Cognitive restructuring in the bilingual mind: motion event construal in early Cantonese-English bilinguals

First and corresponding author

Yi Wang
dtnvywa@ucl.ac.uk
University College London
UCL Centre for Applied Linguistics
20 Bedford Way
London WC1H 0AL, UK

Second author

Li Wei
li.wei@ucl.ac.uk
University College London
UCL Centre for Applied Linguistics
20 Bedford Way
London WC1H 0AL, UK

Abstract

Languages differ typologically in motion event encoding (Talmy, 2000). Furthermore, the cross-linguistic variations in lexicalization modulate cognition in a dynamic and task-dependent manner (Slobin, 1996a). This study aims to investigate whether early Cantonese-English bilinguals behave differently from monolinguals in each language when lexicalizing and categorizing voluntary motion in different language contexts. Specifically, monolinguals were instructed and narrated in their native languages. We assigned bilinguals to a monolingual and a bilingual context by manipulating immediate language use in their oral descriptions. Results from monolinguals suggested an effect of language on event conceptualization. However, results from bilinguals showed that their performances patterned with English monolinguals in both event lexicalization and conceptualization regardless of the language context. These findings indicate that early exposure to a second language has motivated speakers to converge to a single lexicalization pattern compatible for both languages. And the degree of convergence is modulated by the amount of language contact with each language. The study demonstrates that participants draw on their linguistic knowledge during the nonverbal task and provides evidence for L2-biased cognitive restructuring within the framework of thinking-for-speaking.

Key words: cross-linguistic differences, thinking for speaking, motion event conceptualization, cognitive restructuring, language context, early Cantonese-English bilinguals

1. Introduction

The interplay between language and cognition has triggered intensive debate over recent decades with evidence showing that language-specific ways of depicting the reality may contribute to cross-linguistic differences in cognition (Lupyan, 2012; Slobin, 1996b; Wolff & Holmes, 2011). Whilst most of the current research focuses on monolingual speakers, it is important to extend our enquiries to bilingual speakers or second language learners to further explore how the learning and use of a second language affect cognitive behaviours such as perception, attention, recognition memory and categorization. A growing body of research has demonstrated that acquiring another language means internalizing a novel way of thinking and L1-specific 'thinking for speaking' is subject to change due to variations in speakers' learning trajectories, such as age of acquisition, language proficiency and the amount of contact with each language (see Pavlenko, 2011, for a detailed review). Another line of research suggests that recent linguistic exposure can trigger conceptual switching between language-specific representations as a function of language in operation. Most studies along these lines are conducted with late bilingual speakers or adult L2 learners with typologically contrastive languages (Athanasopoulos et al., 2015a; Montero-Melis, Jaeger, & Bylund, 2016; Stocker & Berthele, 2019). However, little is known about how early bilinguals with partial overlapping linguistic systems tend to behave: whether they establish distinct sets of lexical and conceptual representations and switch between them, or if they have a single pattern of 'thinking-for-speaking' that is compatible with both languages.

The current study combines these two lines of enquiry and aims to address how early Cantonese-English bilinguals lexicalize and conceptualize voluntary motion in different language contexts. Specifically, we examine how bilinguals in a monolingual (L1) and a bilingual (L1 and L2) context lexicalize and categorize motion compared with monolinguals

of each language as a function of recent L2 activation. In addition, it also addresses whether the amount of language contact with each language affects bilinguals' performance while controlling for other variables such as age of L2 acquisition and L2 proficiency.

This study combines two research paradigms: a linguistic encoding paradigm that allows us to manipulate participants' short-term language activation and a triads-matching paradigm that has been widely used in the domain of motion to access participants' perceptions of event similarity (Athanasopoulos, Damjanovic, Burnand, & Bylund, 2015b; Ji & Hohenstein, 2018).

2. The interplay between language and cognition

The question of whether language affects cognition has triggered vigorous debates in recent decades (see Bylund & Athanasopoulos, 2014b, for a detailed review). According to Linguistic Relativity (Whorf, 1956), cross-linguistic differences in lexicalization may have an effect on general cognition. Empirical evidence shows that, on the one hand, the effects of language on thought have been detected in a wide range of conceptual domains, such as colours (Athanasopoulos, Damjanovic, Krajciova, & Sasaki, 2011), objects (Pavlenko & Malt, 2011), time (Boroditsky, Fuhrman, & McCormick, 2011) and motion (Ji & Hohenstein, 2018). On the other hand, such effects are context-bound and seen under certain conditions. For example, the effects may appear when language is used as a strategy to solve a task (Gennari, Sloman, Malt, & Fitch, 2002), but disappear when verbal interference is introduced (Flecken, Athanasopoulos, Kuipers, & Thierry, 2015; Montero-Melis & Bylund, 2017). A growing body of research has demonstrated that the effects of language on thought depend on various factors, such as the nature of the experimental stimuli (simplex or complex), the involvement of language (explicit, implicit or with verbal interference) and task manipulation (linguistic priming). Thus, instead of asking whether or not language determines thought, current studies have shifted the focus

to determining which language-specific categories affect which cognitive domains under what conditions (Bylund & Athanasopoulos, 2014b) .

This multifaceted picture has motivated researchers to explore further how language affects thinking under different circumstances. For example, the thinking-for-speaking hypothesis (Slobin, 1996b) emphasizes the effects of language on online thinking, that is, when language is explicitly used in cognitive processing. This approach has generated reliable evidence that speakers of different languages exhibit different conceptualization patterns when engaged in language comprehension or production (Athanasopoulos et al., 2015a; Montero-Melis & Bylund, 2017; Soroli, Hickmann, & Hendriks, 2019). In line with the 'thinking-for-speaking' hypothesis, other studies show that language can be used as a strategy to solve a particular task, especially when the task lacks an objective or correct answer (Flecken, Carroll, Weimar, & Von Stutterheim, 2015). This "thinking with language" effect, as termed by Wolff and Holmes (2011), emphasizes the spontaneous recruitment of linguistic labels to facilitate answer formulation. In addition, in a more recent view, the label-feedback hypothesis suggests that the effects of language on cognition are dynamic and occur in an ad hoc fashion (Lupyan, 2012). In this view, recent linguistic experience can activate related non-linguistic representations that speakers can draw on to carry out a subsequent cognitive task. Mutual feedback between linguistic and nonlinguistic representations can be achieved by short-term manipulations such as verbalization immediately prior to or during mental processing (Montero-Melis & Bylund, 2017).

3. Conceptual representations in the bilingual mind

The fact that language can modulate cognition in various ways raises many intriguing questions: if speakers of different languages have different modes of thinking, how do bilinguals with two typologically different languages behave? Do they have two independent modes of thought and

behave like monolinguals of each language? Or do they develop a dominant mode of thinking integrating typical features of all the languages they know?

Empirical evidence shows that L2 learning needs not only the internalization of novel linguistic frames, but also related conceptual distinctions. This may give rise to the restructuring of existing conceptual categories in the L1 (Jarvis & Pavlenko, 2008). This process, termed as conceptual or cognitive restructuring, refers to conceptual changes that bilinguals undergo in the process of acquiring a new language. It is a gradual process and occurs in bilinguals' verbal and non-verbal behaviours (Pavlenko, 2011). The conceptual changes bilinguals have are gradient and exhibit various forms, such as the co-existence of L1-and L2-based concepts (Hohenstein, Eisenberg, & Naigles, 2006; Sachs & Coley, 2006), convergence (Brown & Gullberg, 2013; Cook, Bassetti, Kasai, Sasaki, & Takahashi, 2006), shift to L2-based concepts (Athanasopoulos, Damjanovic, Burnand, & Bylund, 2015b; Park & Ziegler, 2014) and the attrition of L1-based concepts (Bylund, 2009; Bylund & Jarvis, 2011). The degree of cognitive restructuring may be modulated by various long-term learning effects, such as L2 proficiency (Ji, 2017; Park, 2019) , age of L2 acquisition (Boroditsky, 2001; Lai, Rodriguez, & Narasimhan, 2014) and language contact (Bylund & Athanasopoulos, 2014a, 2015).

Another line of research suggests that the conceptualization patterns that bilinguals have are context-bound and susceptible to immediate experimental manipulations, such as linguistic priming (Lai et al., 2014; Montero-Melis et al., 2016), biased instruction (Brown & Gullberg, 2008; Kersten et al., 2010) and language context (Athanasopoulos et al., 2015a; Stocker & Berthele, 2019). For example, Athanasopoulos et al. (2015a) reported that German-English bilinguals switched between language-specific categorization patterns as a function of language in operation. Participants in a German context patterned with German monolinguals in basing their similarity judgements on endpoint saliency, whereas participants in an English context patterned with English monolinguals in basing their judgements on event ongoingness.

The overall picture demonstrates that bilinguals' conceptual representations are dynamic and multimodal in the sense that they can be affected by various factors. However, it still remains unclear how long- and short-term variations interact with each other in modulating bilinguals' cognition.

