The Syntax and Phonology of Non-Compositional Compounds in Yixing Chinese

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Abstract This article explores the implications of the distribution of tone sandhi domains in Yixing Chinese (a largely undescribed Wu variety) for the syntactic analysis of a type of compound, labelled a Non-Compositional Compound (NCC). Various diagnostics identify these compounds as a well-defined type in Yixing, including non-compositional/idiomatic semantics and opacity in coreference and coordination. NCCs also undergo a particular tone sandhi process, Pattern Substitution (PS). These diagnostics, we show, suggest an analysis whereby NCCs are formed by Merging two uncategorised roots. The root Merge is symmetric, leading to questions of how the resulting structure is to be linearised and labelled. The linearisation, we suggest, is determined post-syntactically by an *Encyclopedia* entry imposing an order due to the diachronic reanalysis of a compositional structure. This Encyclopedia entry is also the source of the non-compositional semantics of these structures, permitted by the encyclopedic search (*en-search*) of Borer (2013a). Symmetric root Merge cannot yield a compositionally derived meaning, which we show follows from the theory of labelling of Chomsky (2013, 2015). Our account explains proposals by authors such as Arad (2003) and Borer (2013a), who stipulate that a first-categorisation domain receives non-compositional, atomic content. The paper also includes a preliminary description of the Yixing tonal system in general.

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1 Background

1.1 Scope

Yixing Chinese[1] is a variety of Wu Chinese (iso 639: wuu), spoken in Yixing County, a subdivision of Wuxi City in China's Jiangsu province. Apart from some preliminary phonetic description by Chao (1928), the variety is undescribed in the linguistic literature.

The scope of the study here is intentionally quite narrow – we focus on a single syntactic phenomenon in Yixing, in part with the aim of providing a precise syntactic description of domains for a particular tone sandhi process, described in the next section. Despite this, the conclusions we draw are quite significant for syntactic theory – we not only provide support for what has been called (e.g. by Chomsky 2013) the Marantz-Borer conception (see e.g. Marantz 1997 *et seq.*, Borer 2005 *et seq.*) that lexical items are introduced as category-less roots, but we also argue that these roots may be directly Merged with each other to form a class of compounds which may be semantically distinguished from compounds and other constructions which contain functional heads in addition to roots. This analysis may be readily extended to other varieties of Chinese (which do not necessarily show the tone sandhi processes which make these structures particularly amenable to analysis in Yixing), and indeed more broadly.

The remainder of section 1 will constitute a preliminary description of the Yixing tonal system, describing its tonal inventory and the sandhi processes which its tones participate in. Section 2 constitutes a description of the phenomenon we focus on here, defining a class of compounds (Non-Compositional Compounds, or NCCs), and offering a range of diagnostics (both syntactic and phonological) to identify them. Section 3 discusses the syntactic structure of these compounds – we propose that they are the result of a direct Merger with two roots, and offer various arguments from their syntactic and phonological behaviour that this is the correct analysis. To show that such structures are well-formed, we propose mechanisms by which they may be labelled (as required by e.g. Chomsky 2013, 2015) and linearised. Section 4 deals with the semantic interpretation of these compounds and shows that they support the explanation by Borer (2013a) of the assignment of non-compositional semantic content – we also show that our account of the labelling of NCCs can explain certain stipulations of Borer's theory and observations made by Arad (2003). Section 5 deals with some residual questions that our analysis raises regarding the contrast between NCCs and idiomatic expressions which are not NCCs.

1.2 Tone and Tone Sandhi in Yixing Chinese

The phonological description here gives a preliminary description of the inventory of tones and sandhi processes in Yixing. While it explains the processes used as diagnostics in the main text, it may be freely skipped over by those whose primary

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[1] The first author is a native speaker of this variety and provided all the examples and judgements given in this paper.

interest is in the syntactic facts. The only key points are that Yixing possesses two tone sandhi processes, Pattern Substitution (PS) and Pattern Extension (PE),[2] that PS and PE apply within different domains, and that the PS domain (identified with the phonological word) is smaller than the PE domain (identified with the phonological phrase). None of the other facts presented in this section are necessary to understand the rest of the text, but the intricacies of the sandhi system are independently interesting, and a summary is offered here for completeness.

