te, ge-lo-ki, vi-pe-ra, se-ki-lo, lo-fi-pe, ra-lo-fi, se-ki-pe, ne-ki-lo, fi-ki-se, vo-lo-ra, se-lo-fi, fi-lo-ri, pa-re-sa, ki-ne-se, ra-ge-ki, ge-te-lo, ra-ki-pe, ki-fi-pe, se-ra-lo, ri-ki-te. The syllables within pseudowords differed across trials to avoid habituation. The auditory form of each trisyllabic compound was checked for pseudoword status in Chinese and English independently by two native speakers per language group.

time (4 seconds each, including a source, mid and target phase), played in a semi-randomised order. The task was to carefully watch the animation and describe the event in one sentence as accurately as possible. Participants could start speaking as soon as they recognised the event, and they were informed that only the first sentence they said would count. No time limit was imposed during verbalisation to ensure spontaneity of expression, and it was the participant who decided about the time to move to the next clip by a key press. After the experiment, each learner completed the language-in-use section of the Oxford Placement Test (Allan, 2004).

### *3.3 Coding and analysis*

The transcribed sentences produced by learners were coded in the following ways. First, grammatical marking of ongoingness on verbs expressing the main event (i.e. achievement verb in the critical items vs. activity verb in the control items) were searched in the learner database. Each instance was individually examined and coded as 0 when ongoingness marking on the key verb was absent (e.g. *the boy took the key from the hook, the boy plays on a rope*), as 1 when interlanguage temporality signalled a combination of the source and target patterns (e.g. *the boy is jumping and got the key off the hook, the boy is hanging on a rope and slid down*), as 2 when the marking was target-like (e.g. *the boy is unhooking the key, the boy is going down a zipline*), or as 3 when the action was not expressed or an unrelated, incomprehensible or non-existent verb was used (*the boy is in the playground*, *the boy is skimming from the up left to the down right*). Learner-specific instances partially marked for ongoingness (e.g. *is smash up*) were also coded as 1. Verb type in the descriptions was also important, i.e. achievement-type events expressed as activities (*cutting a branch* instead of *cutting off a brunch*) were excluded from the achievement counts. The second categorical variable concerned the similarity judgement task, in which "0" meant the model clip was judged more similar to the source-biased alternative, and "1" meant participants found the model clip more similar to the target-biased alternative. Background variables including OPT score (1-100 points), daily use of English (1-100%), and onset of learning English were preserved as continuous data in the analyses.

## 4. Results

### *4.1 Verbal expression*

Participants' responses in the expression task as well as the categorisation task were converted to percentage scores, and, in the first step, the mean score in the learner group was compared to those in the native control groups. Ongoingness in achievements (Figure 2) was expressed most frequently by the English L1 group

(M=56.43, SD=29.3), followed by L2 learners (M=26.9, SD=22.55) resembling the Chinese L1 group[7] (M=21.43, SD=24.38). In activities, the gap between English native speakers (M=85.48, SD=25.78) and L2 learners (M=73.57, SD=21.27) was smaller than between L2 learners and Chinese native speakers[8] (M=48.57, SD=29.44).

To assess the contribution of group membership for ongoingness marking choices, a series of mixed-effect logistic regression models were built by means of the lme4 package in R Studio (Version 3.2.4; R Development Core Team, 2016). The two random effect factors with random intercepts were *participant* and *item*. The binary dependent variable was *ongoingness marking* on the main verb (grammatically marked vs. not marked) with *group* used for the fixed effects. Comparing ongoingness marking as the critical variable, the models confirmed that the preference for ongoingness marking was significantly higher in the English L1 group than in the L2 learner group $\beta$=3.86, *SE*=1.11, *Z*=3.46, *p*=.022 for the achievement-type events, but not for the activity-type events $\beta$=2.09, *SE*=1.09, *Z*=1.91, *p*=.056. Comparing the L1 control groups, Chinese vs. English L1 group membership was a significant contributor to categorical choices both in achievements $\beta$=*5.89*, *SE*=1.51, *Z*=3.89, *p*<.001 and activities $\beta$=*3.23*, *SE*=1.09, *Z*=2.97, *p*=.003[9].