4. Motion event encoding and conceptualization

4.1. The encoding of voluntary motion in English and Cantonese

The domain of motion has served as a suitable testing ground to explore the interplay between language and cognition because world languages exhibit great diversity in how motion is typically expressed. Talmy (2000) divided languages into two distinct categories: satellite-framed languages (S-languages) and verb-framed languages (V-languages), depending on the semantic distribution of path. S-languages, such as English and German, express path in a satellite (e.g., verb particles) but manner in the verb root. In contrast, V-languages, such as Spanish and French express path in the main verb, leaving manner not expressed (by default) or via peripheral devices (e.g., positional phrases or gerundive constituents). Examples (1) and (2) illustrate typical motion constructions in English and French (Tamly, 2000):

(1) English: He ran $_{[Manner]}$ across $_{[Path]}$ the street.

(2) French: Path verb+ Manner subordinate (optional in the expression)

Il traverse $_{[Path]}$ la rue en courant $_{[Manner]}$

"He crossed the street running."

Talmy's typology is useful for analyzing Indo-European languages, but not applicable to serial-verb languages such as Chinese, Tai and other Sino-Tibetan languages where path and manner are encoded in compound forms of equal grammatical status. Thus, Slobin introduced a third type known as equipollent-framed languages, where "both Manner and Path are expressed by equipollent elements, that is, elements that are equal in formal linguistic terms, and appear to be equal in force or significance" (Slobin, 2004, p. 226).

Cantonese, widely spoken in Hong Kong and Guangdong Province in China, is a serial-verb language (Matthews & Yip, 2011). A serial-verb construction in Cantonese consists of two or more components. Each is able to stand alone as an independent element (Matthews, 2006). For instance, the path of motion, 翻 (faan1) and 入 (jap6), can be expressed as either verb complements, as in example (3), or as independent verbs in example (4) and (5). Both constructions are frequently and pervasively used in oral production (Yiu, 2013). Therefore, Cantonese is considered to be an equipollent-framed language, standing midway on the continuum of S-and V-languages (Lamarre, 2007; Yiu, 2013, 2014).

(3) 佢　　跑　　咗　　翻　　入　　睡房

Keoi5　paau2　zo2　faan1　jap6　seoi6 fong2.

S/he　　run　　ASP　return　enter　bedroom

'S/he run back into the bedroom.'

(4) 佢　　翻　　咗　　睡房

Keoi5　faan1　　zo2　　seoi6 fong2

S/he　　return　　ASP　　bedroom

'S/he returned to the bedroom.'

(5) 佢　　入　　咗　　睡房

Keoi5　jap6　　zo2　　seoi6 fong2

S/he　　enter　ASP　　bedroom

'S/he entered the bedroom.'

The typological status of Cantonese is similar to Mandarin Chinese (Ji, Hendriks, & Hickmann, 2011a, 2011b, 2011c) as these two languages have equipollent framing systems with satellite- and verb-framed properties. In addition, Talmy (2009) has suggested that Chinese is the only language that fits the case of equipollence. This can be attributed to diachronic transformations

that classical Chinese went through from a V-language to an S-language (Peyraube, 2006), and such typological transformations in Cantonese are not completed yet (Xu, 2006; Yiu, 2013). Thus, it has been argued that typological distinctions between S-and V-languages should not be viewed as an absolute dichotomy, but as a continuum with various degrees of manner and path salience (Slobin, 2004; Zlatev & Yangklang, 2004) .

Given their typological differences, it is important to investigate whether language-specific ways of talking about motion affect how motion is presented in cognition. According to Slobin's manner salience hypothesis (2004), the codability of manner in lexicalization increases its accessibility in cognitive processing. In this view, S-language speakers tend to attach more salience to manner of motion due to its high codability. However, as manner of motion is not obligatory in V-languages, the frequent omission of manner reduces its cognitive salience in mental representations for V-language speakers. Thus, the current study hypothesizes that English monolinguals attach more salience to manner of motion compared with Cantonese monolinguals in non-verbal categorization.

4.2. Cross-linguistic differences in motion event encoding with monolingual and bilingual speakers

Cross-linguistic research demonstrates that language-specific lexicalization patterns emerge from an early age (Allen et al., 2007; Choi & Bowerman, 1991; Hickmann & Hendriks, 2010; Ji et al., 2011a). For instance, Hickmann and Hendriks (2006) showed that monolingual children began to display L1-specific lexicalization patterns of motion as early as three years old. Similarly, Choi and Bowerman (1991) reported that bilingual children showed sensitivity to the typical patterns of two languages from 17-20 months old. This finding is closely related to the current study as bilinguals with early L2 exposure may become sensitive to the particular ways of linguistic encoding in both languages.

Moving to bilingual speakers, some studies have demonstrated that bilinguals or L2 learners with typologically different languages may transfer certain L1-based lexicalization patterns into the L2. For example, V-language speakers (Japanese, French) tend to encode manner of motion less frequently in their L2 S-languages (English, Danish) compared with S-language monolinguals (Brown & Gullberg, 2008; Cadierno, 2010), whereas S-language speakers learning L2 V-languages may have difficulty in acquiring target lexicalization patterns of manner encoding (Cadierno & Ruiz, 2006; Hendriks & Hickmann, 2015; Hendriks, Hickmann, & Demagny, 2008). However, other studies report that bilinguals and L2 learners are able to restructure their L1-based patterns of 'thinking for speaking' when lexicalizing motion events with an L2 (Hendriks & Hickmann, 2011; Ji & Hohenstein, 2014), and the influence between L1 and L2-based concepts is bidirectional (Brown & Gullberg, 2011; Daller, Treffers-Daller, & Furman, 2011; Hohenstein et al., 2006). For example, Hendriks and Hickmann (2011) showed that intermediate and advanced English learners of French were able to acquire target L2 patterns of conflating path in the main verb when describing voluntary motion. In addition, Hohenstein et al. (2006) reported that Spanish-English bilinguals' lexical choice of manner verbs fell in-between monolingual baselines, suggesting a convergence of L1-and L2-based concepts in the bilingual mind. Lastly, several studies provide evidence for restructuring of the L1-based conceptualization patterns (Bylund & Jarvis, 2011), indicating that conceptual restructuring is a dynamic process and susceptible to individual differences, such as age of acquisition (Filipović, 2011; Hohenstein et al., 2006), L2 proficiency (Cadierno & Ruiz, 2006; Treffers-Daller & Calude, 2015), language contact (Daller et al., 2011) and language context (Stocker & Berthele, 2019).

4.3. Cross-linguistic differences in motion event conceptualization with monolingual and bilingual speakers

Numerous studies have investigated whether different degrees of manner salience in event encoding affect event cognition. Some studies have reported S-and V-language speakers categorizing motion events along the same parameters regardless of typological differences (Loucks & Pederson, 2011; Papafragou, Massey, & Gleitman, 2002). However, other studies have demonstrated a clear language effect on non-verbal behaviours, such as event categorization, recognition memory and attention allocation, when speakers' access to language is not blocked in the decision making process (Gennari et al., 2002; Papafragou, Hulbert, & Trueswell, 2008; Soroli, 2012; Soroli & Hickmann, 2010; Trueswell & Papafragou, 2010). For example, Soroli and Hickmann (2010) investigated whether cross-linguistic differences in motion event lexicalization modulated English and French speakers' categorical preferences by using a triads-matching paradigm. The results suggested that in line with language-specific encoding patterns, French speakers showed a preference for path in both verbal and non-verbal categorization tasks, whereas English speakers presented a significant manner preference only in a verbal condition where linguistic encoding was provided prior to event categorization. Similarly, Montero-Melis and Bylund (2017) examined language's effect on cognition with Swedish (S-language) and Spanish (V-language) native speakers in different conditions. The results suggested that Swedish monolinguals were more likely to use 'same-manner' criteria for similarity assessments as long as they could access the language. However, the language effects disappeared under verbal interference. These converging findings are in line with the hypothesis of 'thinking for speaking' that the effects of language on thought exist only when language is actively involved in online thinking.

Turning to bilingual speakers, the key issue is how spatial concepts are mentally represented. Some studies have reported that event representations in bilinguals are context-bound and can be modulated by short-term language meditation (Athanasopoulos et al., 2015; Lai et al., 2014; Montero-Melis et al., 2016). For example, Montero-Melis et al. (2016) examined whether

recent L2 exposure affected similarity assessments of caused motion with Swedish adult learners of L2 Spanish. Participants repeated L2-priming sentences with different degrees of manner salience prior to making similarity arrangements. The findings showed that Swedish speakers preferred to base their arrangements on 'same-path' criteria when primed with path-biased sentences. A similar pattern was reported in Lai et al. (2014) that late English-Spanish bilinguals who were primed with Spanish sentences preferred to base their similarity judgements on path of motion compared with those who were primed with English sentences prior to categorization. These findings indicate that conceptual representations of bilinguals are flexible and can switch to language-modulated patterns within a short time scale.

In contrast, other studies have shown that bilinguals' mental representations are resistant to change with short-term language manipulations. For example, Filipović (2011) investigated whether early English-Spanish bilinguals performed differently on recognition memory in different language contexts. The results suggested that bilinguals' performances resembled Spanish monolinguals in manner recognition irrespective of the language context. The results echoed Kersten et al. (2010), who examined how Spanish-English bilinguals classified novel objects by using a supervised learning paradigm. The results showed that bilinguals with early exposure to English patterned with English monolinguals in manner classification regardless of the test language.

