

# The partial productivity of schematic idioms in Chinese

## Evidence from speakers' judgment

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Idiomatic expressions are generally manifested as lexically fixed. Yet some expressions allow lexical variations in their open slots and thus show certain degree of productivity in actual use. How young children acquire the productive use of idiomatic expressions, however, has rarely been addressed in current literature. The present study explores the developmental trajectory in learning idiom productivity by targeting the quadra-syllabic schematic idioms in Chinese. Results of two Graded Acceptability Judgment tests showed that acquisition of the selective productivity of schematic idioms may undergo an interactive process shaped by its token frequency, structural complexity, inherent semantic relation and the chunk effect of its open morphemes at different age levels. Findings in the studies are further discussed in relation to the emergentist model in idiom learning.

**Keywords:** schematic idioms, partial productivity, emergentist

### 1. Introduction

Traditionally idiomatic expressions have been held as fixed long words with stipulated meaning which cannot be compositionally derived from their individual components. They are often listed in an 'Appendix to the Grammar'. This view entails that idioms have to be individually learned in the same manner as lexicons (Katz & Postal 1963; Pinker 1994). But the existence of semi-fixed idioms poses challenges to this idiom-as-lexicon viewpoint. Not all idiomatic expressions are fixed. Expressions such as *the X-er, the Y-er; No X, no Y*, are not fully lexicalized and have open slots for variants in actual use. They are referred to as schematic or formal idioms (Fillmore et al. 1988; Moon 1998; Taylor 2002; Croft & Cruse 2004). These schematic idioms are idiosyncratic in the sense that their structure and meaning cannot be generated on the basis of general grammatical rules. However,

they are also not totally fixed expressions that need to be stored as lexical items. To simply list them as part of an 'Appendix to the Grammar' is not proper as they may contain "information about fully productive grammatical patterns" (Fillmore et al. 1988: 504).

Such schematic expressions are also abundant in Chinese idiom formation and are widely used in discourse (Ching 1964; Shi 1979; Zhang 2002; Ji 2007), as in the pattern of *bu-A-bu-B* (不-A-不-B not-A-not-B), *qian-A-wan-B* (千-A-萬-B hundred-A-thousand-B), *A-yan-B-yu* (A-言-B-語 A-words-B-utterances), etc. Such patterns can generate different numbers of idiom variants with various selections of A, B morphemes in the open slots, as shown in the following examples in (1).

- (1) a. *bu-A-bu-B* (不-A-不-B not-A-not-B):  
*bu-da-bu-xiao* (不大不小 not-big-not-small)  
*bu-nan-bu-nv* (不男不女 not-male-not-female)
- b. *qian-A-wan-B* (千-A-萬-B hundred-A-thousand-B):  
*qian-xin-wan-ku* (千辛萬苦 hundred-difficulty-thousand-hardship)  
*qian-qiu-wan-dai* (千秋萬代 hundred-years-thousand-decades)
- c. *A-yan-B-yu* (A-言-B-語 (A-words-B-utterances):  
*hua-yan-qiao-yu* (花言巧語 flowery-words-artful-utterances)  
*tian-yan-mi-yu* (甜言蜜語 sweet-words-honey-utterances)

Nevertheless, the productivity of these schematic patterns is not unlimited since possible A, B morphemes that fill in the open slots must conform to certain constraints operating simultaneously at syntactic, semantic, and even conventional levels. Proper understanding and use of these variants is an integral part of native linguistic competence. Mature speakers tend to have the abstract knowledge of the legitimate morphemes that can enter the open slots and they are capable of figuring out the ultimate interpretation of an expression despite variations of the filled morphemes. This raises interesting learnability issues in language acquisition that have not been properly addressed: how and when do children develop the same competence in the acquisition of such schematic idioms? What factors may affect the learning on the productivity of schematic patterns for young learners?

### 1.1 Chinese schematic idioms

Chinese idioms are mostly quadra-syllabic expressions with fixed lexical constituents. However, there also exists a large number of semi-fixed expressions with open slots, which can be used in generating novel instances, as listed in the examples of (1) above. Such expressions are called semi-fixed phrases by Zhang (2002), and schematic or formal idioms by Fillmore et al. (1988).

Chinese schematic idioms can be viewed as constructional idioms, as the selection of the open morphemes is not arbitrary. Chen (2001) proposed a constructional explanation of the semi-fixed idiomatic expressions *A-lai-A-qu* (A-來-A-去 A-come-A-go) and *A-lai-B-qu* (A-來-B-去 A-come-B-go). The *A-lai-A-qu* /*A-lai-B-qu* expressions, such as *kan-lai-kan-qu* (看來看去 look-come-look-go: look around), *chi-lai-chi-qu* (吃來吃去 eat-come-eat-go: eat again and again), *hu-lai-huan-qu* (呼來喚去 call-come-summon-go: be called again and again), semantically imply a repetition of action specified in the verb A or A/B. This is not predictable from the combination of the constituents alone, as they combine to encode a one-time action specified in A or A/B. Lexical items filling the open slots of *A-lai-A-qu* /*A-lai-B-qu* are mostly activity or achievement verbs denoting repeatable and durable actions, such as *fei* (飛 fly), *zou* (走 walk), which is determined by the aspectual feature of the whole pattern. Thus we can say *bian-lai-bian-qu* (變來變去 change-come-change-go: change again and again), but \**si-lai-si-qu* (\*死來死去 die-come-die-go: die again and again) is not acceptable, as the aspectuality of the verb *si* (死 die) does not conform to that of the whole construction.

Chen (2001) concluded that *A-lai-A-qu* /*A-lai-B-qu* should be viewed as a constructional idiom, instead of a random combination of four characters to account for their unique features and productivity. Gan (2008) and Ji (2007) proposed similar views in understanding the partially productive behavior of schematic patterns such as *bu-A-bu-B* (不-A-不-B not-A-not-B), *gai-A-huan-B* (改-A-換-B change-A-alter-B), and *you-A-wu-B* (有-A-無-B have-A-lack-B).

Meanwhile, studies on English constructions such as the time-away utterances, the Comparative Correlative construction, or the *A-er*, the *B-er* construction, have all demonstrated that these traditionally thought irregular expressions can actually be quite productive and rule-based within the framework of their own constructions (Fillmore et al. 1988; Jackendoff 1997; Culicover & Jackendoff 1999). They are actually patterns that can be identified and defined with generalizations or schemata.

The constructional claim for these schematic expressions is, nevertheless, mainly based on distributional analysis. Whether this claim is also psychologically real in the language learning process has rarely been empirically tested. Do speakers recognize the similarities among different expressions and form abstract schemata based on the systematic behaviors in these expressions? If so, when does this occur in the course of language development? And what factors may contribute to this process of abstraction? One major purpose of the present study is to provide empirical evidence for the constructional claim for schematic idioms in the course of language acquisition.

## 1.2 Learning of constructional idioms – Usage-based account

According to the constructionists, learning of constructions at various levels is inherently usage-based (Barlow & Kemmer 2000; Langacker 2000; Bowerman & Croft 2008; Goldberg 2006, 2013). The mental grammar of a native speaker is hypothesized to consist of “a network of schematic and substantive constructions” (Hoffmann & Trousdale 2013). Acquiring a language is to master various linguistic symbols and constructional schemata (Tomasello 2000). Frequency is regarded as playing a primary role in forming representations of linguistic units (Ellis 2002; Goldberg 2005; Bybee 2006). Other factors that reportedly contribute to construction learning include complexity, consistency (or contingency), and age.

Studies have shown that learners are somehow highly sensitive to the statistical distributions from the very early stage of language development. The more frequently children hear or say a linguistic unit, the earlier they learn it. This is because the frequency or repetition of constructions will result in entrenchment, the strengthened representation in mental grammar. And more entrenched constructions are more readily processed and retrieved during comprehension and production (Bybee & Hopper 2001; Goldberg & Casenhiser 2008; Lieven & Tomasello 2008; Ambridge et al. 2015).

Construction complexity is another factor that interacts with frequency during the course of learning. Diessel & Tomasello’s study (2005) on relative clauses reported that though the frequency of S/A-relatives (relatives with a subject gap) is equal to or even lower than P-relatives (relatives with a direct object gap) in children-directed speech, S/A relatives showed fewer errors than P-relatives in children’s repeating performance. This is because S/A relatives are syntactically less complex due to their similarity to simple non-embedded sentences. Lieven & Tomasello (2008) pointed out that constructions with no analyzable parts are less complex than schematic constructions with an open slot, which are in turn less complex than those with more than one slot.

The usage-based approach also allows for an ontogenetically developmental account of language acquisition. It proposes that children start learning item-based, concrete constructions and gradually abstract grammar and create inheritance hierarchies of constructions with general cognitive mechanisms (Tomasello 2000). Children can constantly modify their grammar with exposure to more linguistic items. Take the learning of English transitive constructions as an illustration. Before age 3, only a few can produce canonical transitive utterances with verbs they have never heard used in that way. From 3 or older, there is evidence that children possess an abstract transitive construction, as they can freely assimilate novel verbs in the construction (Tomasello & Brooks 1998). By age 8, they generally approximate adult competence in the case of the transitive construction. Moreover, studies

reported that children's learning of idiomatic expressions is also a gradual and long-lasting process that starts at 7 or 9 years old and goes on through adolescence even well into adulthood (Cacciari & Levorato 1989; Nippold & Martin 1989; Laval 2003; Liu & Cheung 2014).