Yixing Chinese has an inventory of 8 tones, assigned to each (monosyllabic) morpheme, largely corresponding directly to the tone and register distinctions of Middle Chinese. Examples of the tonal distinctions found in monosyllables are shown in tabular form below.[3]

(1)   *Examples of Yixing Chinese tones in monosyllables*[4]

	I (Ping)	**II (Shang)**	**III (Qu)**	**IV (Ru)**
A (Yin)	b̥iŋ^{55} 'ice'	ʃao^{51} 'small'	kʰae$^{51(3)}$ 'go'	gɔ(ʔ)$^{\underline{5}}$ 'country'
B (Yang)	lae^{15} 'come'	ŋo^{35} 'I'	ɲi^{21} 'two'	w̥ɔ(ʔ)$^{\underline{13}}$ 'study'

However, as in many Chinese varieties, morphemes frequently surface without their underlying tone, instead surfacing with a tonal specification conditioned by some sandhi process (for a survey of such processes across Chinese, see Chen (2000).) As in Wuxi Chinese (Chan and Ren 1989) there are two important processes active in Yixing Chinese, of which the simplest is a process wherein non-initial syllables within a sandhi domain lose their tonal specification, their pitches being determined by the tone of the initial element – we call this process Pattern Extension (PE).

The effect of this process is perhaps most clearly seen in numeral phrases, composed of a numeral, a classifier and a head noun:

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[2] This terminology is due to Chan and Ren (1989), who discuss a very similar system in Wuxi Chinese.

[3] Here we give both the abstract numerical notation we will be using in the rest of this paper to refer to these tones, and the traditional labels of the Middle Chinese tones. The categories indicated by Roman numerals are the tonal categories of Middle Chinese. The categories indicated by capital letters A and B are the Yin and Yang registers of Middle Chinese, corresponding historically to voiceless and voiced initials respectively. Each Middle Chinese tone-register combination corresponds to a separate tone in Yixing. The superscript Arabic numerals represent the surface pitch contour using the standard sinological tone numbers, where 5=highest pitch and 1=lowest pitch. Parentheses indicate part of a contour which is typically found in citation form but which is optional in connected speech. The parenthesised glottal stops are typically pronounced in isolation and phrase-finally, but not phrase-internally.

[4] The original *Yin Ru* (IVA) category, corresponding to historic closed syllables with voiceless initial consonants, is not retained intact in Yixing – many members of the historic class merge with the *Yang Ru* (IVB) category, for instance. we see ʨʰɛ(ʔ)$^{\underline{13}}$ 'seven', with the low rising tone generally associated with historical *Yang Ru* syllables. A non-trivial number, however, superficially seem to merge with the *Yin Ping* (IA) category, displaying high level tone in isolation. As well as generally being shorter, these words show distinct sandhi behaviour from the IA category in context, in particular showing different outputs under the Pattern Substitution process introduced below, and may therefore be treated as a separate class. It is this class which will receive the label IVA in what follows.

(2) *Tone sandhi in numeral constructions*

Tonal Category	Numeral	Num Cl N
IA	sa^{55} 'three'	sa^{54} bən^{43} ʃy^{32} 'three books'
IB	liŋ^{15} 'zero'	liŋ^{12}bən^{51} ʃy^{11} 'zero books'
IIA	dʑu^{51} 'nine'	dʑu^{51} bən^{11} ʃy^{11} 'nine books'
IIB	n̥^{35} 'five'	n̥^{35} bən^{53} ʃy^{31} 'five books'
IIIA	sɨ^{513} 'four'	sɨ^{51} bən^{11} ʃy^{13} 'four books'
IIIB	ɲi^{21} 'two'	ɲi^{11} zə^{11} bən^{11} ʃy^{11} 'twenty (=two ten) books'
IVA	b̥ə(ʔ)$\underline{^5}$ 'eight'	b̥ə^5 bən^{43} ʃy^{32} 'eight books'
IVB	l̥ɔ(ʔ)$\underline{^{13}}$ 'six'	l̥ɔ^{11} bən^{51} ʃy^{11} 'six books'