In summary, the evidence regarding short-term effects of cross-linguistic differences remains mixed and several issues remain unsolved. First, most studies examining the short-term effects of L2 exposure use L2 linguistic priming as a way to manipulate immediate language use. However, it remains unclear whether participants are aware of such priming effects and whether pseudo-priming can properly reflect real-life situations (Montero-Melis et al., 2016). In contrast, Filipović (2011) elicited participants' language production in each of their languages as a way to manipulate the language context. But the activation of two languages at

the same time may counterbalance any potential effects that language places on cognition. Second, although some studies have reported that early bilinguals may differ from late bilinguals in event conceptualization (Lai et al., 2014), it remains unknown how other long-term variations such as language contact affect bilinguals' performance, and how long-and short-term variations interact with each other. Third, the existing literature mainly targets language pairs with contrastive typological features (S- and V-languages) whereas little has been done with languages located between these two extremes (E-languages).

5. The present study

This study extends language pairs under investigation to one of the non-Indo-European languages, Cantonese, with characteristics of satellite-framed and verb-framed languages. It aims to investigate the immediate effect of language use on event categorization in early Cantonese-English bilinguals with varying degrees of language contact with Cantonese and English. We manipulate bilinguals' immediate language use by eliciting their oral descriptions prior to categorization. The purpose of eliciting participants' oral descriptions is twofold: first it can reflect participants' preferences in event encoding based on natural descriptions and second, we can maximize the effects of language on thought by engaging participants in language production. We also manipulate the degree of language activation in bilinguals by randomly assigning them to one of the two contexts: a monolingual (L1) context where Cantonese is the only activated language and a bilingual (L1 and L2) context where both Cantonese and English are kept activated during verbalization and categorization.

The overall aim is to investigate whether and to what extent cross-linguistic differences in lexicalization go beyond the linguistic domain and how bilingual speakers tend to behave under short-term language manipulations. Research questions are:

1. How do Cantonese and English monolingual speakers lexicalize and conceptualize voluntary motion events? Is higher salience in manner encoding associated with more attention to manner in event categorization?
2. How do Cantonese-English bilingual speakers in different language contexts lexicalize and conceptualize motion events compared with Cantonese and English monolinguals?
3. To what extent is language contact associated with bilinguals' motion event encoding and mental representations?

6. Method

6.1. Participants

Altogether 90 adult participants were recruited for the study: 30 Cantonese monolingual native speakers, 30 English monolingual native speakers and 30 Cantonese-English bilingual speakers. All were university students. Cantonese monolinguals ($M_{age=}$22.1, SD=2.7) were recruited from a local university in Shenzhen, China where Cantonese is the mother tongue. English monolinguals ($M_{age=}$23.7, SD=1.9) were involved from a local university in London, UK. The monolinguals in the study refer to functional monolinguals with limited proficiency and minimal exposure to any foreign language (Brown & Gullberg, 2011; Park & Ziegler, 2014). Their dominant language in daily communication is the native language and none of them regard themselves as functional bilinguals according to the language history questionnaire. Cantonese-English bilinguals ($M_{age=}$20.7, SD=2.1) were from Hong Kong where both Cantonese and English are the official languages and used interchangeably in daily communication. Speakers normally start their English language learning at an average age of three as early bilinguals and achieve a high proficiency in English at university. So bilingualism here is defined as an alternate of two languages of equal status in terms of proficiency.

In line with previous studies (Montero-Melis et al., 2016; Park & Ziegler, 2014), bilinguals' language proficiency was assessed in a language history questionnaire (Li, Zhang, Tsai & Puls,

2014) in two forms: self-reported scores of any standardized English proficiency tests taken within the last two years and self-rated scores of current English proficiency. According to Common European Framework of Reference for Language (Council of Europe, 2011), their proficiency was above the upper intermediate level (B2), as measured by their IELTS or TOEFL scores. Participants also evaluated their current proficiency in English based on a seven-point scale where 7 was the maximum rating (M=6.41; SD=0.51). To measure bilinguals' language contact with Cantonese and English, daily language use was estimated by hours. Participants were asked to indicate the time they spent on doing daily activities with each language (e.g., watching television, reading for school, writing emails to friends etc.).

To further explore the effect of language context, bilinguals were randomly assigned to one of the two contexts: a monolingual context (N=15) and a bilingual context (N=15). Both groups had comparable level of English proficiency as measured by their self-rated scores (M=6.26, SD= 0.53 for bilinguals in a monolinguals context; M=6.56, SD= 0.45 for bilinguals in a bilingual context, $t(28) = 1.65$, $p=0.108$) and the onset of English acquisition (M=3.53, SD=0.91 for bilinguals in a monolinguals context; M=3.2, SD=0.56 for bilinguals in a bilingual context; $t(28) =1.20$, $p=0.239$)

6.2. Materials

A cartoon based test was specially designed for the study with an elicited verbal encoding task and a triads matching task to assess participants' performance across each group.

6.3. Experimental tasks

6.3.1. Task1: Linguistic verbal encoding task

The stimulus consisted of 54 sets of animated cartoons with 36 test items and 18 control items. Each cartoon was 6 seconds long. The test items depicted a boy performing a voluntary motion event with various path and manner whereas the control items minimize the path of motion with highlights on manner of motion only. The involvement of control items has two aims: 1)

to distract participants from using same lexicalization patterns throughout the task and 2) to establish a bilingual context (see Procedure for details). The model was originally developed by Hickmann and Hendriks (2010). Different from the previous model, the current stimuli included a total of eight types of path, falling into three categories: vertical path (up and down), deictic path (along, towards, away from) and path of a boundary-crossing (across, into, out of). Altogether 11 types of manners were included, ranging from general manners (walk, run) to manners with instruments (bicycle, skateboard). For detailed information, please refer to Appendix A.

6.3.2. Task2: Non-linguistic similarity judgement task

A total of 54 animated video clips involving 12 sets of test triads and 6 sets of distractors were used as stimuli. The test triads shared the same content with the stimuli used in the linguistic encoding task. This was to make sure that participants had described all scenes prior to event categorization. Each triad consisted of three video clips: a target video illustrated a boy performing a voluntary motion event (A boy walks up a hill), and two alternate videos with either manner or path contrasts. For manner-match alternates, manner of motion was kept consistent whereas the path was changed (A boy walks down a hill). In contrast, for path-match alternates, path of motion was kept the same whereas manner was altered (A boy runs up a hill). All triads were displayed in a fully-randomized order. The target event appeared first, followed by its manner-and path-match alternates displayed simultaneously on the same screen. The presentation order of each triad was counterbalanced across participants in each group. The placement of manner- and path-match alternates on the screen (right-hand side or left-hand side) was counterbalanced in a fixed order.

6.4. Procedure

Participant was tested individually by the experimenter. All the stimuli were displayed and run by the software Superlab 5.0 on a MacBook laptop. In line with Montero-Melis and Bylund

(2017), participants performed an overt verbal encoding task prior to the similarity judgement task to ensure the activation of language (s) during the decision-making process.

In the first experiment, participants of each group were asked to watch the cartoon stimuli first and then describe "what happened" in each video clip. Monolinguals were instructed and narrated using the native language. Bilinguals in the monolingual context were asked to describe all test items and control items in Cantonese. To trigger a bilingual context and avoid a translation effect, bilinguals in the bilingual context were instructed to narrate all test items in Cantonese whereas the control items in English. The control items were presented with a different background color and participants in a bilingual context were informed before the experiment that items with a white background should be narrated in English. Responses to critical items should be in Cantonese. Speakers in a monolingual context were instructed to narrate all items in Cantonese. Two sets of training items were presented at the beginning of the experiment to get participants familiar with the procedures. The stimuli were fully randomized and counterbalanced across participants in each language group.

Right after the encoding, participants were given a similarity judgement task. Monolinguals were instructed in their L1s. Bilinguals in a monolingual context were instructed in Cantonese to keep the L1 as the only active language. Bilinguals in a bilingual context were instructed in English so that both L1 and L2 were kept active during event conceptualization. Participants were informed that the stimuli were presented in a synchronized order: the target video played first and disappeared once completed. Then two simultaneous alternates started playing side by side. Within each triad, a half-second black screen was arranged between the target event and its two alternates. And between each triad, there was one-second black screen. Participants need to decide which alternate video is more similar to the target by pressing one of the two keys, A and L respectively on the keyboard. They were required to make their decisions as soon as possible.

A practice session was given at the beginning of each experiment. Right after the experiment session, participants completed the language history questionnaire.

6.5. Coding

The linguistic data was transcribed in a CHAT format (cha.) following the CLAN manual and coded according to the guidelines for transcribing English and Chinese data (Ji & Hohenstein, 2014). Only test items were included for coding and analysis. The data was first segmented into utterances. Each utterance study was defined in terms of syntactic simplicity: either simple sentences or complex sentences with subordination. Sentences with two or more coordinative clauses, as indicated by conjunctions or in-between phonological pauses, were regarded as a single utterance (Ji & Hohenstein, 2014). Descriptions without a specific focus on motion were excluded from the analysis (e.g., The river was frozen). Within each utterance, the frequency of manner and path encoding was calculated by whether or not this element was encoded and where the element was encoded (i.e., in the main verb or in a satellite). Take the frequency of manner encoding for example, it was coded as 0 when manner was absent (e.g., A boy crossed the street) but as 1 when it was expressed (e.g., A boy walked down the hill).