From this usage-based perspective, the next section will first provide detailed distributional analyses of three typical idiomatic schemata in Chinese: XAXB, XAYB and AXBY schemata (in which X and Y stand for the fixed morphemes while A and B are the lexical selections). Low-level regularities will be revealed regarding their partial productivity in creating new variants. The actual distributional statistics of idiom variants in each schema as reflected in a large Chinese corpus will then be examined. Finally the variables that might affect the learning of idiom productivity will be identified.

## 2. Distributional analysis of schematic patterns in Chinese – XAXB, XAYB and AXBY constructions

### 2.1 XAXB construction

The XAXB pattern is a highly productive schema in Chinese idioms. The two X morphemes are identical and fixed; the A and B morphemes are lexical variables in the open slots. It is inherited by over 40 schematic types with the different selection of X morphemes, such as *zi-A-zi-B* (自-A-自-B self-A-self-b), *yu-A-yu-B* (愈-A-愈-B more-A-more-B). Each is a specific schematic type and can in turn be inherited by various numbers of concrete instantiations via different selections of A, B morphemes in the open slots. XAXB expressions may entail two types of internal semantic relations between the fore part – XA and the hind part – XB: a simple coordinate relation, or a complex subordinate relation (usually a conditional one). The majority of idioms of XAXB schema express a coordinate relation and only several types entail a subordinate relation, as in *lv-A-lv-B* (屢-A-屢-B repeatedly-A-repeatedly-B) and *bai-A-bai-B* (百-A-百-B hundred-A-hundred-B).

The open morphemes of A and B have a complex set of structural and semantic properties. The structural features of A and B are subject to the semantic relations embedded in the expressions. First, in the majority coordinate type of expressions, A and B must belong to the same grammatical category (mainly nouns, verbs and adjectives) and they must be semantically related as in the same semantic field, having similar or opposite meanings, as with *pang-shou* (胖瘦 fat-thin) in *bu-pang-bu-shou* (不胖不瘦 not-fat-not-thin), *gao-da* (高大 tall-big) in *you-gao-you-da* (又高又大 very-tall-very-big) and *mǎi-mài* (買賣 buy-sell) in *yi-mǎi-yi-mài* (一買一賣 one-buy-one-sell). The combination of the selected A-B morphemes may stand as

a fixed lexical word or chunk such as *xin-yi* (心意 wishes) in *quan-xin-quan-yi* (全心全意 whole-heartedly), *yuan-gu* (緣故 reason) in *wu-yuan-wu-gu* (無緣無故 no-reason-at-all); or they are independent morphemes that are not used together as a lexical unit, as with *jia-hu* (家-戶 house-family) in *yi-jia-yi-hu* (一家一戶 every-household), *zhang-chi* (張-馳 tension-relaxation) in *you-zhang-you-chi* (有張有弛 alternate-work-and-rest).

Second, in the subordinate type, the A and B morphemes form a *Verb-Result* sequence, in which A is a verb describing an act or a condition, while B indicates the result of that act or condition, often in the form of an adjective or a verb. A-B combinations may form a lexical unit of the Predicate-Complement type, such as *da-dao* (打倒 overthrow) in *bu-da-bu-dao* (不打不倒 no-fight-no-overthrowing), *zhan-bai* (戰敗 defeat) in *lv-zhan-lv-bai* (屢戰屢敗 lose-in-every-fight); or can be non-lexical units, such as *fa-zhong* (發-中 shoot-targeted) in *bai-fa-bai-zhong* (百發百中 hit-at-every-shot), *po-li* (破-立 break-establish) in *da-po-da-li* (大破大立 (big-breakthrough)).

According to these properties, phrases like *bu-lao-bu-zao* (不老不早 not-old-not-early) sound odd since *lao* (老 old) and *zao* (早 early) do not belong to the same semantic field; phrases like *bai-fa-bai-qiang* (百發百槍 hundred-shoot-hundred-gun) would be unacceptable, since *fa* (發 shooting) and *qiang* (槍 gun) do not form a Verb-Result sequence. More importantly, an instance of XAXB must make sense with the inserted A and B morphemes. That is to say, the meaning of A, B components must stand in agreement with the meaning of the specific construction where they reside. For example, *chui-lei* (吹-擂 horns-blowing-drums-beating) denote the high pitch and great fanfare of drum and horn playing (which metaphorically refers to bragging and boasting). So it naturally co-occurs with *da-A-da-B* (大-A-大-B big-A-big-B) and is semantically incompatible with *xiao-A-xiao-B* (小-A-小-B small-A-small-B) schema, which designates a modest degree of A, B quality.

Some of the combinations of A-B selections make up a lexical compound in modern Chinese, such as *yan-yu* (言語 words) in *bu-yan-bu-yu* (不言不語 not-speak-not-talk), *si-hao* (絲毫 slightest) in *yi-si-yi-hao* (一絲一毫 a shred of), and *bo-lan* (波瀾 waves) in *da-bo-da-lan* (大波大瀾 big-waves). Canonically the constituents of these lexical compounds never occur on their own. The non-canonical separation in these patterns is actually conventional and not every lexical compound can be separated and inserted as open morphemes. For instance, to say *bu-yan-bu-lun* (不言不論 no-speech-no-opinion) would be very odd as the separation of *yan-lun* (言論 comments) is barely allowed here.

In addition, the use of numbers in A, B slots is template-specific. It is only acceptable to say *yi-wu-yi-shi* (一五-一十 one-five-one-ten: in full detail) or *bu-san-bu-si* (不三-不四 not-three-not-four: neither this nor that). And the order of A and B

is usually conventional and unchangeable even if they are free words of similar meanings. For example, the use of *wu-fu-wu-mu* (無父無母 no-father-no-mother) is much more frequent than *wu-mu-wu-fu* (無母無父 no-mother-no-father).

In sum, candidates of open morphemes in an XAXB schematic type have to satisfy these structural and semantic conventions. That is, the productivity of the XAXB schema is highly selective. The constraints are not straightforward and clear-cut, but an intricate interaction of requirements simultaneously operating at structural, semantic, and conventional levels.

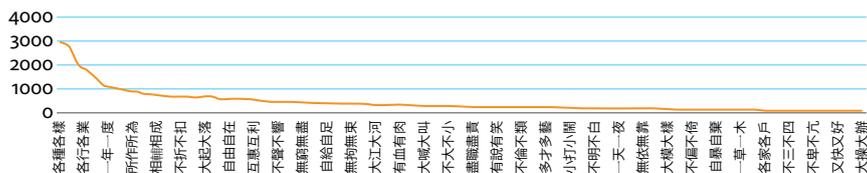


Figure 1. The top 100 frequent tokens in XAXB schema

Mental grammar does not only represent the linguistic distribution information of a construction, but also its usage statistics. The actual use of XAXB expressions was checked in a large Chinese corpus CCL<sup>1</sup>. Figure 1 shows the natural distribution of the top 100 frequent tokens in XAXB construction.

As Figure 1 shows, the distribution of the top frequent exemplars is skewed, i.e. a few exemplars with top frequency actually take the lion's share of the total occurrences. For example, *ge-zhong-ge-yang* (各種各樣 all-kinds-of) stands as the first in frequency ranking and is recorded with 2,925 tokens. *Bu-da-bu-xiao* (不大不小 not-big-not-small) ranks as 50 in frequency but its token records drop to 334. In the top 100 frequent XAXB tokens, the coordinate type predominates, as 97 expressions belong to this type. Only 3 items are subordinate expressions. It seems that the paratactic structure in XAXB expressions makes it more appropriate for expressing coordinate relations. When a subordinate meaning is entailed, there seems to be a mismatch between syntax-semantics: paratactic structure with conditional or resultative semantics (Culicover & Jackendoff 1999). This might partly explain why the number of subordinate instances is disproportionately lower in the top XAXB expressions.

Among the 97 coordinate expressions, 61 are those in which the A, B morphemes combine as lexical chunks, such as *hang-ye* (行業 walks-of-life) in *ge-hang-ge-ye* (各行各業 all-walks-of-life). Moreover, in the top 10 most frequent

1. CCL, an on-line Chinese corpus developed by the Center for Chinese Linguistics at Peking University. (<http://ccl.pku.edu.cn/corpus.asp>)

XAXB expressions, 8 are found with A-B lexical chunks. Generally, these A-B lexical chunks do not allow separation in canonical use of modern Chinese. This indicates that the irregular separation of A-B chunks in schematic idioms is often maintained by their high token frequency, which echoes the suggestion that high token frequency is strongly associated with irregularities in a language (Bybee & Hopper 2001). On the other hand, current studies on Chinese word processing have reported that compound words or lexical bundles are activated more quickly and are easier to access than non-lexical units (Liu & Peng 1997; Myers 2006). It is therefore expected that the lexical chunk effect of the A-B combination may facilitate the decoding of XAXB expressions.