It may be observed that patterns may be distinguished from one another at either end of the sandhi domain – this accounts for the distinction between the tonal pattern imposed on the domain by 'nine' and that imposed by 'four'. To capture this, we analyse the Yixing tones as being bipartite, containing a lexical boundary tone which associates to the right edge of the sandhi domain. As well as this we see a pattern consisting of some (maximally binary) combination tonal autosegments L and H. One further degree of freedom is necessary to distinguish the patterns of *lɔ(ʔ)$\underline{^{13}}$* 'six' and *liŋ^{15}* from that of *n̥^{35}* 'five'. We will assume that the distinction lies in whether the autosegments are underlyingly associated to the syllable or not. If it is assumed that they are not underlyingly associated in *lɔ(ʔ)$\underline{^{13}}$*, this explains why we find a rise between the first and second syllables of *lɔ^{11} bən^{53} ʃy^{31}* 'six books', not on the first syllable as in *n̥^{35} bən^{53} ʃy^{31}* 'five books'.[5]

The patterns of the tonal categories outlined above are as follows, where underlining represents underlyingly unassociated tones.[6]

		I	II	III	IV
(3)	**A**	H L%	HL L%	HL H%	H L%
	B	LH L%	LH L%	L L%	LH L%

Let us be slightly more explicit about what 'Pattern Extension' involves. There are at least three processes – first, the tonal specifications of non-initial syllables are deleted. Second, the lexical boundary tone is placed at the right edge of the domain. Thirdly, unattached tonal autosegments are associated one-to-one, left-to-right. We illustrate this process below:[7]

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[5] The difference between the isolation pitches of *liŋ^{15}* and *lɔ(ʔ)$\underline{^{13}}$* can presumably be attributed to the fact that the latter is a much shorter syllable, not allowing the pitch to reach its maximum value.

[6] As the reader may check, these tone specifications adequately capture the PE sandhi patterns discussed above, but it may be a little more difficult to see how the citation tones above may be recovered. We will not give a detailed account of this here, but the key point is that the H% boundary tones and L% boundary tones behave somewhat differently, with the H% boundary tone (optionally) attaching to the final syllable of the word (regardless of whether it has other tones already associated to it) – the L% boundary tone, on the other hand, does not – it acts solely through interpolation. This explains why the IIIA word *sɨ$^{51(3)}$* has an optional final rise triggered by lexical H%, but the IA word *sa^{55}* has no final fall, in spite of the lexical presence of L%. It should be mentioned that our analysis requires reassociated H tones to behave differently in this respect, however.

[7] Here square brackets represent the edges of the Pattern Extension domain.

(4) a. *Underlying Form:*

[lɔ   bən   ʃy   ]

        L   H L%   L   H   L%   H   L%

b. *Deletion of non-initial tonal patterns:*

[lɔ   bən   ʃy   ]

        L   H L%

c. *Association of boundary tone:*

[lɔ   bən   ʃy   ]

        L   H   L%

d. *Association of tonal autosegments:*

[lɔ   bən   ʃy   ]

        L   H   L%

The other tone sandhi process which applies in Yixing Chinese is what Chan and Ren (1989) call 'Pattern Substitution' – the process wherein the pattern of some tonal category is replaced by another if the morpheme bearing the pattern is followed by another tone-bearing unit in the sandhi domain. Such processes are well attested, for instance in Xiamen Chinese (Chen 1987). They can be straightforwardly formalised as a rule:

(5) $T_1 \rightarrow T_2$ / $[_{SD}\_\_\_T_3]$

Where T_n is an arbitrary tonal specification and $[_{SD} \dots]$ represents the relevant sandhi domain. The sandhi domain for Pattern Substitution is in fact different from that of Pattern Extension. Indeed, the PS domain is always included within the PE domain. This, in combination with the fact that Pattern Substitution feeds Pattern Extension, means that while we may see Pattern Extension without Pattern Substitution, PS *only* applies if PE also applies.

The identity of the tone which triggers PS sandhi is also relevant in Yixing, as it is in nearby varieties such as Wuxi Chinese (Chan and Ren 1989). For example, if a IA tone is followed by a tone in class II or III, it does not undergo sandhi, but if it is followed by a tone in class I or IV, it changes specification from **H L%** to **H H%**. A table of disyllables in PS sandhi environments is shown below:[8]

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[8] A variety of apparently different constructions are displayed here, including proper names of places and people, calques and borrowings from Mandarin, nominal and verbal compounds (of varying degrees of transparency), and abbreviations, all of which pattern together phonologically.