The categorization data in the similarity judgement task was coded as a binary categorical variable, where "0" indicates participants' overt selection for path-match preferences, whereas "1" represents manner-match preferences.

7. Results

7.1. Linguistic encoding of motion event

7.1.1. Frequency of Manner and Path encoding across different language groups

Participants' linguistic encodings were calculated by the frequency of manner and path selection. Participants' responses to each stimulus were transformed into percentages and the mean percentage for each group was compared in terms of participant group and language context. Participants of each group presented a high tendency of path encoding, with a ceiling

effect across four language groups (Cantonese: M=96.97%, SD=6.09%; Bilingual in a monolingual context: M=96.93, SD=6.02%; Bilingual in a bilingual context: M=97.4%, SD=4.61%; English: M=98.1%, SD=3.71%). However, with regard to manner encoding, bilinguals and English monolinguals encoded manner more often than Cantonese monolinguals (Cantonese: M=74.7%, SD=10.52%; Bilingual in a monolingual context: M=94.6, SD=6.69%; Bilingual in a bilingual context: M=96.6%, SD=5.53%; English: M=97.9%, SD=4.73%).

To access whether speakers from different groups differed in their likelihood of manner and path encoding, two separate logistic mixed-effect models [1] were built with the *lme4* package (Bates et al., 2014) in R (R Development Core Team, 2018). Within each model, the binary dependent variable was whether the target semantic element (e.g., manner and path of motion) was encoded (code=1) or not (code=0). The fixed effect was participant group (four levels: Cantonese monolinguals *vs*. bilinguals in a monolingual context vs. bilinguals in a bilingual context vs. English monolinguals). The random effects were random intercepts for participant and item. For path encoding, results showed that the inclusion of group did not significantly increase the model fit compared with the null model (χ^2 (3) =0.63, p=0.88), indicating that group was not a main effect. In other words, participants across different groups were equally likely to encode path of motion when describing voluntary motion.

However, for the frequency of manner encoding, including participant group as the fixed effect significantly optimized the model compared with the null model (χ^2 (3) =56.4, p<.001), indicating that group was a main effect. Then forward coding was used to compare the likelihood of manner encoding with the next group. As shown in Figure 1, bilinguals in a monolingual context encoded more manner than Cantonese monolinguals ($\beta_{\text{Cantonese-Bilinguals in monolingual context}}$ = -1.79, SE = 0.50, Wald z =-3.57, p < .001) but patterned with bilinguals in a bilingual context ($\beta_{\text{Bilinguals in monolingual context--Bilinguals in bilingual context}}$ = -1.47, SE = 0.75, Wald z =-1.95, p = 0.1). Meanwhile, no difference between bilinguals in a bilingual context and English

monolinguals was detected ($\beta_{\text{Bilinguals in bilinguals in bilingual context-English monolinguals}} = -0.23$, SE = 0.77, Wald z =-0.30, p = 0.76). As predicted, Cantonese monolinguals encoded significantly less manner than English monolinguals ($\beta_{\text{Cantonese-English}} = -3.5$, SE = 0.57, Wald z =-6.11, p < .001). The findings indicated that bilinguals demonstrated a cognitive shift towards L2-based encoding patterns regardless of language context.

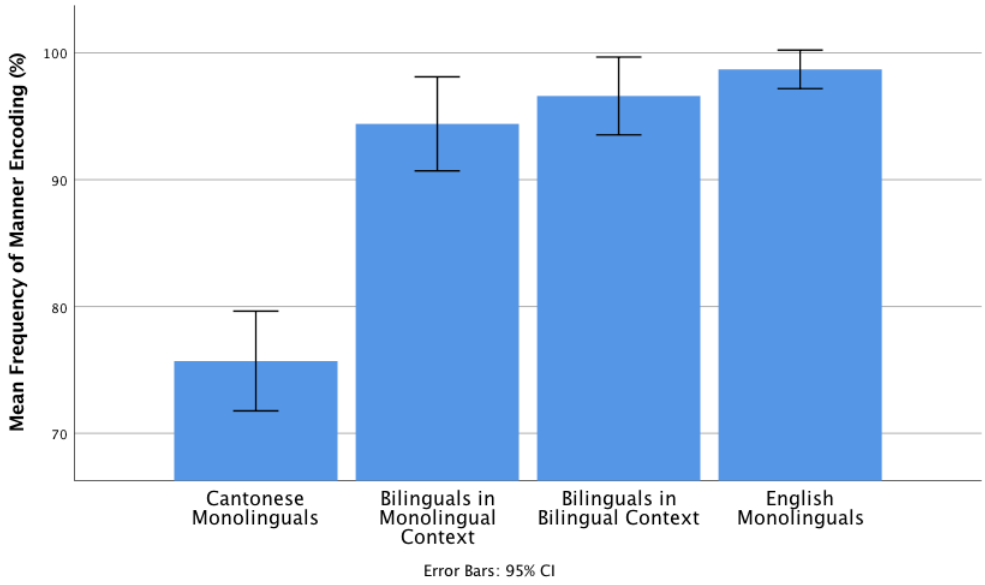


Figure 1. Mean percentage of manner encoding across participant group and language context

7.1.2. Framing strategies of voluntary motion event across different language groups

Based on the frequency of manner and path encoding, we further explored the semantic distribution of each component within the utterance (Table 2). Results indicated that as a typical S-language, English monolinguals encoded manner in the main verb (M=92.9%, SD=11.6%) whereas path in verb particle (M=96.5%, SD=7.1%). As an E-language, Cantonese showed flexibility in the semantic distribution of manner and path. For manner encoding, Cantonese monolinguals encoded manner in either the main verb (M= 54.8%, SD=16.3%) or outside of the verb via a gerund (M=29.3%, SD=10.8%). In addition, path was encoded as either directional verbs (M=48.2%, SD=14.8%) or satellites (M=57.7%, SD=12.1%).

Table 1. Percentages of semantic distribution of manner/path in verb (V) or outside of it (OHT).

	Cantonese (%)			**Bilinguals in monolingual context (%)**			**Bilinguals in bilingual context (%)**			**English (%)**		
Component	V	OTH	Total	V	OTH	Total	V	OTH	Total	V	OTH	Total
Manner	54.8	29.3	74.7	73.7	17.6	94.6	80.4	17.8	96.6	92.9	9.6	97.9
Path	48.2	57.7	96.9	32.1	75.3	96.9	35.5	68.7	97.4	1.48	96.5	98.1

Notes: The sum of the first two columns within each language group doesn't always add up to the total proportion as the manner or path of motion can be double-encoded in V and OTH at the same time (e.g.: The boy is [jumping]$_{verb}$ downstairs [with one leg] $_{OTH}$).

The semantic distribution of manner and path is in line with the typological status of Cantonese, an equipollent-framed language standing midway on the continuum of S-and V-languages. Take path encoding for example, it could be either encoded in the main verb as V-languages or in a satellite as S-languages. Examples are given below in (8), (9) and (10).

A qualitative analysis was conducted regarding the framing strategies of each language. English monolinguals used satellite-framing as the dominant strategy for motion event encoding whereas verb-framing was hardly used. Examples were given in (6) and (7).

(6) Satellite-framing: A boy is cycling [manner in verb] up [path in satellite] the hill.

(7) Verb-framing: A boy crossed [path in the verb] the road on a skateboard [manner in OTH].

In contrast, as an E-language where path of motion can stand alone as an independent element, Cantonese monolinguals used both satellite- and verb-framing as primary strategies in the linguistic encoding. The example of satellite-framing is illustrated in example (8). There are two sub-types in verb-framing strategies. In the first type, manner of motion is not expressed, as shown in example (9). In the second type, manner of motion is encoded in a gerund as illustrated in example (10).

(8) Satellite-framing: Manner in the verb, Path outside

個男仔 係度 鴨仔跳[Manner in verb] 由左至右[Path in the satellite]

a boy there jump from right to left

"A boy is jumping from left to right"

(9) Verb-framing (type 1): Path in verb without expressing manner of motion

個男仔 入 [Path in verb] 去 間房

a boy entered go (deictic) the room

'A boy entered the room'

(10) Verb-framing (type 2): Path in verb and manner in a gerund

個男仔 踩住單車 [Manner in the gerund] 落 [Path in verb] 山

a boy cycling DUR descend the mountain

'A boy descended the mountain cycling'

Bilinguals expressed more manner and adopted a predominant satellite-framing strategy compared with Cantonese monolinguals as illustrated by Figure 2 (Cantonese monolinguals: M=56.1%, SD=14.5%; Bilinguals in a monolingual context: M=77.0%, SD=14.2%; Bilinguals in a bilingual context: M=85.6%; SD=9.8%; English monolinguals: M=94.4%, SD=8.25%). A mixed-effect logistic model [2] was fitted with the presence or absence of verb-framing as the binary dependent variable. The fixed effect was group and the random effects were intercepts for participant and item. Results showed that bilinguals in a monolingual context used less verb-framing strategies than Cantonese monolinguals ($\beta_{\text{Cantonese--Bilinguals in monolingual context}} = 1.12$, SE = 0.31, Wald z =3.54, $p < .001$) but patterned with bilinguals in a bilingual context ($\beta_{\text{Bilinguals in monolingual context--Bilinguals in bilingual context}} = 1.25$, SE = 0.44, Wald z =2.81, $p = 0.09$). Meanwhile, bilinguals in a bilingual context used more verb-framing strategies than English monolinguals ($\beta_{\text{Bilinguals in bilingual context-English monolinguals}} = -2.21$, SE = 0.86, Wald z =-2.54, $p < 0.01$).