## 2.2 XAYB construction

In the XAYB schema, the fixed X and Y morphemes serve as operators; A, B are variants with lexical meanings in the open slots. This schema is also quite productive as more than 40 schematic types can be listed, among which 10 types belong to subordinate ones. The coordinate type predominates in the XAYB schema.

In the coordinate type, XA and YB usually share the identical internal structures, such as adjective-nouns (*da-jie-xiao-xiang* 大街小巷 big-streets-small-lanes), modifier-modified (*ming-cha-an-fang* 明察暗访 publicly-observe-secretly-investigate), verb-nouns (*gai-tou-huan-mian* 改頭換面 change-head-remake-face) or subject-predicate (*nan-zun-nv-bei* 男尊女卑 man-superior-women-inferior). In the subordinate type, various complex relations between XA and YB are witnessed: adversative, as in *bu-qing-zi-lai* (不請自來 come-without-being-invited), concessive, as in *bai-zhe-bu-hui* (百折不回 hundred-setbacks-not-retreat), etc. The varied X and Y in the XAYB pattern actually increase its potential in expressing subordinate relations.

The open morphemes in XAYB schema have the following structural and semantic properties. In the coordinate type, the A, B morphemes should belong to identical grammatical categories and possess either similar or opposite meanings. The combinations of A-B may form lexical chunks, as with *luo-wang* (羅網 net-trap) in *tian-luo-di-wang* (天羅地網 sky-net-earth-trap) or stand as independent free morphemes which do not form a lexical chunk, as with *jia* (家 house) and *hu* (戶 family) in *qian-jia-wan-hu* (千家萬戶 hundred-house-thousand-family). In the subordinate type, the fixed X and Y are usually functional words expressing various relations, and the selection of the A, B morphemes depends on the specific functions of X and Y. The whole pattern tends to be a condensed form of a complex sentence. For example, *bai-A-bu-B* (百-A-不-B hundred-A-not-B) can be extended as a concession clause: *in spite of A happening a hundred times, B still does not*

occur. A-B combinations in this pattern are required to form a *Condition-Result* sequence. Thus *bai-kan-bu-yan* (百看不厭 hundred-see-not-bored) means *in spite of seeing it a hundred times, the person does not show any boredom*. For another example, *wu-A-bu-B* (無-A-不-B no-A-not-B) expresses an all-inclusive relation: *There is no A that is not B-ed; to B every A*. Accordingly *wu-e-bu-zuo* (無惡不作 no-crime-not-do) means *to commit all kinds of crimes*. A-B combinations in this pattern make up a reversed *Verb-Object* sequence.

In addition, the selection of A, B morphemes may also be conventional as well. The order of XA and YB is usually not changeable even when they express similar meanings. For example, though *wan-huan-qian-hu* (萬喚千呼 urge-a-thousand-times) is not absolutely unacceptable, it is extremely rare compared to *qian-hu-wan-huan* (千呼萬喚 hundred-calls-thousand-urges). And the use of numerals is also highly culture-bound. It is only acceptable to say *tiao-san-jian-si* (挑三揀四 pick-three-select-four: choosy), and *shuo-san-dao-si* (說三道四 talk-three-and-four: gossip). The numerals in these instances are not replaceable.

In sum, the selection of the A, B constituents in the open slots of XAYB schema is not arbitrary at all, but is determined by the specific structural, semantic, and conventional requirements of the schematic type that they reside in.

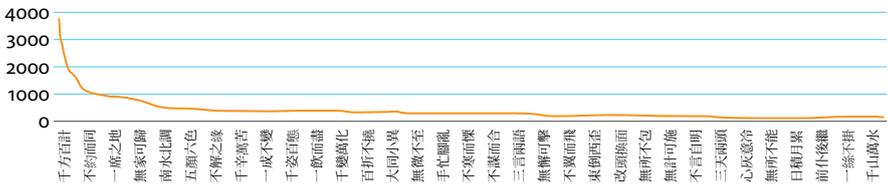


Figure 2. The top 100 frequent tokens in XAYB schema

A check on the statistical distribution of the top 100 frequent XAYB instances in CCL is demonstrated in Figure 2, which also appears as skewed. Among the top 100 tokens, there are 50 coordinate expressions, and also 50 subordinate ones. Nevertheless, the total token of coordinate expressions is slightly higher than the subordinate ones (22,356 : 21,807). Among the 50 coordinate instances, 30 are found with chunk A-B selection in the open slots, as in *ri-ji-yue-lei* (日積月累 days-months-accumulating). It is also believed the chunk effect of A-B selections can facilitate the decoding process of XAYB expressions.

### 2.3 AXBY construction

In the AXBY schema, the positions of the fixed morphemes and variables are reversed as compared to the XAYB schema. Over 30 schematic types can be named in the AXBY schema, with various fixed morphemes of X and Y. Most X, Y morphemes are nominal ones, serving as heads in the AX and BY subparts. Virtually every instances of AXBY belong to the coordinate type except one: *A-er-B-zhi* (A-而-B-之 A-in-order-to-B), which encodes a subordinate relation. In *A-er-B-zhi*, the fixed *er* (而) is a functional word with no content meaning; *zhi* (之) is a third person pronoun in classical Chinese. The inserted A, B usually form a *Predicate-Complement* type and the whole pattern delivers an act-purpose relation. For example, in *fen-er-zhi-zhi* (分而治之 divide-to-rule-it), the purpose of *fen* (分 to divide) is to *zhi* (治 to rule). The expression means *to rule by the means of dividing it*.

In the coordinate AXBY expressions, open morphemes also share a number of structural and semantic properties. First, the A and B morphemes must be from the identical grammatical categories and appear as either synonyms or antonyms in semantics. In addition, they have to be grammatically agreeable with the fixed X and Y, which is usually the head word in the AX and BY subparts. For instance, in *A-yan-B-yu* (A-言-B-語 A-words-B-utterances), X and Y are the nominal heads, which requires A, B selections in the open slots must be modifiers for nouns, as in *tian-yan-mi-yu* (甜言蜜語 honey-and-sweet-words), *hao-yan-zhuang-yu* (豪言壯語 brave-and-lofty-words), etc.

Again the selection of some open morphemes may be conventional. The order of some coordinate AXBY expressions can be reversed as BYAX, but it is not as frequent as the original one. For example, *qian-jun-wan-ma* (千軍萬馬 hundred-soldiers-thousand-horses) is the more frequent form than *wan-ma-qian-jun* (萬馬千軍 thousand-horses-hundred-soldiers). The use of numerals is conventional as well. As in *san-chang-liang-duan* (三長兩短 three-long-two-short: unexpected misfortune) and *qi-shou-ba-jiao* (七手八腳 seven-hands-eight-feet: in a bustle), numerals are not substitutable.

Therefore, in both subordinate and coordinate AXBY expressions, the selections of the open morphemes are far from arbitrary, but the results of an interactive process of the structural, semantic, and conventional requirements of a specific template.

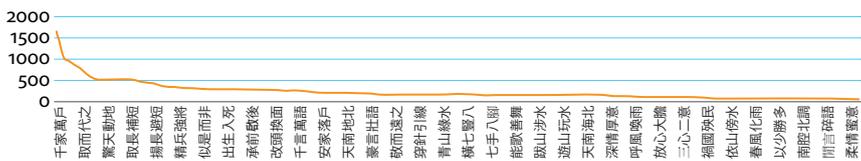


Figure 3. The top 100 frequent tokens in AXBY schema

The distribution of the 100 most frequent AXBY tokens as recorded in the CCL was shown in Figure 3, which also tends to be skewed. Among the top 100 frequent instances, only 10 are subordinate expressions. For the majority of coordinate expressions, 46 have chunk selections in the open slots. Considering that there is virtually only one subordinate type identified here in the AXBY schema, the coordinate relation predominates in both token and type frequency.

The major findings in the above distribution analysis of the three schematic patterns can be summarized as such. First, the XAXB construction is structurally simpler than the non-XAXB ones, i.e. XAYB and AXBY constructions, due to its identical fixed morphemes. It seems that the initial experience with simple schemata may support and pave the way for learning of more complicated ones. Second, coordinate instances predominate in each schematic construction, especially with the XAXB and AXBY constructions. Therefore, we suggest the coordinate interpretation tends to be the core sense of the three schemata. Third, there is a strong consistency between high token frequency and the chunk A-B selection in the open slots of schematic patterns, especially with the XAXB pattern. It is expected the A-B chunk effect in schematic idioms may facilitate the processing and decoding of the overall expression.

### 3. Current study

The productivity of schematic idioms is highly selective and constrained. Apparently learners cannot memorize each instance by rote. How speakers, especially young children, build up the exact generalization that produces only grammatical expressions, no more and no less, poses a particularly interesting issue here. The present study aims to look at the learning of the partial productivity of schematic idioms as reflected in XAXB, XAYB, and AXBY constructions for L1 speakers at various age levels.

Based on the major findings reported above, four factors are identified as potentially significant for the learning process: token frequency, structural complexity, inherent internal semantic relation and chunk effect of open morphemes. The following hypotheses are raised accordingly.