(6)

↓ T1 T2 →	IA	IB	IIA	IIB
IA	sin^{55}dʑaŋ^{55} 'Xinjiang'	doŋ^{55}dae^{55} 'Dongtai'	sao^{54}dʑou^{32} 'shaojiu'	si^{54}ləŋ^{32} 'sirloin'
IB	ɲi^{11}sin^{25} 'Yixing'	zən^{11}miŋ^{25} 'people's'	waŋ^{13}xae^{51} 'Yellow Sea'	miŋ^{13}liŋ^{51} 'Mingling''
IIA	xae^{22}ə^{55} 'Haian'	dʑu^{22}dʑɥe^{55} 'Jiuchuan'	xae^{35}kʰou^{53} 'Haikou'	ʃao^{35}mo^{53} 'foal'
IIB	vu^{11}tsʰaŋ^{25} 'Wuchang'	n̩^{11}dae^{25} 'Mt. Wutai'	zaŋ^{11}xae^{25} 'Shanghai'	wu^{35}ny^{53} 'dancing girl'
IIIA	gwae^{22}dʑou^{55} 'Guizhou'	gwae^{22}jaŋ^{55} 'Guiyang'	faŋ^{35}sou^{53} 'let go'	xə^{35}ɲy^{53} 'Chinese language'
IIIB	do^{11}sa^{25} 'Dashan'	da^{11}lie^{25} 'Dalian'	dzu^{11}sou^{25} 'assistant'	zi^{11}ngo^{25} 'ego'
IVA	bə^{5}dʑiŋ^{55} 'Beijing'	bə^{5}miŋ^{55} 'Pak-ming (director)'	ə^{5}dʑou^{42} 'Ah Jiu'	dzo^{5}mo^{42} 'Drolma (Tib. name)'
IVB	lɔ^{11}ə^{25} 'Lu'an'	lɔ^{11}o^{25} 'Luhe'	bɔ^{11}dʑou^{51} 'baijiu'	vɔ^{11}li^{51} 'physics'

↓ T1 T2 →	IIIA	IIIB	IVA	IVB
IA	siŋ^{54}xo^{32} 'Xinghua'	si^{54}zaŋ^{32} 'Tibet'	dʑoŋ^{55}ɲɔʔ^{55} 'China'	dʑi^{55}ɲɔʔ^{55} 'chicken (meat)'
IB	wu^{13}fu^{51} 'Hufu'	niŋ^{13}wɔ^{51} 'Ningxia'	ŋo^{11}gɔʔ^{25} 'Russia'	zaŋ^{11}zɔʔ^{25} 'Changshu'
IIA	dʑiŋ^{35}kʰou^{53} 'import'	gu^{51}zi^{11} 'story'	xae^{22}bəʔ^{5} 'altitude'	gou^{22}ɲɔʔ^{25} 'dog meat'
IIB	vu^{35}xə^{53} 'Wuhan'	lao^{35}do^{53} 'eldest child'	vu^{11}ʃɛʔ^{25} 'Wuxi'	doŋ^{11}vɔʔ^{25} 'animal'
IIIA	ʃou^{35}kʰou^{53} 'cufflink'	sə^{35}do^{53} 'Shantou U'	dʑaŋ^{22}əʔ^{55} 'stewed duck'	xə^{22}vɔʔ^{25} 'hanfu'
IIIB	da^{13}tʃʰiŋ^{51} 'Daqing'	wɔ^{13}do^{51} 'Xiamen U'	za^{11}dʑɛʔ^{25} 'shoot'	zi^{11}vɔʔ^{25} 'object'
IVA	bə^{51}gɔ^{13} 'gossip'	jɪ^{51}diŋ^{13} 'certain'	ə^{5}sɔʔ^{55} 'uncle (FyB)'	ə^{55}ɲɔʔ^{55} 'duck meat'
IVB	zə^{11}bao^{51} 'daily'	lɔ^{11}mao^{51} 'cuckoldry'	lɔ^{11}gɔʔ^{33} 'Six Kingdoms'	dɔ^{11}jɔʔ^{33} 'poison'