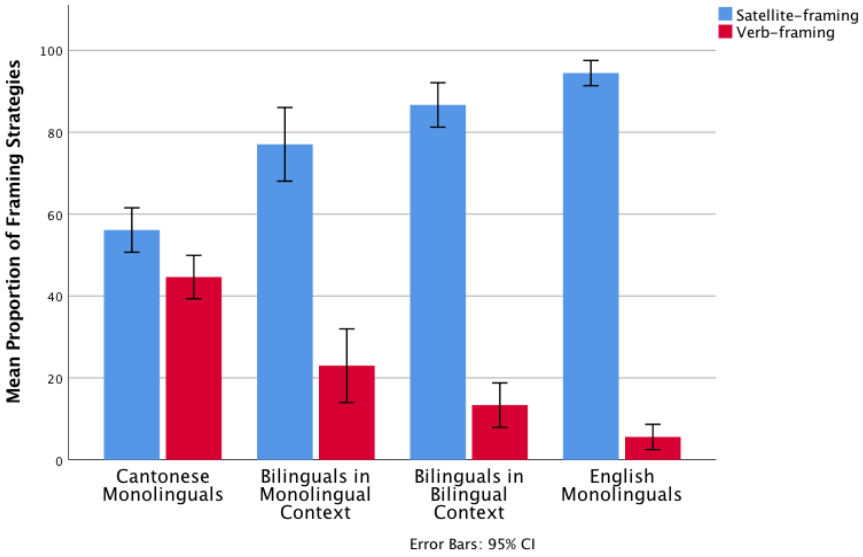


Figure 2. Mean percentage of different framing tendencies (satellite-framing and verb-framing) across participant group and language context

7.2. Similarity judgment of motion event

Regarding participants' manner-or path-match preferences in subsequent categorization task (Figure 3), English monolinguals (M=70.63%; SD=16.8%) and bilinguals in different language contexts (M=58.87%; SD=24.52% for monolingual context and M= 60.53%; SD=18.87% for bilingual context) had a manner-match preference compared with Cantonese monolinguals (M=44.80%; SD=21.49%). A mixed-effect logistic model [3] was fitted with participants' manner-match preferences as a binary dependent variable. The fixed effect was participant group. The random effects were crossed-random intercepts for participant and item. Involving participant group as the fixed-effect significantly optimized the model (χ^2 (3) =21.55, p<.001) compared with the null model, indicating that group is a main effect in participants' similarity judgements. The lack of significance in overall intercept (β_0 = 0.64, SE = 0.36, Wald z =1.77, p = 0.07) indicated that participants across language groups did not have an overall preference for either manner-or path-match alternates. Then forward difference coding was given to compare the likelihood of manner-match selection in this group with the next group. Results confirmed that bilinguals in a monolingual context preferred more manner-match alternates

than Cantonese monolinguals ($\beta_{\text{Cantonese-Bilinguals in monolingual context}}$ = -0.88, SE = 0.34, Wald z =-2.59, p =0.03) but patterned with bilinguals in a bilingual context ($\beta_{\text{Bilinguals in monolingual context-Bilinguals in bilingual context}}$ = -0.07, SE = 0.39, Wald z =-0.19, p = 0.84). Meanwhile, no difference was found between bilinguals in a bilingual context and English monolinguals ($\beta_{\text{Bilinguals in bilinguals in bilingual context-English monolinguals}}$ = -0.36, SE = 0.34, Wald z =-1.05, p = 0.60). As expected, Cantonese monolinguals selected less manner-match alternates than English monolinguals ($\beta_{\text{Cantonese-English}}$ = -1.31, SE = 0.28, Wald z =-4.67, p < .001). The findings suggested that bilinguals showed a cognitive shift towards L2-based categorization patterns regardless of the language context.

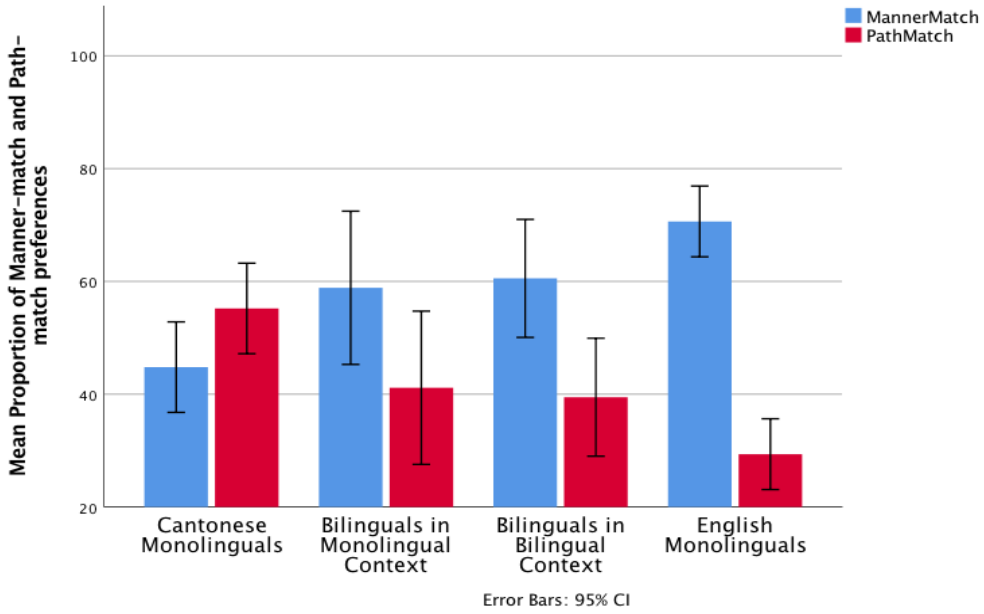


Figure 3. Mean percentage of manner/path preferences across participant group and language context

7.3. Factors predictive of bilinguals' motion event lexicalization and categorization

We further explored to what extent language contact was associated with bilinguals' performance and whether language contact and language context interact with each other. Following Athanasopoulos (2009), language contact is defined as the amount of use bilingual speakers have with each language and measured by participants' self-reported scores. The daily amount of language use was converted into percentage scores. As the proportion of English

and Cantonese use was added up to 1, we used the former as the explanatory variable. Two separate logistic mixed effect models were built with frequency of manner encoding, and manner-match preferences as separate binary dependent variables. The random effects were random intercepts for participant and item. The main effects were language context and the amount of English use. As the interaction of these two factors were not statistically significant and including the interaction did not significantly optimize the model (χ^2 (1) =1.334, p=0.248 for manner encoding in lexicalization; χ^2 (1) =0.781, p=0.376 for manner-match preferences in categorization), the final models [4] [5] included the main effects only. As shown in Table 3 and 4, only language contact was significantly correlated with bilinguals' frequency of manner encoding and manner-match preferences.

Table 3: Fixed effects on the probability of manner encoding in event lexicalization

Fixed effects	**Estimate**	**SE**	**Wald z**	**Pr(>|z|)**
Intercept	0.697	1.476	0.473	0.636
Language Context	-0.936	0.581	-1.611	0.107
Amount of English use	6.133	2.518	2.435	0.014 *

Note: The intercept represents the predicted probability of manner verb encoding (log-odds) when language context is bilingual and the frequency of English use is 0.

Table 4: Fixed effects on the probability of manner-match preferences in event categorization

Fixed effects	**Estimate**	**SE**	**Wald z**	**Pr(>|z|)**
Intercept	-2.452	0.857	-2.864	0.004
Language Context	-0.266	0.327	-0.813	0.415
Amount of English use	5.291	1.341	3.947	<0.001**

Note: The intercept represents the predicted probability of manner-match preference (log-odds) when language context is bilingual and the frequency of English use is 0.