In the learner group, interlanguage temporal expressions combining source and target patterns to express ongoingness (see examples of combined forms in Table 5) occurred on average in 21.67% (SD=20.25) of the achievement-type events.

[7] These counts include resultative verb compounds, also known as complex achievements (e.g. *da-po* 'hit-broken'). Although complex achievements show some tolerance to progressive aspect (Xiao & McEnery, 2004:213), and the videos allow for such constructions, each of the 16 instances found in the Chinese L1 data were either marked as perfective or were used without an aspect marker.

[8] Lower ongoingness marking in activities in Chinese can be attributed to the structural property that allows the expression of ongoingness in this verb type via aspectually unmarked forms (e.g. in the English-Chinese parallel corpus, 86.05% of all aspectually unmarked verbs translated as ongoing in English were activity-type events (Xiao & McEnery, 2004:259)). In this study, 32.31% of activities were aspectually unmarked in the Chinese L1 dataset. If the unmarked and the *zhe-/zai*-marked forms are counted together, no crosslinguistic contrast emerges for activity-type events.

[9] Initially, all three groups were entered in the same model. Where group membership was a significant predictor, follow-up models with group pairs were built. Results from the latter are reported in direct response to the related predictions.

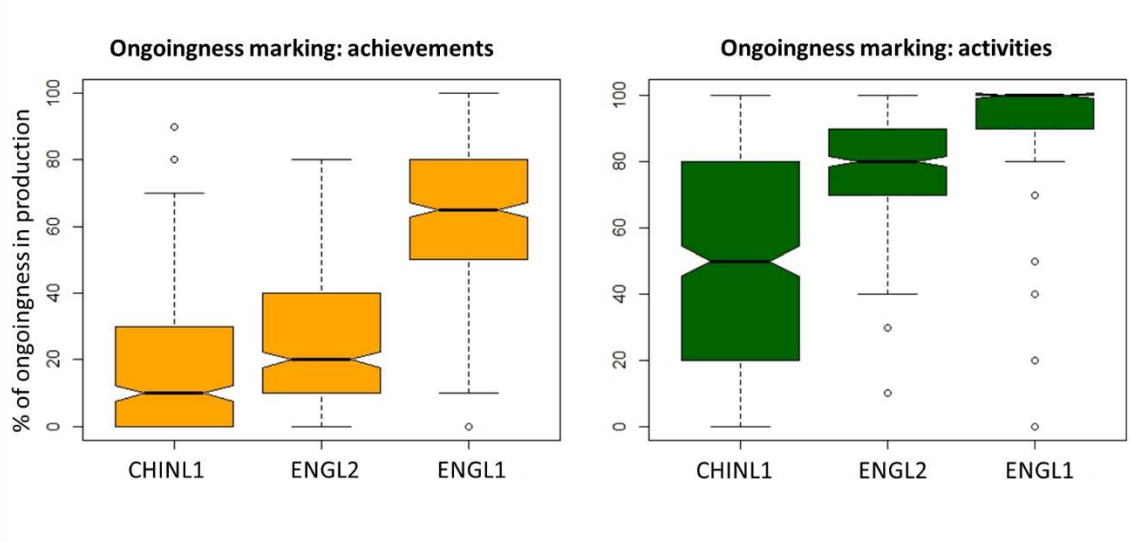
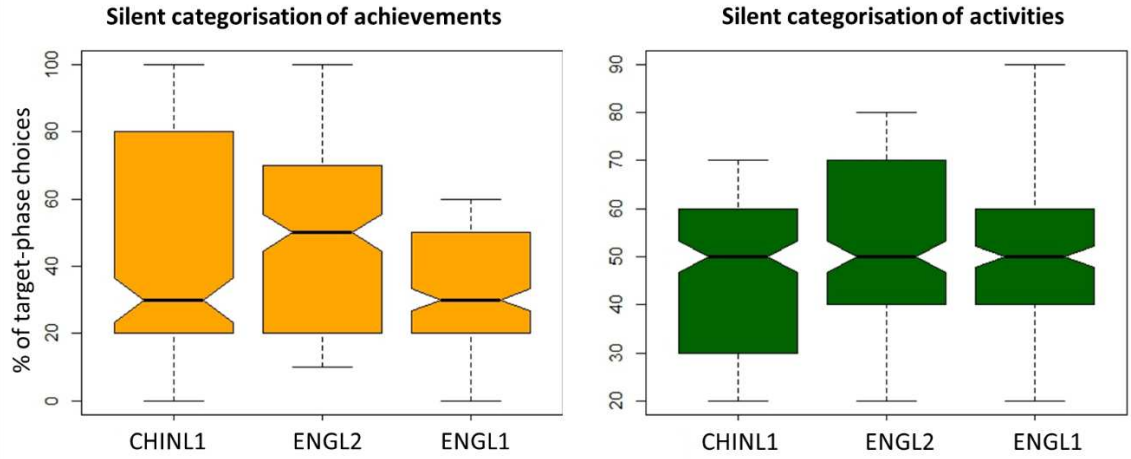