Hypothesis 1: Productivity of the XAXB construction will be learned earlier and better than the non-XAXB constructions for speakers of different age groups.

Hypothesis 2: Productivity of coordinate expressions will be better learned than subordinate ones in both the XAXB and non-XAXB constructions across different age groups.

Hypothesis 3: Productivity of coordinate expressions with A-B chunk selections will be learned earlier and better than those with non-chunk selections in both the XAXB and non-XAXB constructions across different age groups.

Each hypothesis will be tested with expressions with high frequency (HF) and low frequency (LF). To observe the developmental path in learning idiom productivity, three age levels are selected in this research: 4th graders aged 9–10 years old, 2nd juniors aged 13–14 years old, and an adult group. Most studies on learning of idiomatic expressions focused on 9-year-olds (Gibbs 1987; Levorato & Cacciari 1992; Laval 2003; Cain et al. 2005; Hsieh & Hsu 2010) and the preadolescent period (Nippold & Duthie 2003). Therefore, targeting these two age levels makes the results of the present study easily comparable with current research.

A 4-point Likert-scale judgment task, ranging from *strongly acceptable* to *strongly unacceptable*, is used as the testing instrument in this study (Theakston 2004; Ambridge et al. 2006). Participants are required to indicate how much they find the given expression acceptable by ticking the responding item on the scale: 1. strongly unacceptable; 2. unacceptable; 3. acceptable; 4. strongly acceptable. As an aid for the younger participants, some small graphics are added in the rating scale. For example, two smiling faces signal that the expression is strongly acceptable; one smiling face stands for acceptable; one crying face means unacceptable; and a cross signals completely unacceptable (See Appendices A & B).

To test the three hypotheses, two experimental studies are conducted. Study One addresses Hypothesis 1 and 2; Hypothesis 3 is tested in Study Two. The following part gives detailed description on each study.

### 3.1 Study One

#### 3.1.1 Variables

Study One intends to test the roles of structural complexity and semantic relation during the learning of schematic idioms, with both the HF and LF idioms. Therefore Study One involves 4 independent variables: token frequency (high frequency vs. low frequency), structural complexity (XAXB schema vs. non-XAXB schema), inherent semantic relations (coordinate vs. subordinate) and age. So this is a 2 (frequency)  $\times$  2 (complexity)  $\times$  2 (semantic relations)  $\times$  3 (age) factorial design. Token frequency of an expression is determined by its record in the CCL corpus. Expressions whose token frequency is over 100 are defined as high frequency items. Low frequency items refer to the expressions whose frequency is below 100.

### 3.1.2 *Materials*

In the Acceptability Judgment Task, 40 acceptable instances are included as targets. 20 of these instances are coordinate expressions, including 10 items of HF and 10 items of LF; the other 20 items are subordinate expressions, also half frequent items and half less frequent ones. Within each frequency range, half of the items (5 items) are from the XAXB schema; half are from the non-XAXB schema.

Native speakers' intuition includes not only what combinations are acceptable in a schema, but also what are not acceptable. Another set of 40 novel schematic instances are thereby invented to match each subgroup of the acceptable items: 20 items in the XAXB schema, 20 in the non-XAXB schema. Novel expressions refer to those in which the lexical selections are not legitimate candidates in the open slots thus they never occur in natural settings. The A-B selections in the novel expressions differ from the acceptable A-B selections only in one morpheme and they tend to have similar meanings. For example, *wu-ju-wu-shu* (無拘無束 no-restrict-no-hindrance: at ease) is an acceptable expression. Its matched novel expression can be *\*wu-ju-wu-jin* (無拘無謹) in which *ju-jin* (拘謹 over-cautious), though semantically similar to *ju-shu* (拘束 restrained), is not legitimate selections in the schema of *wu-A-wu-B* (無-A-無-B no-A-no-B) and hence unacceptable. The rating scores on novel instances between the XAXB and non-XAXB schemata will be compared in the statistical analysis. So, altogether there are a total of 80 items in the task, with 40 non-novel (acceptable) items and 40 novel (unacceptable) expressions. See Appendix A for all the testing items.

### 3.1.3 *Participants*

There were 30 participants in each age group. The group of 9-year-olds (range 9; 2–9; 11) and 14-year-olds (range 13; 7–14; 8) were randomly selected out from a local primary school in Guangzhou. The adult group included 30 volunteers of college students from a university in Guangzhou, who were paid modestly for the participation. So there were a total of 90 participants in Study One.

### 3.1.4 *Procedure*

Participants were asked to tick the degree of acceptance of 80 expressions in the judgment task. Instructions were carefully read to them. There were five items for practice before the real test. For the younger groups, the task was split into two sessions, with 40 items in each session. In general, adults spent about 15 minutes on the test while it took about 20–25 minutes for the younger groups to finish the whole task.

### 3.1.5 Scoring

The acceptability point participants chose on the scale equals to the rating score they got. The maximum rating score for one expression is thus 4 and the minimum is 1. The higher the rating score, the more acceptable the expression tends to be as judged by the participants. The lower rating score signals that the expression is judged as less or not acceptable.

### 3.1.6 Results

Table 1 lists the average ratings of participants on non-novel expressions in terms of structural complexity and semantic relation. Half of the expressions are HF ones and the other half LF ones. The maximum score in each category is 20 points.

**Table 1.** Cross-group means (and standard deviation(s) (SDs)) of ratings on non-novel expressions in Study One

			9-year-olds	14-year-olds	Adults
HF	X-X	X-X-Co	13.53 (2.71)	17.93 (2.70)	19.43 (1.17)
		X-X-Sub	14.70 (2.38)	18.13 (2.78)	19.43 (1.10)
	non-X-X	non-X-X-Co	16.67 (2.77)	18.00 (2.60)	19.90 (0.31)
		non-X-X-Sub	15.63 (2.57)	18.87 (1.89)	19.43 (1.28)
LF	X-X	X-X-Co	11.93 (2.90)	14.83 (2.57)	14.97 (1.90)
		X-X-Sub	11.47 (2.43)	13.97 (3.17)	15.77 (2.11)
	non-X-X	non-X-X-Co	13.77 (1.74)	16.53 (2.65)	17.50 (2.06)
		non-X-X-Sub	11.50 (2.78)	13.47 (3.25)	15.77 (2.08)

*Note:* X-X-Co stands for the coordinate XAXB expressions such as *wu-you-wu-lv* 無憂無慮

no-worry-no-anxiety;

X-X-Sub stands for the subordinate XAXB expressions such as *yu-yan-yu-lei* 愈演愈烈

to-grow-more-intensified;

non-X-X-Co stands for the coordinate non-XAXB expressions such as *tian-yan-mi-yu* 甜言蜜語

honey-sweet-words;

non-X-X-Sub stands for the subordinate non-XAXB expressions such as *bu-mou-er-he* 不謀而合

agree-with-no-discussion.

A four-way repeated measure analysis of variance was conducted, with frequency, complexity, and semantic relations as the within-subject factors and age as the between-subject factor. The results, see Table 2, showed there were significant main effects for input frequency ( $F(1, 87) = 564.25, p < .001$ , partial  $\eta^2 = .87$ ), structural complexity ( $F(1, 87) = 53.72, p < .001$ , partial  $\eta^2 = .38$ ), and semantic relations ( $F(1, 87) = 22.42, p < .001$ , partial  $\eta^2 = .21$ ). The four-way interaction was not significant. In addition, the three-way interactions of frequency by complexity by age ( $F(2, 87) = 7.47, p = .001$ , partial  $\eta^2 = .15$ ), and frequency by relation by age ( $F(2, 87) = 6.48, p = .002$ , partial  $\eta^2 = .13$ ) were both significant.

**Table 2.** Results of four-way ANOVA on non-novel expressions in Study One

Effect	Df (degree of freedom)	F (F value)	P (Probability)	Eta Square
Frequency	1, 87	564.248	.000	.866
Complexity	1, 87	53.722	.000	.382
Relation	1, 87	22.418	.000	.205
Age	2, 87	91.235	.000	.677
Frequency*complexity*age	2, 87	7.468	.001	.147
Frequency*relation*age	2, 87	6.483	.002	.130

To better understand the significant three-way interaction of frequency by complexity by age, a two-way repeated analysis of variance (ANOVA) of frequency by complexity was then conducted at each age level. Results showed that the main effect of frequency was significant for 9-year-olds ( $F(1, 29) = 99.00, p < .001$ , partial  $\eta^2 = .77$ ), 14-year-olds ( $F(1, 29) = 219.57, p < .001$ , partial  $\eta^2 = .88$ ) and adults ( $F(1, 29) = 379.06, p < .001$ , partial  $\eta^2 = .93$ ). All participating groups gave higher ratings on HF expressions than LF ones. The main effect of structural complexity was also significant for 9-year-olds ( $F(1, 29) = 32.52, p < .001$ , partial  $\eta^2 = .53$ ), 14-year-olds ( $F(1, 29) = 6.00, p = .021$ , partial  $\eta^2 = .17$ ) and adults ( $F(1, 29) = 18.91, p < .001$ , partial  $\eta^2 = .40$ ). Idioms in the non-XAXB schema got overall higher ratings than those in the XAXB schema in all age groups.