8. General discussion and Conclusion

The current study investigated whether language utilized at the time of speaking had a "thinking-for-speaking" effect on subsequent categorization. We tested early Cantonese-English bilinguals in both a monolingual and a bilingual context to explore whether recent L2 activation had immediate consequences for categorization behaviour. To establish a baseline, we first asked how monolinguals of each language lexicalize and conceptualize voluntary motion using a similarity judgement task with verbal encoding. The results provided clear evidence that as a typical S-language, English monolinguals reached a ceiling level in manner encoding and had a manner-match preference in categorization. Cantonese monolinguals, on the other hand, demonstrated a lower frequency of manner encoding and a lower level of manner-match preferences in categorization. These differences can be attributed to the typological status of English and Cantonese. Due to the availability of path verbs in Cantonese, manner of motion can be easily added or dropped in descriptions. This allows Cantonese monolinguals to choose from different framing strategies with varying degrees of manner salience. Although English has a set of path verbs (ascend, descend), most of them are Latinate borrowings and less colloquial in style. Thus, path verbs in English are seldom used in oral expressions (Slobin, 1996a). Thus, the frequency of manner encoding in Cantonese is lower than in English. The current findings lend support the manner salience hypothesis (Slobin, 2004) that cross-linguistic differences in motion event encoding are only detected in the likelihood of manner selection. And the codability of manner in lexicalization is associated with the accessibility of this information in cognition. The cross-linguistic differences observed in categorization echoed previous findings that participants' lexicalization patterns are predictive of their conceptual preferences when the access to language is not blocked in the decision-making process (Gennari et al., 2002; Montero-Melis & Bylund, 2017; Papafragou & Selimis, 2010; Soroli & Hickmann, 2010). One possible explanation is that when participants are asked

to do a categorization task that lacks a correct answer, they might depend on all available resources, including recent linguistic experience to solve the task. In this case, as proposed by the 'thinking-for-speaking' and 'thinking-with-language' accounts, the involvement of language as a strategy for categorical perception exhibits language-specific features (Lupyan, 2012; Slobin, 1996a; Wolff & Holmes, 2011). Therefore, the different weight or salience that speakers attach to each semantic element in the linguistic encoding tends to trigger a language-specific way of thinking during similarity judgements.

The second research question examined how bilinguals in different language contexts lexicalized and conceptualized motion events compared with the monolingual baseline. Bilinguals' responses in a monolingual and a bilingual context were compared. The results suggested that, on the one hand, bilinguals' overall performances were significantly different from those of Cantonese monolinguals but patterned with English monolinguals in manner encoding and manner-match selection. On the other hand, bilinguals' performances patterned with each other, irrespective of the language context. Their attested behaviours indicated a cognitive shift towards English-based conceptualization patterns. Qualitative analysis of the linguistic encoding further indicated that bilinguals chose to use more manner verbs with finer details and opted for fewer verb-framing strategies compared with Cantonese monolinguals. Thus, the higher manner of salience in linguistic encoding modulated speakers' reliance on this component in subsequent similarity judgements. Similar results were reported in previous findings in that language-specific labels tend to modulate categorization when a certain linguistic element is made salient during or prior to event categorization (Kersten et al., 2010; Lupyan, 2012; Montero-Melis et al., 2016). Furthermore, it suggests that the active learning and using of two languages in daily life gives rise to readjustment of the original categories developed in the L1 and provides positive evidence for cognitive restructuring (Jarvis & Pavlenko, 2008).

However, we did not detect any effect of recent L2-activation on event lexicalization or categorization. There are two reasons that may account for these results. One possible explanation is that, for early bilinguals, it may be more efficient to rely on a common linguistic framework that works well for two languages. According to Talmy (2000), the most characteristic way of expressing a voluntary motion in English to encode manner in the main verb, whereas path in the satellite is due to the grammatical constraint that a path particle cannot stand alone as an independent element. For example, sentence like "*A boy up the hill*" is regarded as ungrammatical in English. Although there is a set of path verbs in English, they are rarely used in daily communication (Slobin, 1996a). However, in Cantonese, as path verbs can be used independently, the encoding of manner is optional and depends on whether speakers opt for it or not. For example, descriptions like "*A boy ascends the hill"* and "*A boy walks up a hill*" in Cantonese are grammatically correct and frequently used in daily communication. Given the different linguistic patterns available in Cantonese but not in English, it may be more efficient for early bilinguals to draw on a single linguistic pattern which is workable in both languages and generalizable to a wide range of communication contexts. In addition, previous findings have shown that language-specific concepts are established in early childhood (Hickmann & Hendriks, 2006; Ji & Hohenstein, 2018). Early exposure to a second language may enable bilinguals to be more sensitive to the typical patterns of both languages. In the current case, both Cantonese and English are official languages in HK. Participants usually acquire an L2 at an average age of three and use both languages actively at school and in daily interactions. Thus, early exposure to and active use of two languages may lead to a convergence of different conceptual categories, which will not be affected by short-term linguistic manipulations. Similar findings are reported for other cognitive processes such as classification (Kersten et al., 2010; Lai et al., 2014) and memory recognition (Filipović, 2011). For example, Lai et al. (2014) reported that early English-

Spanish bilinguals patterned with L2-Spanish in event categorization, regardless of the language in use. It is suggested that the effects of speaking on thinking are not limited to the languages in immediate operation, but also applicable to a common pattern of "thinking-for-speaking" developed through a whole lifetime's experience. Similar results were reported by Filipović (2011) that early English-Spanish bilinguals demonstrated an L2-based conceptualization pattern irrespective of the test language. It was indicated that bilinguals tended to opt for a 'whatever-works-in-both' approach in cognitive processing in terms of processing the costs and benefits. It was concluded that "bilinguals do not seem to have two separate processing systems but rather an intertwined use of the two".

We are aware that not all studies have reported similar results. For example, Berthele & Stocker (2017) examined the influence of language mode on event lexicalization with German-French bilinguals. The results showed that participants in bilingual mode were more likely to converge towards a French pattern when both languages were kept active. One possible reason for this discrepancy may be attributed to the typological status of languages under investigation. In fact, the extent of discrepancies between English and Cantonese (and in general, between S- and E-languages) is not as contrastive as that between S-languages and V-languages in terms of manner salience. Strictly speaking, learning L2-English is more about the activation of an already-existing pattern in Cantonese rather than the internalization of a brand-new linguistic frame. In this view, the partial overlap between Cantonese and English reinforces the degree of convergence between these two languages compared with other language pairs under investigation.

The final research question further examined whether language contact was predictive of early bilinguals' performance. The results suggested that the amount of language contact with English per day was positively associated with their language-specific performance. Thus, the more frequently English was used in daily communication, the more likely was the speaker to

encode manner information in lexicalization and to present manner-match preferences in event categorization. Similar findings have been reported by previous studies that language contact plays an important role in cognitive restructuring. That is, the more frequently learners use an L2, the more likely are their cognitive behaviours to shift away from the L1 and pattern with the target language (Bylund & Athanasopoulos, 2014a, 2015; Daller et al., 2011). The findings suggest that frequent exposure to and active use of an L2 presents learners with sufficient instances of language-specific patterns. For instance, with sufficient exposure, bilinguals may understand that English attaches great importance to manner in linguistic encoding. The reinforcement of language-specific encoding patterns may strengthen the associations with conceptual representations (Bylund & Athanasopoulos, 2014a; Jarvis, 2011). Consequently, participants who used English more frequently tend to exhibit categorization preferences based on manner variants.

9. Limitations and Conclusion

One limitation of this study is the use of a triads-matching task in event categorization. Although the triads-matching paradigm has been extensively used as a classical measure of participants' preferences and successfully implemented in different cognitive domains (Bylund & Athanasopoulos, 2014b; Ji & Hohenstein, 2018; Park, 2019), a shortcoming of the design is that, to some extent, it confounds path preference with manner preference. That is, this paradigm assumes that a higher proportion of manner preference is equivalent to a lower proportion of path preference. Therefore, recent studies suggest that it is necessary to adequately tease out manner and path preferences when addressing motion-event cognition (Kersten et al., 2010; Montero-Melis & Bylund, 2017).

In conclusion, the current study has sought to investigate whether early Cantonese-English bilinguals behaved differently from monolinguals in each language when lexicalizing and categorizing voluntary motion based on different language contexts. The results showed that

early bilinguals patterned with English monolinguals in both event lexicalization and categorization, regardless of the language context. The findings indicated that long-term L2-learning experience restructured L1-specific conceptual categories towards a convergent mode of 'thinking-for-speaking'. And the degree of cognitive restructuring was modulated by the amount of contact with each language. The current study contributes to the literature in two ways. First, it demonstrates that cross-linguistic differences in lexicalization can go beyond the linguistic domain and modulate cognitive representations when participants are involved in the process of "thinking-for-speaking". And second, the effects of language on mental representations are context-bound and open to change due to variations in learners' language-learning history.

Notes:

[1] model1<- glmer(FrequencyManner ~Group+(1|Subject) +(1|Item), family=binomial, data=Task1)

[2] mode2<- glmer(VerbFraming ~Group+(1|Subject) +(1|Item), family=binomial, data=Task1)

[3] model3<- glmer(PreferenceManner ~Group+(1|Subject) +(1|Item), family=binomial, data=Task2)

[4] model4<- glmer(FrequencyManner ~LanguageContext+LanguageContact+(1|Subject) +(1|Item), family=binomial, data=bilingual)

[5] model5<- glmer(PreferenceManner ~LanguageContext+LanguageContact+(1|Subject) +(1|Item), family=binomial, data=bilingual)

References

Allen, S., Özyürek, A., Kita, S., Brown, A., Furman, R., Ishizuka, T., & Fujii, M. (2007). Language-specific and universal influences in children's syntactic packaging of Manner and Path: A comparison of English, Japanese, and Turkish. *Cognition*, *102*(1), 16-48.