*Figure 2* Notched plots with the percentages of ongoingness marking for achievements vs. activities in the learner group (ENGL2), Chinese controls (CHINL1) and English controls (ENGL1). Boxes are the interquartile ranges (25-75% of the data), mid-lines are medians, whiskers show 99.3% of normal distribution, notches are confidence intervals around medians.

### *4.2 Categorisation*

Regarding choices during silent categorisation (Figure 3), the learner group selected the target-phase alternate in achievements more frequently (M=49.05, SD=29) than the English L1 group did (M=31.43, SD=20.58), and their choices aligned overall more closely with the Chinese L1 group (M=46.67, SD=32.19). Choices for activities were relatively more similar across groups (M=53.33, SD=18.65 in ENL2; M=50.48, SD=19.19 in ENL1; M=46.67, SD=32.2 in CHL1). During categorisation with pseudoword distractors, no language-specificity emerged, either for achievements (M=50.95, SD=17.2 in ENL2; M=51.9, SD=20.89 in ENL1; M=45.71, SD=22.85 in CHL1) or for activities (M=55.71, SD=12.97 in ENL2; M=55.71, SD=18.45 in ENL1; M=57.14, SD=21.69 in CHL1).



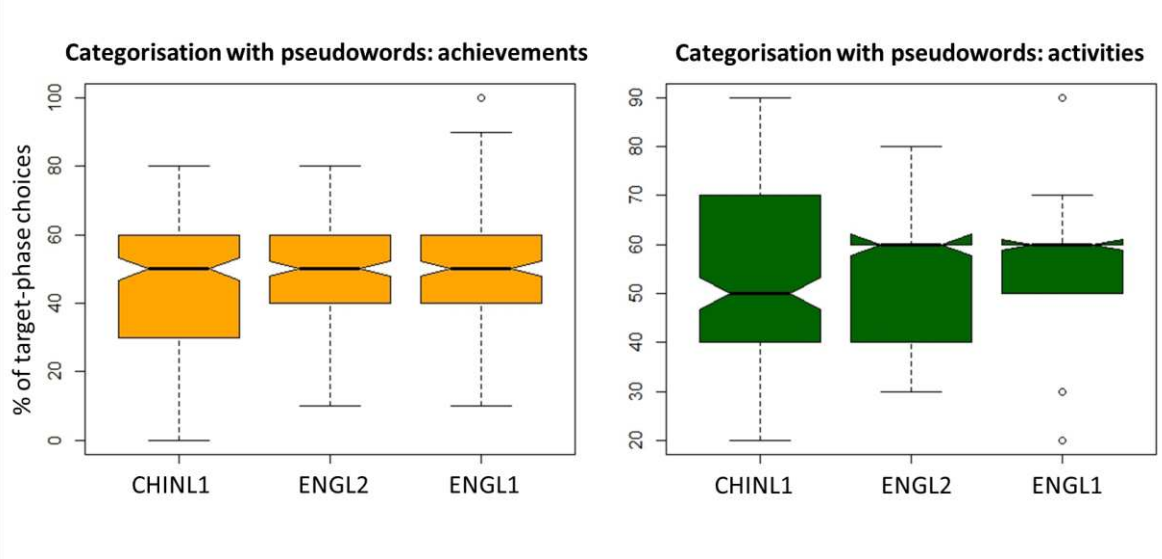



*Figure 3* Notched plots with the percentages of target-phase choices in the nonverbal categorisation of achievements vs. activities by the learner group (ENGL2), Chinese controls (CHINL1) and English controls (ENGL1)

The contribution of group membership for different categorical choices was assessed via mixed-effect logistic regression modelling. This time, the binary dependent variable was categorisation preference (source-phase vs. target-phase centred animation) with *group* used for the fixed effects, and the two random effect factors with random intercepts were *participant* and *item*. Comparing the choice of target-phase clips as the critical experimental variable, the models (Table 2) confirmed that the preference for target-phase clips was significantly lower in the English native group than in the L2 learner group $\beta$=−.96, *SE*=.42, *Z=-2.29*, *p*=.022 for the achievement-type events, but not for the activity-type events $\beta$=−.12, *SE*=.25, *Z*=−.49, *p*=.62. Similar