The two-way interaction between frequency and complexity was significant in ratings made by 9-year-olds ( $F(1, 29) = 5.37, p = .028$ , partial  $\eta^2 = .16$ ) and adults ( $F(1, 29) = 9.99, p = .004$ , partial  $\eta^2 = .26$ ). For both adults and the youngest learners, ratings on non-XAXB expressions tended to be much higher than those on XAXB expressions in judging the acceptability of LF idioms.

To sum up, these two-way ANOVA results showed that the main effect of both frequency and structural complexity reached significance at each age level. In general, for both young and adult speakers, HF idiom variants were rated higher than LF ones; Idioms in the non-XAXB schema got higher ratings than those in the XAXB schema. These results clearly suggest that HF idioms were better learned than LF ones and speakers did have different rating performance on XAXB and non-XAXB expressions, even at an early age of 9. The interaction between frequency and complexity was significant for 9-year-olds and adults; but not for 14-year-olds. This should be the source for the significant three-way interaction of frequency by complexity by age. As can be seen from the means in Table 1, adults' higher ratings on non-XAXB expressions was mainly observed in the LF condition (non-XAXB:XAXB = 33.27 : 30.74). Their rating difference between XAXB and non-XAXB idioms hardly showed up under HF condition. 14-year-olds followed adults' pattern very closely, and they gave non-XAXB idioms higher ratings in both

LF (30.00 : 28.80) and HF conditions (36.87 : 36.06). 9-year-olds rated non-XAXB expressions higher than XAXB ones mainly in the HF condition (32.30 : 28.23). This suggests 14-year-olds' rating on schematic idioms was actually more similar to the adults' than those of 9-year-olds.

Similarly, for the significant three-way interaction of frequency by relation by age, a repeated two-way ANOVA of frequency and relation was further conducted at each age level. Results showed the main effect of semantic relations was significant for 9-year-olds ( $F(1, 29) = 6.66, p = .015, \text{partial } \eta^2 = .19$ ), 14-year-olds ( $F(1, 29) = 11.65, p = .002, \text{partial } \eta^2 = .29$ ) and adults ( $F(1, 29) = 5.12, p = .031, \text{partial } \eta^2 = .15$ ). Idioms with coordinate meaning were generally rated higher than those in subordinate meaning for all age groups. The two-way interaction between frequency and relation was significant for 9-year-olds ( $F(1, 29) = 7.95, p = .009, \text{partial } \eta^2 = .22$ ) and 14-year-olds ( $F(1, 29) = 26.85, p < .001, \text{partial } \eta^2 = .48$ ). Both the young groups tended to give noticeably higher ratings on coordinate idioms when judging LF idioms.

These results showed that the main effect of semantic relation was significant for acceptability ratings at all age levels. Idioms in coordinate relation got overall higher ratings than those in subordinate relation for all groups. It seems that coordinate variants were indeed learned better than subordinate ones. The significant interaction between frequency and relation was found with 9 and 14-year-olds, but not with adults, which should be the source for the significant three-way interaction of frequency by relation by age. 9- and 14-year-olds both gave noticeably higher ratings to coordinate expressions mainly in the LF condition, while adults made similar ratings on HF and LF idioms in terms of internal relations. This result implies that in dealing with less familiar idiom variants, young speakers attempted more analysis on internal relation while for adults this internal processing might have become kind of autonomous.

There was also a significant between-subject effect on age ( $F(2, 87) = 91.24, p < .001, \text{partial } \eta^2 = .68$ ). Adults gave higher overall ratings ( $M = 17.78, SD = 2.48$ ) than 14 year-olds ( $M = 16.47, SD = 3.33$ ), whose average ratings were also higher than 9 year-olds ( $M = 13.65, SD = 3.11$ ). Post Hoc Scheffe tests showed significant differences between each age group. This age effect indicates that in judging the legitimacy of an idiom variant, 14-year-olds were much more competent than 9-year-olds, but they still did not reach adult competence.

Study One also includes 40 novel (non-existing) items, which are invented with only one word different from the canonical expression and are supposed to be rejected. Now let us compare ratings on the novel expressions across age groups. Table 3 shows the means of ratings on novel phrases given by all age groups. The maximum score for each item is 4.

**Table 3.** Cross-group means (and SDs) of judgment ratings on novel expressions in Study One

	Novel expressions
9-year-olds	2.07 (0.28)
14-year-olds	2.10 (0.28)
Adults	1.92 (0.27)

A one-way ANOVA was conducted with age as the independent variable. Results showed that there was a significant main effect of age ( $F(2, 87) = 3.73, p = .028$ ). Post Hoc Scheffe tests showed the difference between 14-year-olds and the adults was significant, but the differences between all other groups were not significant. These findings suggest that children of 4th graders, at the age of 9, began to be able to reject novel schematic phrases as well as 14-year-olds and adults as they made equally low rating scores on novel phrases. It implies 9-year-olds started to have some awareness of what kind of word combinations can enter the open slots of a schematic pattern and what cannot. One interesting point is that 14-year-olds ( $M = 2.10, SD = .28$ ) appeared as a bit more tolerant than the other groups: their average ratings on novel combinations were the highest. This may due to that 14-year-olds' knowledge on the constrained productivity were not stable and likely to undergo overgeneralizations.

To see whether participants' judgments on novel expressions were also influenced by schematic structures, their ratings on XAXB and non-XAXB phrases were compared in paired T-tests. Results showed significant difference in ratings between XAXB and non-XAXB novel phrases for adults ( $t(29) = -8.551; p < .001$ ) and 9-year-olds ( $t(29) = -.203; p = .029$ ), but not for 14-year-olds. Adults rated non-XAXB novel phrases much higher than XAXB ones, as did the 9-year-olds.

These results on novel item judgments provided indirect evidence that speakers have developed stronger schematic knowledge of XAXB idioms as they did not readily accept new variants in the schema. The failure to observe the same difference in ratings by 14-year-olds could be explained by their high tendency to overgeneralize at this very developmental stage.

### 3.1.7 Discussion of Study One

Results in Study One show that participants judged the frequent idiom variants as more acceptable than the less frequent ones, even for adult speakers. Idioms in the non-XAXB schema tended to be judged as more acceptable than those in the XAXB schema. Participants rated idiom variants in coordinate meaning as more acceptable than those in subordinate meaning, especially for the less familiar ones. These are clear evidence that speakers, as young as 9 years old, have already established abstract schematic knowledge of the XAXB or non-XAXB construction and have

noticed the relations between the A, B open morphemes as they took advantage of this knowledge in making judgment decisions.

Findings in Study One did provide empirical support for the overall effects of structural complexity and semantic relation in judging the productivity of idiomatic schemata. Speakers tended to judge variants in the structurally more complex non-XAXB schema as more acceptable. This should be taken as evidence that speakers' schematic knowledge on the XAXB pattern tended to be more robust and stronger. Thus they showed less tolerance for new variants in it, as witnessed in their ratings on novel phrases. That is, speakers did have awareness that A, B morphemes were more constrained in the XAXB construction. At the same time, speakers also tended to judge coordinate idioms as more acceptable than subordinate ones. And this tendency was most noticeable in ratings on non-XAXB expressions. This shows being semantically less complex facilitated the judgment, especially those with less strong schematic knowledge.

These findings prove that Hypothesis One and Hypothesis Two were confirmed. The simpler XAXB schema did enjoy earlier and better learning, so did being coordinate in semantic relations. Moreover the effect of structural complexity and semantic relations were found stronger with less frequent idioms and they even interacted with each other in shaping the learning of schematic idiom productivity at different stages of language development.

Results in Study One also indicate kids as young as 9 can already largely tell which idiom variants are non-novel and which are novel. They have developed the generalizations upon which they make decisions about which variants are acceptable and which are not. By the age of 14, kids still have not established adult-like competence in judging the partial productivity of schematic variants, suggesting the learning of schematic idioms is a long process (Nippold & Duthie 2003). It is also observed that even for adult speakers, their judgments were not absolutely free from the influence of idiom token frequency as they judged HF variants more acceptable than LF ones.

## 3.2 Study Two

### 3.2.1 *Variables*

Study Two addresses Hypothesis 3 and is to test the role of chunk selection in the open slot in learning the productivity of XAXB and non-XAXB idioms for native speakers. It is similar to Study One in design. There are also four independent variables, input frequency (high frequency vs. low frequency), structural complexity (XAXB schema vs. non-XAXB schema), chunk effect (chunk vs. non-chunk open morphemes) and age. So, Study Two is also a 2 (input frequency)  $\times$  2 (structural complexity)  $\times$  2 (chunk effect)  $\times$  3 (age) factorial design.