Athanasopoulos, Bylund, E., Montero-Melis, G., Damjanovic, L., Schartner, A., Kibbe, A., Thierry, G. (2015a). Two Languages, Two Minds: Flexible Cognitive Processing Driven by Language of Operation. *Psychological Science*, *26*(4), 518-526.

Athanasopoulos, P. (2009). Cognitive representation of colour in bilinguals: The case of Greek blues. *Bilingualism: Language and Cognition, 12*(1), 83-95.

Athanasopoulos, P., Damjanovic, L., Burnand, J., & Bylund, E. (2015b). Learning to Think in a Second Language: Effects of Proficiency and Length of Exposure in English Learners of German. *Modern Language Journal, 99*(S1), 138-153.

Athanasopoulos, P., Damjanovic, L., Krajciova, A., & Sasaki, M. (2011). Representation of colour concepts in bilingual cognition: The case of Japanese blues. *Bilingualism: Language and Cognition, 14*(1), 9-17.

Bates, D. M., Maechler, D., Bolker, B. M., & Walker, S. (2014). lme4: Linearmixed-effects models using Eigen and S4.Retrieved from http://CRAN.R-project.org/package=lme4.

Berthele, R., & Stocker, L. (2017). The effect of language mode on motion event descriptions in German–French bilinguals. *Language and Cognition, 9*(4), 648-676

Boroditsky, L. (2001). Does Language Shape Thought? Mandarin and English Speakers' Conceptions of Time. *Cognitive Psychology, 43*(1), 1-22.

Boroditsky, L., Fuhrman, O., & McCormick, K. (2011). Do English and Mandarin speakers think about time differently? *Cognition, 118*(1), 123-129.

Brown, A., & Gullberg, M. (2008). Bidirectional cross-linguistic influence in L1-L2 encoding of manner in speech and gesture: A study of Japanese speakers of English. *Studies in Second Language Acquisition, 30*(2), 225-251.

Brown, A., & Gullberg, M. (2011). Bidirectional Cross-Linguistic Influence in Event Conceptualization? Expressions of Path among Japanese Learners of English. *Bilingualism: Language and Cognition, 14*(1), 79-94.

Brown, A., & Gullberg, M. (2013). L1-L2 Convergence in Clausal Packaging in Japanese and English. In *Bilingualism: Language and Cognition, 16*(3), 477-494.

Bylund, E. (2009). Maturational Constraints and First Language Attrition. *Language Learning, 59*(3), 687-715.

Bylund, E., & Athanasopoulos, P. (2014a). Language and thought in a multilingual context: The case of isiXhosa. *Bilingualism: Language and Cognition, 17*(2), 431-441.

Bylund, E., & Athanasopoulos, P. (2014b). Linguistic Relativity in SLA: Toward a New Research Program. *Language Learning, 64*(4), 952-985.

Bylund, E., & Athanasopoulos, P. (2015). Televised Whorf: Cognitive Restructuring in Advanced Foreign Language Learners as a Function of Audiovisual Media Exposure. *Modern Language Journal, 99*(S1), 123-137.

Bylund, E., & Jarvis, S. (2011). L2 effects on L1 event conceptualization. *Bilingualism: Language and Cognition, 14*(1), 47-59.

Cadierno, T. (2010). Motion in Danish as a second language: Does the learner's L1 make a difference? In Z. Han & T. Cadierno (Eds.), *Linguistic relativity in SLA : Thinking for speaking*. Bristol, UK: Multilingual Matters.

Cadierno, T., & Ruiz, L. (2006). Motion events in Spanish L2 acquisition. *Annual Review of Cognitive Linguistics, 4*(1), 183-216.

Choi, S., & Bowerman, M. (1991). Learning to express motion events in English and Korean: The influence of language-specific lexicalization patterns. *Cognition, 41*(1), 83-121.

Cook, V., Bassetti, B., Kasai, C., Sasaki, M., & Takahashi, J. A. (2006). Do bilinguals have different concepts? The case of shape and material in Japanese L2 users of English. *International Journal of Bilingualism, 10*(2), 137-152.

Council of Europe. (2011). Common European Framework of Reference for Languages: Learning, Teaching, Assessment (CEFR). Council of Europe.

Daller, M. H., Treffers-Daller, J., & Furman, R. (2011). Transfer of conceptualization patterns in bilinguals: The construal of motion events in Turkish and German. *Bilingualism: Language and Cognition, 14*(1), 95-119.

Filipović, L. (2011). Speaking and remembering in one or two languages: bilingual vs. monolingual lexicalization and memory for motion events. *International Journal of Bilingualism, 15*(4), 466-485.

Flecken, M., Athanasopoulos, P., Kuipers, J. R., & Thierry, G. (2015). On the road to somewhere: Brain potentials reflect language effects on motion event perception. *Cognition, 141*, 41-51.

Flecken, M., Carroll, M., Weimar, K., & Von Stutterheim, C. (2015). Driving along the Road or Heading for the Village? Conceptual Differences Underlying Motion Event Encoding in French, German, and French-German L2 Users. *Modern Language Journal, 99*(S1), 45-78.

Gennari, S. P., Sloman, S. A., Malt, B. C., & Fitch, W. T. (2002). Motion events in language and cognition. *Cognition, 83*(1), 49-79.

Hendriks, H., & Hickmann, M. (2011). Space in second language acquisition. In V. Cook & B. Bassetti (Eds.), *Language and Bilingual Cognition* (pp. 315-339). Hove, UK: Psychology Press.

Hendriks, H., & Hickmann, M. (2015). Finding One's Path Into Another Language: On the Expression of Boundary Crossing by English Learners of French. *Modern Language Journal, 99*(S1), 14-31.

Hendriks, H., Hickmann, M., & Demagny, A. C. (2008). How English native speakers learn to express caused motion in English and French. *Acquisition et Interaction en Langue Étrangère, 27*, 15-41.

Hickmann, M., & Hendriks, H. (2006). Static and dynamic location in French and in English. *First Language, 26*(1), 103-135.

Hickmann, M., & Hendriks, H. (2010). Typological constraints on the acquisition of spatial language in French and English. *Cognitive Linguistics, 21*(2), 189-215.

Hohenstein, J., Eisenberg, A., & Naigles, L. (2006). Is He Floating across or Crossing Afloat? Cross-Influence of L1 and L2 in Spanish-English Bilingual Adults. *Bilingualism: Language and Cognition, 9* (3), 249-261.

Jarvis, S. (2011). Conceptual transfer: Crosslinguistic effects in categorization and construal. *Bilingualism: Language and Cognition, 14*(1), 1-8.

Jarvis, S., & Pavlenko, A. (2008). *Crosslinguistic influence in language and cognition*. New York/London: Routledge.

Ji, Y. (2017). Motion Event Similarity Judgments in One or Two Languages: An Exploration of Monolingual Speakers of English and Chinese vs. L2 Learners of English. *Frontiers in Psychology, 8*.

Ji, Y., Hendriks, H., & Hickmann, M. (2011a). Children's expression of voluntary motion events in English and Chinese. *Journal of Foreign Languages, 34*(4), 2-20.

Ji, Y., Hendriks, H., & Hickmann, M. (2011b). The expression of caused motion events in Chinese and in English: Some typological issues. *Linguistics, 49*(5), 1041-1077.

Ji, Y., Hendriks, H., & Hickmann, M. (2011c). How children express caused motion events in Chinese and English: Universal and language-specific influences. *Lingua, 121*(12), 1796-1819.

Ji, Y., & Hohenstein, J. (2014). The syntactic packaging of caused motion components in a second language: English learners of Chinese. *Lingua, 140*, 100-116.

Ji, Y., & Hohenstein, J. (2018). English and Chinese children's motion event similarity judgments. *Cognitive Linguistics, 29*(1), 45-76.

Kersten, A. W., Meissner, C. A., Lechuga, J., Schwartz, B. L., Albrechtsen, J. S., & Iglesias, A. (2010). English Speakers Attend More Strongly than Spanish Speakers to Manner of Motion when Classifying Novel Objects and Events. *Journal of Experimental Psychology: General, 139*(4), 638-653.

Lai, V. T., Rodriguez, G. G., & Narasimhan, B. (2014). Thinking-for-Speaking in Early and Late Bilinguals. *Bilingualism: Language and Cognition, 17*(1), 139-152.

Lamarre, C. (2007). The linguistic encoding of motion events in Chinese: With reference to cross-dialectal variation. *Typological studies of the linguistic expression of motion events, 1*, 3-33.

"Li, P., Zhang, F., Tsai, E., Puls, B. (2014). Language history questionnaire (LHQ 2.0): A new dynamic web-based research tool. *Bilingualism: Language and Cognition, 17*(3), 673-680.

Loucks, J., & Pederson, E. (2011). Linguistic and non-linguistic categorization of complex motion events. In J. Bohnemeyer & E. Pederson (Eds.), *Event representation in language and cognition* (pp. 108-133). Cambridge: Cambridge University Press.