The abstract tonal specifications which can be deduced from these patterns are as follows:[9]

(7)

↓ T1 T2 →	IA	IB	IIA	IIB	IIIA	IIIB	IVA	IVB
IA	H H%	H H%	H L%	H L%	H L%	H L%	H H%	H H%
IB	L H%	L H%	LH L%	LH L%	LH L%	LH L%	L H%	L H%
IIA	LH H%	LH H%	LH H%	LH H%	LH H%	HL L%	LH H%	LH H%
IIB	L H%	L H%	L H%	LH L%	LH L%	LH L%	L H%	L H%
IIIA	LH H%	LH H%	LH H%	LH H%	LH H%	LH H%	LH H%	LH H%
IIIB	L H%	L H%	LH L%	LH L%	LH L%	LH L%	L H%	L H%
IVA	H H%	H H%	H L%	H L%	HL H%	HL H%	H H%	H H%
IVB	L H%	L H%	LH L%	LH L%	LH L%	LH L%	LH H%	LH H%

There are a few patterns to be observed here: Tones IA and IB (the so-called 'even' tones) always trigger identical PS sandhi, as do tones IVA and IVB (the 'entering' or 'checked' tones). Indeed, the A and B registers of all tonal categories generally trigger the same substitution, with two exceptions (IIA + IIIB is different to IIA + IIIA, and IIB + IIA is different to IIB + IIB). More often than not, 'even' and 'checked' tones trigger the same PS sandhi process, with the single exception of the sandhi of syllables specified for tone IVB (which has sandhi specification **L H%** before an even tone, but **LH H%** before a checked tone). Tones in the II and III categories also often (but not always) pattern alike with respect to PS, both as triggers and as undergoers.

Pattern Substitution is most productively seen in the adjectival system of Yixing Chinese. If an adjective is used attributively, it takes an attributive marker *lao*, [10]

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[9] There are a few points of individual, stylistic and dialectal variation which are not captured here – in one particular point of more-or-less free variation, IVB tones can optionally display the substituted pattern **L H%** before tones in categories II and III as well as I.

[10] Since *lao* never appears in isolation, it is difficult to be certain of its tonal identity: when coerced in isolation it seems to be realised with a IIIB (i.e. low falling) contour. The substitution sandhi pattern displayed by *lao*, however, does not reflect the sandhi pattern triggered by any one tonal category, though

which triggers Pattern Substitution in the adjective stem. These phrases (usually) fall within the same Pattern Extension domain as their head noun, and so this substituted pattern spreads onto it. This is illustrated in the examples below:

(8) *Pattern extension tone sandhi in attributive constructions*

Tonal Category	Adjective	Attributive Construction
IA	$siŋ^{55}$ 'new'	$siŋ^{54}$ $ŋao^{43}$ $ʃy^{32}$ 'new book'[11]
IB	la^{15} 'blue'	la^{11} lao^{51} $ʃy^{11}$ 'blue book'
IIA	$ʃao^{51}$ 'small'	$ʃao^{22}$ lao^{55} $ʃy^{55}$ 'small book'
IIB	gou^{35} 'thick'	gou^{21} lao^{11} $ʃy^{14}$ 'thick book'
IIIA	$gwae^{51(3)}$ 'expensive'	$gwae^{22}$ lao^{55} $ʃy^{55}$ 'expensive book'
IIIB	$dʑu^{21}$ 'old'	$dʑu^{21}$ lao^{11} pi^{14} 'old pen'
IVA	$sə(ʔ)^{5}$ 'astringent'	$sə^{3}$ lao^{55} $dzɔ^{55}$ 'astringent tea'
IVB	$lɔ(ʔ)^{13}$ 'green'	$lɔ^{44}$ lao^{11} $ʐy^{55}$ 'green tree'

The inventory of tonal patterns which emerge only due to Pattern Substitution tone sandhi before *lao* are shown in the table below:[12]

(9)

	I	II	III	IV
A	H L%	<u>LH</u> H%	<u>LH</u> H%	<u>LH</u> H%
B	<u>LH</u> L%	L H%	L H%	<u>HL</u> H%

The processes deriving the surface tonal properties of an adjectival phrase are illustrated below:[13]