### 3.2.2 Materials

40 non-novel (acceptable) schematic idioms (all coordinate ones) were chosen as targets. 20 of these instances contained AB chunk selections, with half being HF items and half being LF ones. The other 20 instances contained AB non-chunks, again half being frequent items and half being less frequent ones. Within each frequency range, half items (5 items) were from the XAXB schema and half from the non-XAXB schemata. Another set of 40 novel phrases were similarly invented for each corresponding subgroup of targets. For instance, the novel phrase invented for *ke-ge-ke-qi* (可歌可泣 evoking-praises-and-tears) is \**ke-ge-ke-chang* (可歌可唱). So there were also a total of 80 testing items in Study Two. See Appendix B for the testing items.

### 3.2.3 Participants

30 participants were included in each age level. The groups of 9-year-olds (range 9; 1–9; 10) and 14-year-olds (range 13; 10–14; 7) were randomly chosen from a different local primary school in Guangzhou. The adult group consisted of another group of 30 college students (mean age 20; 3) selected from the same university as in Study One.

### 3.2.4 Procedure

The procedure in Study Two is similar to that in Study One. Altogether adult participants spend about 15 minutes in rating all the expressions; the younger groups spend about 15–20 minutes on the task.

### 3.2.5 Results

Table 4 lists participants' average ratings on non-novel expressions in terms of chunking effect and structural complexity. The maximum score in each category is 20 points.

A four-way repeated measure analysis of variance was conducted, with frequency, complexity, and chunk effect as the within-subject factors, and age as the between-subject factor. The results found significant main effects for frequency ( $F(1, 87) = 792.11, p = .000$ , partial  $\eta^2 = .90$ ) and structural complexity ( $F(1, 87) = 39.58, p = .000$ , partial  $\eta^2 = .31$ ). The overall chunk effect did not reach significance. The effect of age was also significant ( $F(2, 87) = 49.63, p = .000$ , partial  $\eta^2 = .53$ ). The four-way interaction was not significant. The three way interactions of frequency by chunk by age ( $F(2,87) = 3.41, p = .038$ , partial  $\eta^2 = .07$ ), complexity by chunk by age ( $F(2, 87) = 7.77, p = .001$ , partial  $\eta^2 = .15$ ), and frequency by complexity by chunk ( $F(1, 87) = 13.18, p = .000$ , partial  $\eta^2 = .13$ ) were all significant. See Table 5.

**Table 4.** Cross-group means (and SDs) of ratings on non-novel expressions in Study Two

			9-year-olds	14-year-olds	Adults
HF	X-X	X-X-Ch	16.80 (2.41)	18.57 (1.63)	18.63 (1.33)
		X-X-non-Ch	13.70 (2.34)	19.13 (1.46)	19.47 (1.11)
	non-X-X	non-X-X-Ch	18.30 (1.77)	19.80 (0.48)	19.60 (1.00)
		non-X-X-non-Ch	17.10 (2.77)	19.03 (1.33)	19.70 (0.65)
LF	X-X	X-X-Ch	12.23 (2.47)	12.70 (2.25)	13.20 (2.73)
		X-X-non-Ch	13.07 (2.39)	15.30 (2.20)	16.43 (2.21)
	non-X-X	non-X-X-Ch	14.13 (1.89)	14.17 (2.17)	15.57 (1.94)
		non-X-X-non-Ch	13.17 (2.72)	14.17 (2.54)	14.47(2.19)

*Note.*

X-X-Ch stands for XAXB expressions with chunk selections, e.g. *yi-dian-yi-di* 一點一滴 every-little-bit; X-X-non-Ch stands for XAXB expressions with non-chunk selections, e.g. *xiang-fu-xiang-cheng* 相輔相成 be-complementary;

non-X-X-Ch stands for non-XAXB expressions with chunk selections, e.g. *dong-zhang-xi-wang* 東張西望 look-around;

non-X-X-non-Ch stands for non-XAXB expressions with non-chunk selections, e.g. *pai-shan-dao-hai* 排山倒海 irresistible.

**Table 5.** Results of four-way ANOVA on non-novel expressions in Study Two

Effect	Df	F	p	Eta Square
Frequency	1, 87	792.109	.000	.901
Complexity	1, 87	39.582	.000	.313
Age	2, 87	49.633	.000	.533
Frequency*complexity*chunk	1, 87	13.177	.000	.132
Frequency*chunk*age	2, 87	3.406	.038	.073
Complexity*chunk*age	2, 87	7.766	.001	.151

Since age is the common factor for the significant three-way interactions of frequency by chunk by age, and complexity by chunk by age, two sets of two-way ANOVAs of frequency by chunk, complexity by chunk were thereafter performed at each age level.

The two-way ANOVA of frequency by chunk was first calculated. Results showed a significant effect of frequency for 9-year-olds ( $F(1, 29) = 127.15, p < .001$ , partial  $\eta^2 = .81$ ), 14-year-olds ( $F(1, 29) = 359.02, p < .001$ , partial  $\eta^2 = .93$ ) and adults ( $F(1, 29) = 400.06, p < .001$ , partial  $\eta^2 = .93$ ). HF expressions were generally rated higher than LF ones. The chunking effect was also significant for 9-year-olds ( $F(1, 29) = 33.44, p = .015$ , partial  $\eta^2 = .54$ ), 14-year-olds ( $F(1, 29) = 13.15, p = .001$ , partial  $\eta^2 = .31$ ) and adults ( $F(1, 29) = 15.16, p = .001$ , partial  $\eta^2 = .16$ ). 9-year-olds

tended to give higher ratings to idioms with chunk selections in the open slots; while for 14-olds and adults, idioms with non-chunk selections in the open slots got overall higher ratings.

The two-way interaction between frequency and chunk was significant for 9-year-olds ( $F(1, 29) = 19.26, p < .001$ , partial  $\eta^2 = .40$ ), 14-year-olds ( $F(1, 29) = 18.60, p < .001$ , partial  $\eta^2 = .39$ ) but not for adults. 9-year-olds tended to give higher ratings on variants with chunk open morphemes in HF condition; while for 14-year-olds, higher ratings were given to variants with non-chunk open morphemes in LF condition. Adults tended to rate expressions with non-chunk selections in the open slots higher in both HF and LF conditions.

A repeated two-way ANOVA of complexity by chunk was then conducted at each age level to better understand the significant three-way interaction of complexity by chunk by age. Results showed that the main effect of complexity was significant for 9-year-olds ( $F(1, 29) = 33.82, p < 0.001$ , partial  $\eta^2 = .54$ ) and adults ( $F(1, 29) = 5.66, p = .024$ , partial  $\eta^2 = .16$ ), but not for 14-year-olds. Like adults, 9-year-olds rated non-XAXB expressions higher than XAXB ones.

The two-way interaction between complexity and chunk was significant for 14-year-olds ( $F(1, 29) = 15.40, p < .001$ , partial  $\eta^2 = .35$ ) and adults ( $F(1, 29) = 30.85, p < .001$ , partial  $\eta^2 = 0.52$ ), but not for 9-year-olds. For both adults and 14-year-olds, in rating XAXB expressions, idioms with non-chunk selections got much higher ratings than those with chunk selections.

To sum up, the results of the above two-way ANOVAs showed that although the overall main effect of chunking was not significant, it did reach significance at each age level. Specifically, 9-year-olds gave overall higher ratings to idioms with chunk selections while 14-year-olds and adults rated idioms with non-chunk selections higher in most cases. This suggests speakers did notice the lexical status of A, B open morphemes and whether they combine as chunks or not influenced their judgments on acceptability of schematic idioms.

Results also show that the effect of chunking interacted with frequency or structural complexity in different age levels. First, the interaction between frequency and chunking was significant for both 9- and 14-year-olds, but not for adults. This should be the source for the significant three-way interaction of frequency by chunk by age. As shown in the mean scores in Table 4, adults made similar ratings on HF and LF idioms in relation to chunking: they gave higher ratings to idioms with non-chunk selections regardless of frequency (38.23 : 39.17 for HF idioms; 28.77 : 30.90 for LF ones). 9-year-olds rated idioms with chunk selections higher than those with non-chunk selections mainly with HF idioms (35.10 : 30.80); whereas 14-year-olds tended to give higher ratings to idioms with non-chunk selections, mainly in LF condition (26.87 : 29.47). This can explain why the main chunk effect did not reach significance in the four-ANOVA analysis as the results from

9-year-olds and older groups may counterbalance each other. Such results indicate that the effect of chunking emerged gradually in the learning process with more language exposure. Children slowly approximated the adult pattern. Second, the significant interaction between complexity and chunk was observed with 14-year-olds and adults, but not with 9-year-olds, which should be the source for the significant three-way interaction of complexity by chunk by age. As can be seen from the mean scores in Table 4, XAXB variants with chunk open morphemes were rated particularly lower than others. This was also true in 9-year-olds's rating on LF idioms. This prevalent difficulty indicates that speakers did realize that A, B selection is more constrained in the XAXB schema, and they were not sure whether the separation of chunk A-B in the open slots was acceptable or not, especially the LF variants, such as *yi-hu-yi-xi* (一呼一吸 every-breath), *zi-chou-zi-jian* (自籌自建 self-prepare-and-build) and *bu-gui-bu-ju* (不規不矩 not-properly), whose ratings tended to be the lowest for each group.