results emerged for the L1 control groups, with Chinese vs. English L1 group membership being a significant contributor to categorical choices in achievements $\beta$=−1.07, *Z*=−2.32, $p < .05$ but not in activities $\beta$=.23, *Z*=.99, *p*=.32. Comparing L1 and L2 English, group membership was not a significant predictor of preferred animation choices in categorisation with pseudowords, either for achievement or activities (Table 3).

*Table 2* Coefficients for a mixed effects logistic regression model fitted to the silent categorisation data (achievements on the left, activities on the right) from L2 learners vs. English natives

| ***Random effects*** | ***Variance*** | ***SD*** | | |
|---|---|---|---|---|
| Participants (intercept) | 1.25 | 1.12 | | |
| Items (intercept) | 0.13 | 0.36 | | |
| ***Fixed effects*** | ***Estimate*** | ***SE*** | ***Z*** | ***p*** |
| (Intercept) | -0.02 | 0.31 | -0.06 | 0.95 |
| Group | -0.96 | 0.42 | -2.29 | 0.022* |

| ***Random effects*** | ***Variance*** | ***SD*** | | |
|---|---|---|---|---|
| Participants (intercept) | 0.21 | 0.45 | | |
| Items (intercept) | 0.07 | 0.26 | | |
| ***Fixed effects*** | ***Estimate*** | ***SE*** | ***Z*** | ***p*** |
| (Intercept) | 0.14 | 0.19 | 0.74 | 0.46 |
| Group | -0.12 | 0.25 | -0.49 | 0.62 |

*Table 3* Coefficients for a mixed effects logistic regression model fitted to the categorisation data with pseudowords (left: achievements, right: activities) from L2 learners vs. English natives

| ***Random effects*** | ***Variance*** | ***SD*** | | |
|---|---|---|---|---|
| Participants (intercept) | 0.24 | 0.5 | | |
| Items (intercept) | 0.07 | 0.27 | | |
| ***Fixed effects*** | ***Estimate*** | ***SE*** | ***Z*** | ***p*** |
| (Intercept) | 0.04 | 0.2 | 0.2 | 0.84 |
| Group | -0.02 | 0.25 | -0.07 | 0.94 |

| ***Random effects*** | ***Variance*** | ***SD*** | | |
|---|---|---|---|---|
| Participants (intercept) | 0.01 | 0.1 | | |
| Items (intercept) | 0 | 0 | | |
| ***Fixed effects*** | ***Estimate*** | ***SE*** | ***Z*** | ***p*** |
| (Intercept) | 2.3e-01 | 1.41e-01 | 1.63 | 0.1 |
| Group | 9.94e-06 | 1.99e-01 | 0 | 1 |