(10) a. *Underlying Form:*

[PE [PS ʃao   lao] [PS ʃy   ]   ]

          H   L   L%   T   H   L%
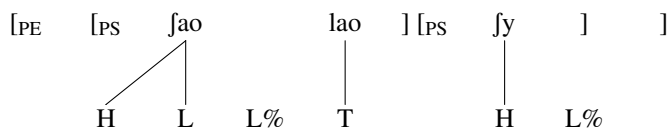
b. *Pattern substitution rule* HL L% → <u>LH</u> H%

[PE [PS ʃao   lao] [PS ʃy   ]   ]

          L H   H%   T   H   L%

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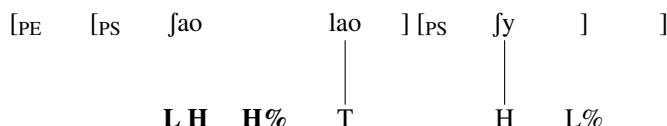
each of the substitutions we observe are available options given the underlying tone of the adjective in question. It seems plausible that *lao* is simply unspecified for tone, since it never occurs in isolation, and that the observed sandhi processes are due to a rule inserting a tonal specification onto *lao* in a particular environment, which in turn produces the observed sandhi patterns. This is speculative however, and will require further research.

[11] As observed above, tone IA does not undergo PS sandhi before tones in classes II and III, such as the IIIB tone putatively borne by *lao*. This means that this example has an identical pattern to the one involving PE alone, above.

[12] In fact, there is some variability here. For example, underlying IB tones may be realised by PS sandhi tones <u>LH</u> L% or L H%. The variants given here are the most frequent.

[13] Here [PS ...] represents a Pattern Substitution domain and [PE ...] represents a Pattern Extension domain. Elswhere, we will often not represent these domains if they are non-branching.

c.   *Deletion of non-initial tones*

[PE   [PS   ʃao   lao   ] [PS   ʃy   ]   ]

L H   H%

d.   *Association of tones:*

[PE   [PS   ʃao   lao   ] [PS   ʃy   ]   ]

L   H   H%

It seems reasonable to attempt to identify the sandhi domains in question with some phonological constituent – since these constituents seem to be larger than syllables or feet,[14] it is sensible to provisionally identify the Pattern Substitution domain with next smallest (generally accepted) constituent, namely the Phonological Word (ω). The Pattern Extension domain, on the other hand, may be identified with the larger Phonological Phrase (ϕ). One reason for positing these constituents (rather than, for example, supposing the sandhi processes to be conditioned directly by syntax) is that sandhi domains and syntactic constituents are not isomorphic to one another. Consider, for example, coordination in compounds. If we coordinate the first members of a compound, the second coordinated element forms a PE domain together with the head of the compound, while the first coordinated element groups with the coordinator. This is in spite of the fact that the coordinated modifiers of the compound form a semantic (and presumably syntactic) unit. This is illustrated for o^{11} $doŋ^{13}$ xae^{51} $ʃy^{11}$ 'river and sea water' below.[15]

(11)   a.   *Putative Syntactic Structure*

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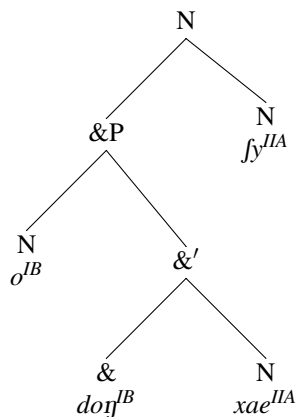
[14] Trisyllabic substitution domains have not been illustrated so far, but do exist – an example is the verbal compound $ma^{11}$$doŋ^{11}$$si^{25}$ 'go shopping' (= ma^{IIIB} 'buy' + $doŋ^{IA}$$si^{IA}$ 'things'). The existence of trisyllabic domains of this type strongly suggests that the substitution domain is larger than a foot.