For the significant three-way interaction of frequency by complexity by chunk, a two-way ANOVA of frequency by complexity was further conducted in terms of chunking since the overall effect of chunking was found insignificant.

Under the chunking condition, results showed that there was a significant main effect of frequency ( $F(1, 89) = 655.25, p < .001$ , partial  $\eta^2 = .35$ ). HF idioms were rated higher. The effect of complexity was also significant ( $F(1, 89) = 66.60, p < .001$ , partial  $\eta^2 = .43$ ). Idioms in the non-XAXB schema got higher ratings. The two-way interaction was not significant. Under the non-chunking condition, results showed that the main effect for input frequency was also significant ( $F(1, 89) = 271.29, p < .001$ , partial  $\eta^2 = .75$ ). The main effect of complexity did not reach significant level. The two-way interaction between frequency and complexity was significant ( $F(1, 89) = 20.05, p < .001$ , partial  $\eta^2 = .18$ ). For HF expressions, idioms in non-XAXB schema got noticeably higher ratings than those in the XAXB schema.

So, the significant interaction between complexity and frequency was found only under the non-chunking condition. This should be the source for the significant three-way interaction of frequency by complexity by chunk. The overall effect of structural complexity was only observed under chunking condition. It shows having chunk open morphemes better facilitated ratings on non-XAXB expressions, such as *qian-xun-wan-mi* (千尋萬覓 search-for-thousands-of-times), than on XAXB ones, such as *yi-hu-yi-xi* (一呼一吸 every-breath). Again it shows speakers were quite conservative on the acceptance of XAXB variants with chunk open morphemes.

For the between-subject effect of age, the Post Hoc Scheffé test showed that there were significant differences in ratings between each age group. The interaction between age and frequency was also significant ( $F(2, 87) = 11.07, p < .001$ , partial  $\eta^2 = .20$ ). As illustrated in Figure 4, though 14-year-olds could make similar

judgments with adults on HF idioms, their judgments on LF idioms were still noticeably lower. These results again suggest that 14-year-olds had approximated adults' competence in judging the acceptability of HF idiom variants.

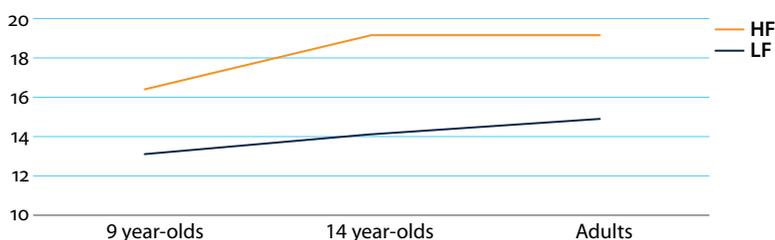


Figure 4. Age effect on judgment ratings with HF and LF idioms in Study Two

### 3.2.6 Discussion of Study Two

In Study Two, the main effect of chunking was found significant at each age level. Older speakers tended to judge idioms with non-chunk selections in the open slot as more acceptable than those with chunk selections. 9-year-olds, on the contrary, performed in reverse fashion. Older speakers did not accept variants with chunk open morphemes as readily as those with non-chunk open morphemes. They had realized the non-canonical separation of lexical chunks in a schematic template was not freely applicable. This indicates their knowledge on idioms with chunk open morphemes is much stronger and better. 9-year-olds' alternative pattern suggests that they still have not developed adult-like constraints on the legitimacy of A, B open morphemes in a schematic template. Hypothesis 3 is partly confirmed.

At the same time, the effect of chunking was found to be interacting with structural complexity in ratings given by 14-year-olds and adults in similar patterns. The XAXB expressions with chunk selection were more likely to be rejected by older speakers, especially the LF ones. Test items such as *wu-qing-wu-xu* (無情無緒 not-in-the-mood) and *bu-gui-bu-ju* (不規不矩 not-properly) were rated among the lowest. The chunk A-B combinations here *qing-xu* (情緒 mood; temper) and *gui-ju* (規矩 rules; manners) are lexical compounds that do not allow separation in canonical use. This may actually lead to their low acceptability ratings for these expressions. Speakers do not readily accept the non-canonical separation of lexical chunks in the XAXB schema, even for adults.

These findings suggest that children of age 9 are still not sensitive enough to the lexical status of open morphemes in an expression, and it is not until the age of 14 that the chunking effect completely takes shape in the development of their idiomatic competence.

## 4. General discussion

This study presents an empirical exploration on the issue how young speakers acquire the partial productivity of Chinese schematic idioms within the framework of construction grammar and the usage-based language learning theory. Four factors have been confirmed to play significant roles during the learning process: token frequency, structural complexity, internal semantic relation and the chunk effect of open morphemes.

### 4.1 Input frequency

The present study witnessed the significant role of token frequency in learning the productivity of Chinese schematic idioms. Expressions in HF were rated much higher than those in LF for both young and adult learners. This frequency effect is consistently observed across all age groups, suggesting that input frequency is a quite reliable predictor for the rating task. Results also show that the effects of other identified factors were more observable on ratings of LF idioms. It seems LF idioms require more metalinguistic analysis on the constraints of their productivity, whereas HF idioms tend to be more entrenched and autonomous in representation, hence their higher rating scores.

### 4.2 Structural complexity and internal semantic relation

Structural complexity has influenced the acceptability of schematic variants: native speakers tended to be reluctant to accept less familiar variants in the XAXB schema. The implication is that the XAXB schema tends to be more entrenched and enjoys better learning due to its higher token frequency in utterance and less complexity in structure. Results also showed that the internal semantic relation of an idiom influenced its acceptability: variants in coordinate meaning tended to be rated higher than those in subordinate meaning, suggesting that being coordinate in meaning does have a facilitating effect on the learning of idiom productivity.

These findings indicate that idioms are not lexical entries since the processing of their structural complexity and internal semantic relation is not prevented or terminated during the rating judgment. The underlying mechanism in the processing of schematic idioms remains no different from the processing of other syntactic constructions.

### 4.3 Chunk effect of open morphemes

Results in Study Two showed that older speakers did not readily accept the less familiar variants with chunk open morphemes. This is evidence that representation of idioms with chunk open morphemes is much stronger. They realized that the separation of the lexical bundles in the open slots was not freely allowed, and thus tended to reject those unfamiliar instances, especially those of the XAXB schema.

It was clear that speakers do not memorize the schematic idiom as an unanalyzable whole. They have noticed that there are open slots in schematic idioms and that the selection of open morphemes is not arbitrary but lexically related to each other. Speakers do rely on the lexical status of open morphemes in idiom processing, though the 9-year-olds may be still not competent enough to do so.

### 4.4 Empirical evidence of schematic idioms as constructions

The psychological reality of constructions in processing and representation has been reported and verified in the literature, most of which focused on argument structure constructions such as ditransitive and transitive constructions (Ahrens 1995; Kaschak & Glenberg 2000), passive constructions (Bock 1986), etc. Few studies have focused on constructions other than those at the syntactic level.

The constructional understanding of schematic idioms has been long proposed and recognized in theoretical studies on language systems (Fillmore et al. 1988; Jackendoff 1997; Kay & Fillmore 1999; Taylor 2002, 2012; Croft & Cruse 2004; Hilpert 2014). Nevertheless, cross-linguistic studies on schematic idioms other than English are still rare at present (Chen 2001; Gan 2008). And investigations on the learning of schematic idioms are even less. This study provides direct empirical evidence for the theoretical claim that Chinese schematic idioms are constructional units.

Children as young as 9 years old began to form generalizations on the partial productivity of schematic idioms as they could largely tell the difference between acceptable expressions and novel phrases that do not exist. Till adolescence, around age 14, speakers began to make similar judgment decisions as adults, especially on the frequent idioms, showing that they have established similar underlying generalizations regarding the selective constraints on open morphemes.

These empirical findings strongly suggest that what speakers know is not individual phrases, but abstract patterns at various levels that allow them to identify the phrases as conventional expressions. The abstract pattern is a kind of cognitive schema, a construction, which specifies what works and what does not work in the open slots. Constructional understanding of Chinese schematic idioms, therefore,

is not only a linguistic proposal, but prove to be empirically real in language acquisition as well.

The empirical findings tell us that these idiomatic variants must be processed analytically as other non-idiomatic expressions (Glucksberg 1993; McGlone et al. 1994). It is not possible that the meaning and form of the idiomatic variants, especially the less frequent ones, are stipulated and stored in memory. For the novel expressions in the judgment tasks, they are by no means retrievable in the mental lexicon. Yet the correct judgment on acceptability of novel phrases offer clear evidence that these schematic idioms must be processed linguistically.

To process and understand a new schematic idiom, the following steps may be involved. When children initially come across a variant form, they might perceive the expression as an unanalyzable chunk. Repetition of the same expression may lead to entrenchment in representation. As instances with the same structural frame accumulate, children may notice the shared similarity across instances and are encouraged to form a schema by analogy: a template composed of fixed morphemes and flexible morphemes in the open slots. Later with more exposure and language development, they begin to decompose the expressions by analyzing the features of open morphemes and how they relate to the ultimate interpretation of the overall expression. Gradually abstract schemata, i.e. Constructions, at different hierarchical levels will be established, from concrete constructions such as <bu-da-bu-xiao> (不大不小 not-big-not-small) to partially abstract ones like <bu-A-bu-B> (不-A-不-B not-A-not-B) then to fully abstract ones <XAXB>. Once such instance-schema mappings are formed, they will be relied on in judging the acceptability and the understanding of new variants.