To reiterate the main question, this study set out to test if temporal reference patterns in the interlanguage relate to choices during nonverbal event categorisation. The interrelation between combined forms for temporal reference in the learners' interlanguage and preferences in silent categorisation is presented in the correlation matrix in Table 4. A Pearson's *r* test showed a significantly correlated relationship between interlanguage features and categorisation choices, $r = -.381$, $p < .001$. This negative correlation coefficient indicates that as the proportion of combined features increased in expression, non-English-like target-phase choices in categorisation tended to decrease. Interlanguage features also significantly correlated with current L2 use and L2 proficiency, but both of these correlations were weak (Table 4). Another significant correlation was found between OPT scores and ongoingness marking (Table 4), but this correlation was also too weak for drawing meaningful generalisations. In the dual-task paradigm with pseudowords, the overall choices of learners were not target-like, however, within-group variation in the preferences of categorising achievements was also significantly correlated with the frequency of interlanguage features in expression, $r = -.354$, $p < .001$. No other significant correlations in the pseudoword group apart from interlanguage features and categorical choices were strong or moderate.

*Table 4* Correlation matrix showing Pearson's *r* for the background variables, target-phase choices in silent categorisation, ongoingness marking, and combined forms in interlanguage

| | *AoA for ENGL2* | *ENGL2 use per day* | *OPT score* | *Target phases* | *ONGOING marks* | *INTERLANG features* |
|---|---|---|---|---|---|---|
| ***AoA for ENGL2*** | 1 | .044 | .200** | -.216 | -.027 | -.063 |
| ***ENGL2 use per day*** | | 1 | -.098 | .058 | .024 | -.203** |
| ***OPT score*** | | | *1* | *-.067* | *-.187** | *.193** |
| ***Target phases*** | | | | 1 | -.093 | **-.381**** |
| ***ONGOING marks*** | | | | | 1 | -.036 |
| ***INTERLANG features*** | | | | | | 1 |

*p<.05, **p<.01

### *4.3 Qualitative analysis*

A qualitative analysis was performed to examine the finer detail of interlanguage temporality that characterises learners' form-function pairings in the verbal encoding of achievements. Crosslinguistic influence was expected to emerge as digressions from target-like ongoingness marking in achievement-type events. Learners exhibited four different verbalisation patterns, namely absence of ongoingness, target-like marking, unrelated verb choice, and combination of source and target patterns. The former two types were also found in the English L1 group, while the latter two are better characterised as learner-specific. Instances where L1 and L2 structures competed for selection are shown in examples (1-10) in Table 5, together with the sum of all structural amalgams that were found per event.

*Table 5* Examples of combined interlanguage forms for achievement-type events

| **Event (combined forms/total)** | **Examples of combined forms in the L2** |
|---|---|
| (1) BREAK DOWN A WALL (8/42) | is holding a hammer to knocks down the bricks, is smash up the bricks by using a tool**, is using** a hammer **and hit** some bricks |
| (2) CATCH A FLYING LEAF (14/42) | was jumping and catched a leaf, is catch a leaf, is chasing after a leaf and he catched it, **is following and catched** a leaf |
| (3) CUT OFF A BRANCH (7/42) | is using a knife cut branches of the tree, **is jumping and cut** the branch, was jumping and he use his knife to cut the leaf |
| (4) PUT OUTA FIRE (6/42) | made the fire disappear with a piece of cloth, is tried to put out the fire, **is using** a cloth **and put out** the fire |
| (5) HANG A HAT ON A HOOK (11/42) | was jumping and put his hat on a hook, hang a hat above his head by jumping, **is jumping and put** a hat on the roof |
| (6) HIT AWAY A TENNIS BALL (4/42) | is playing tennis with a hit, stands for a while and play the tennis, **is using racket** […] **hit** the tennis ball, is hit a ball |
| (7) LAND ON THE PAVEMENT (6/42) | **is flying down land** on the ground, is dropping down with a parachute, is using an umbrella back to the ground |
| (8) SQUASH A WATERMELON (9/42) | is standing on a melon and the melon is broken, **is jumping and crushed** the melon, is jumping to the melon and the melon exploded |
| (9) THROW AWAY A FRISBEE (4/42) | is playing with a flying plate and throw it**, is playing** with a plate **and threw** it away, the boy throw a plate |
| (10) UNHOOK A KEY (15/42) | **is jumping and** he finally **got** the key from the hook, is jumping and get a key from the roof, the boy get the key by jumping |