[15] The components of this phrase with citation tones are o^{15} (IB) 'river', $doŋ^{15}$ (IB) 'and', xae^{51} (IA) 'sea' and $ʃy^{51}$ (IIA) 'water'.

    b.   *Sandhi Domains*
        $[_{PE}$ o^{11} doŋ^{13}] $[_{PE}$ xae^{51} ʃy^{11}]

These domains also condition segmental processes. For instance, glottal stops are deleted both phrase-internally and word-internally, in the latter case blocking vowel changes which apply in checked syllables. For example, underlying /o/ is regularly realised as [ɔ] in isolated checked syllables. If a syllable with an underlying glottal stop appears non-finally in a substitution sandhi domain (a phonological word, by hypothesis), the vowel in question is realised as [o]. This is true even when substitution sandhi applies vacuously. If an element is phrase-internal but word-final, glottal-stop deletion applies, but the vowel is realised as [ɔ].[16]

(12) *Glottal Stop Deletion*
    a.   ɲɔʔ$^{\underline{13}}$ 'meat' (IVB)
    b. $[_{PE}$ $[_{PS}$ ɲ**o**^{11} bao^{13}]] 'meat-bun'
    c. $[_{PE}$ ɲɔ^{11} bao^{53}] '*meat* bun' (not a vegetable bun)
    d. $[_{PE}$ ɲɔʔ$^{\underline{13}}$] $[_{PE}$ bao^{55}] 'meat *bun*' (not a dumpling)
    e. $[_{PE}$ $[_{PS}$ ɲ**o**^{11} pʰu^{51}]] 'butchers' shop'
    f. $[_{PE}$ ɲɔ^{11} pʰu^{51}] '*meat* stall' (not a vegetable stall)
    g. $[_{PE}$ ɲɔʔ$^{\underline{13}}$] $[_{PE}$ pʰu^{513}] 'meat *stall*' (not a shop)

Phonological words may be independently diagnosed by a tonal downstep rule which takes place between them if they share a phonological phrase. [17] If a phrasal boundary appears between the words (e.g. due to focus on the second word), downstep of this type does not apply.

(13) *Downstep Between Phonological Words*
    a. $[_{PS}$ $[_{PS}$ ʃao^{22} ʃy^{55}]] 'comic book'
    b. $[_{PE}$ $[_{PS}$ ʃao^{22} lao^{55}] $^{\downarrow}[_{PS}$ ʃy^{55}]] 'small book'
    c. $[_{PE}$ $[_{PS}$ ʃao^{22} lao^{55}]] $[_{PE}$ $[_{PS}$ ʃy^{55}]] 'small *book*'

Here ʃy^{55} 'book' is produced with the same pitch in (13a), where the adjectival root forms a substitution domain with the nominal root, and (13c) where there is a phrasal boundary between the adjective and the noun.[18] In (13b), however, where there is a word boundary but no phrasal boundary, the pitch of ʃy^{55} is downstepped.

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[16] This can presumably be accounted by assuming two glottal stop processes – one which applies within words, and another which applies within phrases. The former can be taken to precede the vowel change, the latter to follow. This could be modelled either using ordered rules or a model such as Stratal OT (Kiparsky 2000). There is a third process which removes glottal stops even in phrase-final position, but this applies only optionally – the processes discussed here are obligatory.

[17] This rule appears to apply at a fairly late stage, after PE has applied – it might be taken to be a type of phonetic implementation rule, which is, of course a type of rule which we do not expect to be conditioned by syntactic structure, lending support to the identification of these domains with prosodic rather than syntactic constituents. We neglect this downstep elsewhere in this paper.

[18] Focus always creates a phrasal boundary before the focussed element, which can be diagnosed in most cases by the absence of PE. The underlying high level tone of ʃy^{55} makes this unclear, however, as it is the same pitch contour we would expect to be assigned by PE.

The particular identification of the PS domain with the phonological word and the PE domain with the phonological phrase is a simple consequence of a reduced inventory of prosodic constituents, along the lines of Ito and Mester (2013) – Ito and Mester posit only three types of constituent above the foot, namely ω, ϕ and the intonational phrase (ι). Identifying the domains with the smallest available units yields the identification of the PS domain with ω and PE domain with ϕ, as discussed above.

These prosodic constituents are generally presumed to interface with syntax, with their boundaries largely determined by syntactic structure (see e.g. Nespor and Vogel 1986 et seq.) – this certainly seems to be true of these sandhi domains, and there do not seem to be any phonological considerations which determine their extent. This means that tone sandhi processes can be used as a means by which to uncover syntactic structure. The principles we suppose to relate the ω domain in particular to syntax will be discussed further in the course of this paper.