During this process, high token frequency of schematic idioms leads to entrenchment in representation and autonomy in processing. High type frequency of schematic idioms helps to form proper range of productivity of certain schematic types, i.e. the kinds of lexical items that can be selected into the open slots. The most frequent forms in a schematic type will be regarded as the prototype, or original form. Less frequent forms will be regarded as variants or extensions. In addition, preemption will also help to form proper generalizations on a schema's productivity (Tomasello 2000; Goldberg 2006). That is, the existence of a form will preempt an alternative. For instance, seeing the form *wu-ju-wu-shu* (無拘無束 no-restrict-no-hindrance: at ease) may preempt a similar alternative \**wu-ju-wu-jin* (無拘無謹) though *ju-shu* (拘束 restrained) and *ju-jin* (拘謹 over-cautious) are both adjective compounds with similar meanings and functions; *da-bo-da-lan* (大波大瀾 big-waves) might preempt \**da-bo-da-tao* (大波大濤) since *bo-lan* (波瀾 waves) and *bo-tao* (波濤 billows) are noun phrases with similar meanings and functions.

In short, speakers are not restricted to what they have experienced. Instead, they generalize over the encountered usages, and gradually work out the proper range of productive use for each schema via domain general cognitive abilities, including categorization, entrenchment, schematization, and even statistical preemption.

#### 4.5 Emergentist model on idiom learning

Findings in this research provide direct support for an emergentist model in idiom learning, where experience plays an important role in representation and acquisition of linguistic units (Goldberg 1995, 2006; Bybee 1998, 2007; Tomasello 2003). The emergentist model proposes that all linguistic units in a language are represented and processed similarly and are equally affected by experience. Previous exposure of schematic expressions does influence their representation strength, as high frequency idiom variants were rated as more acceptable. Generalizations on idiom use and productivity gradually emerge with the increase of language exposure, as 14-year-olds were observed to follow adult patterns more closely than 9-year-olds. Language exposure is a determinant factor in the learning of schematic idioms.

At the same time, findings in the present research may be seen as offering indirect evidence for the compositional model in idiom learning (Gibbs & Nayak 1989; Glucksberg 1993). Chinese schematic idioms targeted in this study are not fully specified in their compositional words, leaving two open slots for variations. They cannot be stored and retrieved directly from memory. Rather speakers have to analyze the phrases linguistically during processing and comprehension, especially for the less familiar ones.

### 5. Conclusion

Studies on schematic idiom learning are important as they may provide empirical evidence in regard to their constructional proposal. Chinese schematic idioms arouse special research interests here due to their salient cross-linguistic uniqueness: the sophisticated figurative meaning is located in a semi-fixed four-word pattern, typically with two open slots inside. This study shows that school-age children as young as 9 could tell the difference between acceptable and unacceptable idiom variants in a systematic way, an implication that those four-character schematic idioms are not stipulated lexical units, but form-meaning pairings with their own subregularities. Findings in this study also indicate that the learning of schematic idioms is a gradual and developmental process shaped by domain general cognitive factors such as input frequency and age, as well as specific linguistic factors such as

structural complexity, internal semantic relation and the chunking effect of open morphemes.

The pragmatic dimension of schematic idioms is left unaddressed in this research as the focus narrows down on the structural and semantic dimensions. Since context is an indispensable element in the usage-based approach (Barlow & Kemmer 2000; Langacker 2000), future research should seek to examine the role of context in schematic idiom learning and see how it might interact with the factors reported in this research.

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## Abbreviations

ANOVA	analysis of variance
F	F value
Df	degree of freedom
HF	high frequency
LF	low frequency
<i>M</i>	mean
P	Probability
Post Hoc	Post Hoc comparisons
P-relatives	relatives with a direct object gap
S/A-relatives	relatives with a subject gap
<i>SD(s)</i>	standard deviation(s)
t	t value

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## Appendix A

請判斷下面表格中列出的四字詞語的可接受程度。程度分為四個等級：完全不可接受 ；基本不能接受 ；基本能接受 ；完全可以接受  。例如，玩具車是完全可以接受的詞語  ；玩具塊是完全不能接受的 ；玩具人的可接受程度則是介於兩者之間的。四字詞語是常見的中文組詞形式，但四字詞語並非字詞的隨意組合。例如，一舉一動是完全可以接受的詞語  ；一舉一重則是完全不可接受的詞語組合 ；而一舉一行則是介於兩者之間的組合。請認真就下面80個詞語的可接受度做出判斷，並在相應的欄目下打勾。

序號	四字詞語	完全不可接受 	不可接受 	可以接受 	完全可以接受  
1	不屈不撓				
2	互惠互優				
3	評長價短				
4	一絲不苟				
5	有肌有肉				
6	愈戰愈鬥				
7	無憂無傷				
8	千考百慮				
9	屢猜屢中				
10	無計可施				
11	汙言穢語				
12	不謀而劃				
13	隨看隨見				
14	招三惹四				
15	無處不在				
16	大起大落				
17	明槍暗箭				
18	百試百靈				
19	多買多送				
20	百阻不撓				
21	不謀而合				
22	招五惹六				
23	一線不苟				
24	百折不撓				
25	無憂無慮				
26	汙言染語				

序號	四字詞語	完全不可接受 	不可接受 	可以接受 	完全可以接受 
27	多禮多送				
28	不屈不服				
29	千思百慮				
30	無計可算				
31	有血有肉				
32	明槍暗擊				
33	互惠互利				
34	愈戰愈強				
35	大起大步				
36	百試百題				
37	評長論短				
38	隨看隨忘				
39	屢猜屢謎				
40	無處不所				
41	有張有弛				
42	愈演愈導				
43	明察暗訪				
44	大驚大險				
45	無業可事				
46	千姿百色				
47	不飲不食				
48	不言而語				
49	無書不讀				
50	屢戰屢敗				
51	百禁不嚴				
52	百發百中				
53	揚長言短				
54	互幫互忙				
55	一文不名				
56	隨叫隨喊				
57	甜言蜜語				
58	多勞多得				
59	說七道八				
60	無認無識				
61	有奔有馳				

序號	四字詞語	完全不可接受 	不可接受 	可以接受 	完全可以接受 
62	揚長避短				
63	不言而喻				
64	無知無識				
65	說三道四				
66	多勞多動				
67	不飲不品				
68	百禁不止				
69	隨叫隨到				
70	蜂言蜜語				
71	愈演愈烈				
72	一文不書				
73	屢勝屢敗				
74	大驚大動				
75	互幫互助				
76	千姿百態				
77	無聞不讀				
78	明察暗覺				
79	百發百現				
80	無業可就				

## Appendix B

序號	四字詞語	完全不可接受 	不可接受 	可以接受 	完全可以接受 
1	奇思異想				
2	無拘無束				
3	千難萬覓				
4	如饑如餓				
5	自私自有				
6	安家落戶				
7	盡忠盡職				
8	東摘西抄				
9	不模不樣				

序號	四字詞語	完全不可接受 	不可接受 	可以接受 	完全可以接受 
10	改頭換面				
11	一點一滴				
12	推山倒海				
13	依山賴水				
14	有奔有馳				
15	可悲可歎				
16	精挑密選				
17	不折不扣				
18	天經地常				
19	相尊相敬				
20	七嘴八舌				
21	東摘西要				
22	大模大樣				
23	同思異想				
24	排山倒海				
25	七嘴八腳				
26	依山靠水				
27	自私自利				
28	精挑細選				
29	安門落戶				
30	千尋萬覓				
31	無拘無謹				
32	有張有弛				
33	相知相敬				
34	可悲可苦				
35	有折有扣				
36	改頭換目				
37	天經地義				
38	一水一滴				
39	如饑如渴				
40	盡忠盡誠				
41	可歌可泣				
42	千改萬化				
43	跋山游水				
44	盡善盡良				
45	七高八低				

序號	四字詞語	完全不可接受 	不可接受 	可以接受 	完全可以接受 
46	一呼一吸				
47	不規不則				
48	改型換代				
49	大波大瀾				
50	精計細算				
51	東張西望				
52	如沉如醉				
53	自籌自建				
54	胡思亂想				
55	無情無感				
56	天差地距				
57	追家逐戶				
58	有聲有色				
59	移山動海				
60	相輔相成				
61	不規不矩				
62	跋山涉水				
63	大狂大瀾				
64	如癡如醉				
65	精打細算				
66	一呼一出				
67	七高八下				
68	移山填海				
69	盡善盡美				
70	千變萬化				
71	自設自建				
72	挨家逐戶				
73	有聲有音				
74	天差地遠				
75	胡思亂考				
76	無情無緒				
77	可歌可唱				
78	東仰西望				
79	相輔相導				
80	改型革代				

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