Upon closer inspection, the combined interlanguage forms reveal a recurring pattern. Learners often segmented achievements into source and target phases and assigned different aspectual properties to each. Expressions in which ongoingness was encoded for the source phase but not for the target phase (examples 1-10, in bold) were found across the full range of achievements shown in the video stimuli. Target phases in these expressions were marked as completed (typically with past simple, examples 2, 8, 9, 10), unmarked for aspect/ambiguous (examples 3, 4, 5), chained as a second component of a serial verb (example 7) or encoded in the form of a nominalised prepositional phrase (example 6). In comparison, segmentation of activities (e.g. *is gripping a rope and swings* for [SWING ON A ROPE]) was more than twice as rare (35/420) as segmentation of achievements (84/420).

## 5. Discussion and conclusions

This study examined the extent to which advanced L2 learners' event expression and categorisation exhibit crosslinguistic influence, most notably L1-based conceptual transfer. Using interlanguage temporality and nonverbal categorisation in L2 learners and L1 controls as diagnostic tools, the crosslinguistic contrast under scrutiny was grammatical ongoingness marking of achievements – compatible in English but infelicitous in Chinese. The main novel finding is covariation between combined forms in production and target-like categorisation, which is interpreted as cognitive restructuring as a function of changes in the verbal encodings of grammatical aspect.

The first set of research questions concerned the traces of L1 influence in learners' linguistic expression. Crosslinguistic influence in this case was operationalised as the level of inclination to use partly or fully L1-modulated form-function pairings. In line with studies reporting L1-driven temporal features even at advanced stages of second language acquisition (Carroll *et al.*, 2000; Flecken *et al.* 2013; Dietrich *et al.*, 1995), video verbalisations in this study furnish evidence for a reduced proportion of ongoingness marking in Chinese learners' interlanguage temporality. This is not to say that L1 structural knowledge, i.e. marking achievements as completed (Klein *et al.*, 2000; Xiao & McEnery, 2004), transferred without any influence of the L2; on the contrary, co-activation of L1 and L2 structural knowledge was one of the characteristic features of the interlanguage expressions. Novel learner-specific forms showing co-activation of structural knowledge from more than one source is interpreted as empirical validation of the original interlanguage hypothesis (Selinker, 1972).

These learner-specific form-function pairings partly resembled target-like expression by marking ongoingness for the source phases of achievement-type events. However, and most importantly, these combinations also exhibited L1-transfer in the expression of the same events' target phases as completed (e.g. *the boy is jumping*

*and he finally got the key*). This way of segmenting achievements can be interpreted as a signal of co-activated L1 and L2 systems creating a system in its own right (Selinker, 1972, 2014), which can also be viewed as a signal of convergence in bilingualism (Pavlenko, 2014). In line with previous findings (e.g. von Stutterheim & Lambert, 2005; Vanek & Hendriks, 2015), the present study shows that combined forms are also present in the temporal interlanguage at a relatively advanced level of L2 proficiency.