Lupyan, G. (2012). Linguistically modulated perception and cognition: The label-feedback hypothesis. *Frontiers in Psychology, 3*, 54.

Matthews, S. (2006). On serial verb constructions in Cantonese. In Y. Alexandra, Aikhenvald, & R. M. W. Dixon (Eds.), *Serial Verb Constructions. A Cross-Linguistic Typology* (pp. 69-87). Oxford & New York: Oxford University Press.

Matthews, S., & Yip, V. (2011). *Cantonese: A comprehensive grammar*. London: Routledge.

Montero-Melis, G., & Bylund, E. (2017). Getting the ball rolling: the cross-linguistic conceptualization of caused motion. *Language And Cognition, 9*(3), 446-472.

Montero-Melis, G., Jaeger, T. F., & Bylund, E. (2016). Thinking Is Modulated by Recent Linguistic Experience: Second Language Priming Affects Perceived Event Similarity. *Language Learning, 66*(3), 636-665.

Papafragou, A., Hulbert, J., & Trueswell, J. (2008). Does Language Guide Event Perception? Evidence from Eye Movements. *Cognition, 108*(1), 155-184.

Papafragou, A., Massey, C., & Gleitman, L. (2002). Shake, rattle, 'n' roll: The representation of motion in language and cognition. *Cognition, 84*(2), 189-219.

Papafragou, A., & Selimis, S. (2010). Event categorisation and language: A cross-linguistic study of motion. *Language and Cognitive Processes, 25*(2), 224-260.

Park, H. I. (2019). How do Korean–English bilinguals speak and think about motion events? Evidence from verbal and non-verbal tasks. *Bilingualism: Langauge and Cognition*. Advance online publication. doi:https://doi.org/10.1017/S1366728918001074.

Park, H. I., & Ziegler, N. (2014). Cognitive shift in the bilingual mind: Spatial concepts in Korean–English bilinguals. *Bilingualism: Language and Cognition, 17*(2), 410-430.

Pavlenko, A. (2011). Thinking and Speaking in Two Languages: Overview of the field. In A. Pavlenko (Ed.), *Thinking and speaking in two languages* (pp. 237-257). Bristol: Multilingual Matters.

Pavlenko, A., & Malt, B. C. (2011). Kitchen Russian: Cross-Linguistic Differences and First-Language Object Naming by Russian-English Bilinguals. *Bilingualism: Language and Cognition, 14*(1), 19-45.

Peyraube, A. (2006). Motion events in Chinese: Diachronic study of directional complements. In M. Hickmann & S. Robert (Eds.), *Space in languages: LIinguistic systems and cognitive categories* (pp. 121-135). Philadelphia: Benjamins.

R Development Core Team. (2018). R: A language and environment for statisticalcomputing. Vienna, Austria: R Foundation for Statistical Computing.

Sachs, O., & Coley, J. (2006). Envy and Jealousy in Russian and English: Labeling and Conceptualization of Emotions by Monolinguals and Bilinguals: Emotional Experience, Expression, and Representation. In A. Pavlenko (Ed.), *Bilingual minds : emotional experience, expression, and representation* (pp. 209-231). Clevedon: Multilingual Matters.

Slobin, D. I. (1996a). From"thought and language" to "thinking for speaking". In J. Gumperz & S. Levinson (Eds.), *Rethinking linguistic relativity* (pp. 70-96). Cambridge: Cambridge University Press.

Slobin, D. I. (1996b). Two ways to travel: Verbs of motion in English and Spanish. In M. Shibatani & S. A. Thompson (Eds.), *Grammatical constructions: Their form and meaning* (pp. 195-220). Oxford: Clarendon Press.

Slobin, D. I. (2004). The Many Ways to Search for a Frog: Linguistic Typology and the Expression of Motion Events. In S. Strömqvist & L. Verhoeven (Eds.), *Relating events in narrative, Vol. 2. Typological and contextual perspectives* (pp. 219-257). Mahwah, NJ: Erlbaum.

Soroli, E. (2012). Variation in spatial language and cognition: exploring visuo-spatial thinking and speaking cross-linguistically. *Cognitive Processing, 13*(1), 333-337.

Soroli, E., & Hickmann, M. (2010). Language and spatial representations in French and in English: evidence from eye-movements. In G. Marotta, A. Lenci, L. Meini, & F. Rovai (Eds.), *Space in language* (pp. 581-597). Pisa, Italy: Editrice Testi Scientifici.

Soroli, E., Hickmann, M., & Hendriks, H. (2019). Casting an eye on motion events: Eye tracking and its implications for linguistic typology. In M. Aurnague & Stosić (Eds.), *The semantics of dynamic space in French: Descriptive, experimental and formal studies on motion expression* (pp. 297-353). Amsterdam: John Benjamins.

Stocker, L., & Berthele, R. (2019). The roles of Language mode and dominance in French–German bilinguals' motion event descriptions. *Bilingualism: Language and Cognition* 1-13. Advance online publication. doi:10.1017/S1366728919000294.

Talmy, L. (2000). *Toward a cognitive semantics*. Cambridge: MIT Press.

Talmy, L. (2009). Main Verb Properties and Equipollent Framing. In J. Guo, E. Lieven, & N. Budwig (Eds.), *Crosslinguistic Approaches to the Psychology of Language: Research in the Tradition of Dan Isaac Slobin* (pp. 389-402). New York: Psychology Press.

Treffers-Daller, J., & Calude, A. (2015). The role of statistical learning in the acquisition of motion event construal in a second language. *International Journal of Bilingual Education and Bilingualism, 18*(5), 602-623.

Trueswell, J. C., & Papafragou, A. (2010). Perceiving and Remembering Event Cross-Linguistically: Evidence from Dual-Task Paradigms. *Journal of Memory and Language, 63*(1), 64-82.

Whorf, B. L. (1956). *Language, thought, and reality.* Cambridge, MA: MIT Press.

Wolff, P., & Holmes, K. J. (2011). Linguistic relativity. *Wiley Interdisciplinary Reviews: Cognitive Science, 2*(3), 253-265.

Xu, D. (2006). *Typological change in Chinese syntax*. Oxford: Oxford University Press.

Yiu, C. (2013). Directional Verbs in Cantonese: A Typological and Historical Study. *Language and Linguistics, 14*(3), 511-569.

Yiu, C. (2014). Directional verbs in modern Cantonese: A typological perspective In C. Yiu (Ed.), *The Typology of Motion Events : An Empirical Study of Chinese Dialects* (pp. 33-135). Berlin/Boston: De Gruyter Mouton.

Zlatev, J., & Yangklang, P. (2004). A third way to travel: The place of Thai in motion event typology. In S. Strömqvist & L. Verhoeven (Eds.), *Relating events in narrative* (pp. 159-190). Mahwah, NJ: Erlbaum.

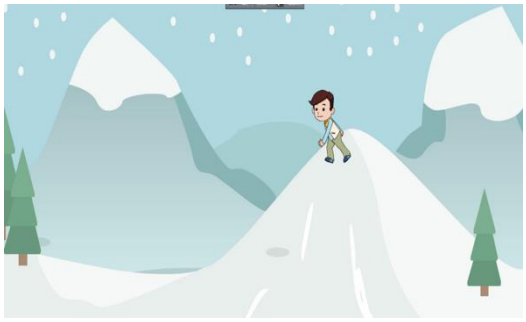
Appendix A

A full list of 36 test stimuli in linguistic encoding and similarity judgement

Item	Target	Manner-match alternate	Path-match alternate
1	Walk down a snow mountain	Walk up a snow mountain	Crawl down a snow mountain
2	Walk out of a room	Walk into a room	Jump out of a room
3	Cycle towards a river	Cycle away from a river	Skateboard towards a river
4	Run down the stairs	Run up the stairs	Hop down the stairs
5	Cycle out of a castle	Cycle into a castle	Roller-skate out of a castle
6	Jump away from a tree	Jump towards a tree	Crawl away from a tree
7	Swim across a river	Swim along a river	Surf across a river
8	Cycle up a slope	Cycle down a slope	Skateboard up a slope
9	March across a street	March along a street	Hop across a street
10	Crawl into a room	Crawl out of a room	Jump into a room
11	Walk towards a house	Walk away from a house	Hop towards a house
12	Cycle across a street	Cycle along a street	Roller-skate across a street

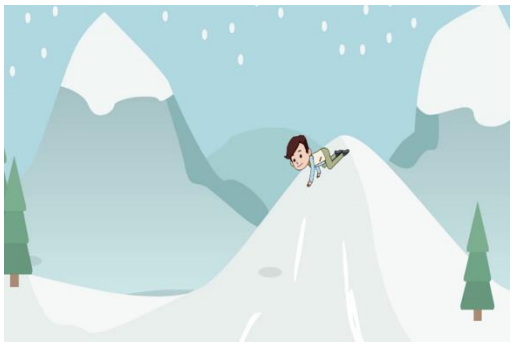
Appendix B

A demonstration of the video stimuli used in the similarity judgement task (Item 1).



Target event

Manner-match alternate



Path-match alternate