The same first set of research questions also probed whether crosslinguistic influence confirmed in expression could be replicated in a context without overt verbalisation. Learners' relative underuse of ongoingness markers for achievements strongly indicated L1-influenced temporal expression in L2 (Dietrich *et al*., 1995). Statistical analyses confirmed that L1-like patterns were not limited to the verbal domain but also surfaced during learners' silent categorisation, the interpretation of which is conceptual transfer (Jarvis, 2011; Odlin, 2010) of L1-modulated event conceptualisation patterns evident in both nonlinguistic and linguistic behaviour. We show here that covariation of features in interlanguage temporality (Bardovi-Harlig, 2014) and nonverbal categorisation is best characterised as a result of co-activation between source and target event construal patterns in L2 expression.

The second set of research questions tested the covariation between the frequency of combined forms in expression and categorisation preferences. Using our combined new methodology, our findings from categorisation provide a confirmation that independent nonlinguistic variables co-vary with linguistic variables. Considering that the frequency of combined forms in speech co-varied with the level of target-like categorisation shows that learner-specific interlanguage combinations are indicative of a changing conceptual system in the bilingual mind. The link between combined forms in interlanguage temporality and cognitive restructuring can be explained via a mechanism of cue competition (MacWhinney, 1997; Zhao & MacWhinney, 2010) and cue strength readjustment. Under this view, L1-routinised forms (frequent completion marking in achievements) and L2-routinised forms (frequent ongoingness marking in achievements) are cues with different strength, co-activated and competing for selection in learners' verbal encodings. Cue strength variation is not random. Incorporation of ongoingness marking for the source-phase of achievements shows that the strength of L2–specific cues is greater in learners with more frequent combined interlanguage features than in learners with more L1-like expressions. The finding that increases in combined interlanguage features co-vary with decreases in L1-like categorisation suggests that cue strength differences reflected in learners' verbal encodings modulate linguistic expression and also categorisation without overt verbalisation in similar ways.

In terms of factors typically linked to cognitive restructuring, the nonverbal behaviour of the learners studied here was not found to shift from more L1-like (completion-centred) to more L2-like (action-focused) categorisation as a function of increasing L2 proficiency (Park & Ziegler, 2014), intensity of recent exposure to the target

language (Bylund & Athanasopoulos, 2015) or age of L2 acquisition onset (Malt & Sloman, 2003). Possible reasons are that the modulating potential of the three background variables in cognitive restructuring could have been compressed by the relatively high learner-group homogeneity, or that the overall L2 proficiency of the learners was lower here than in related studies (75.7 % in this study, 90.4% in Park & Ziegler, 2014).

The new L2-based categorisations were not powerful enough to suppress L1-based categorisation routines characterised in the group of Chinese learners of English tested in this study. One explanation comes from a U-shaped dip observed in L2 populations with medium recent exposure to the target language (Athanasopoulos *et al.*, 2015). On another level of analysis, the data spread was large enough to attest nonverbal event categorisation preferences changing as a function of combined form frequency in interlanguage temporality. In terms of individual variation, Chinese learners whose expression incorporated more L1-L2 combined forms tended to approximate to the target categorisation pattern more closely. This result is understood as evidence that even if event descriptions are variable and probabilistic rather than categorical (Goschler & Stefanowitsch, 2013), recurring interlanguage features do include strong enough aspectual cues that learners' phase categorisation can build on. The contributing role of interlanguage features to event categorisation that goes beyond overt verbalisation is also supported by the dual task results. Namely, significant expression-categorisation covariation was not only observed in silent categorisation but also when categorical judgements were made during pseudoword repetition. The fact that covariation between combined forms and categorical choices was preserved in the context with verbal interference suggests that in this condition the automatic recruitment of (inter)language labels might have been down-regulated (Perry & Lupyan, 2013), but these labels were still available to assist with the categorisation task. The capacity of interlanguage systems to modulate learners' nonverbal behaviour could present a new fruitful avenue for linguistic relativity research, the full explanatory potential of which is yet to be empirically explored.

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