1.3 Transcription Conventions

In this subsection we will briefly outline the system of tone transcription we use in this paper. In this section, and sporadically in the rest of the paper, we have represented tones using Chao tone numbers for Yixing. Elsewhere, we will use diacritics derived from the IPA, so that $\acute{V}$ represents a high tone on a vowel, $\bar{V}$ a mid, $\grave{V}$ a low, $\check{V}$ a rise and $\hat{V}$ a fall. Finer distinctions than this will generally only be represented where contrastive – for example, to distinguish high rises ($\acute{V}$) and low rises ($\grave{V}$) on isolated monosyllables.

The representation of tones of monosyllables in isolation using this system is as follows:

		I	**II**	**III**	**IV**
(14)	**A**	b̥íŋ 'ice'	ʃâo 'small'	kʰæ̃e 'go'	g̥ɔ́(ʔ) 'country'
	B	lǎe 'come'	ŋ̊ó 'I'	ɲì 'two'	w̥ɔ̀(ʔ) 'study'

When citing Mandarin examples, we will make use of the conventional pinyin diacritics for tones 1-4, where $\bar{V}$ is a high level tone, $\acute{V}$ a rising tone, $\check{V}$ a 'dipping' (low falling or fall-rise) tone and $\grave{V}$ a high falling tone.

2 The Syntax and Phonology of Compounds in Yixing: The Facts

2.1 Non-compositional compounds and compositional constructions in Yixing

Yixing Chinese, and indeed Chinese more broadly, contains a construction which may be called a *non-compositional compound* (henceforth NCC). As the name suggests, these are a class of compounds whose meaning may be quite removed from the compositional meaning of their components. Although this construction is commonly found in other Chinese varieties such as Mandarin, we focus on Yixing here

for two reasons – firstly because the phenomenon appears to be even more productive in Northern Wu dialects such as Yixing, and secondly because Yixing shows clear phonological evidence for the syntactic analysis we propose, which is not available in most other varieties. This is because one of the tone sandhi processes (Pattern Substitution sandhi) has a much more restricted distribution in Yixing compared to other varieties – PS sandhi occurs almost exclusively in NCCs. Yixing was also chosen in part because the system has not previously been described in any great detail – this work constitutes a partial attempt to rectify this gap.

Several types of NCCs can be identified, displaying both nominal and verbal categorisations. A selection are shown below:[19, 20]

(15) *Nominal NCCs*

    a.   ʃào ɲíŋ
        small person
        'kid'

    b.   ʃào ʃý
        small book
        'comic'

(16) *Verbal NCCs*

    a.   ʧʰɛ̀ vǎ
        eat rice
        'dine'

    b.   ɲè ʃy̌
        read book
        'study'

The above examples can be contrasted with semantically transparent *compositional constructions* (henceforth CC), which on the surface may contain the same elements, and are best analysed as consisting of phrasal constituents DP (with an adjectival modifier) or VP (with an object), respectively. Examples of these are shown below:

(17) a. *DP with modifier*

       ŋó jâo jí bə̀n **wàŋ ŋâo ʃỳ**, fɔ́ zɔ̀ **lɔ́ lâo ʃý**
       1SG want one CL yellow ATTR book NEG COP green ATTR book

       'I want a yellow book, not a green book'

    b. *VP with object*

---

[19] A reviewer notes that these forms appear to show different degrees of 'non-compositionality'. This follows as a consequence of the fact that NCCs are grammaticalised (as discussed in section 3.4) from compositional constructions. It is not surprising, then, that some NCCs retain meanings that are close to compositional meanings. Meanings of NCCs may then drift from their compositional counterparts over time.

[20] We have used tonal diacritics rather than tone letters when discussing syntax, as it enhances readability. We have retained the more precise tone letters when discussing phonology, however.

    ʥíŋdzào ŋó   ʥɔ́ **ʧʰɛ̀ và** fɔ́   **ʧʰɛ̀ tsʰãĭ**
    today   1SG only eat rice NEG eat dish

    'Today I will only eat rice, I won't eat any [main] dishes'

A reviewer notes that in Mandarin, collocations such as *chī fàn* 'eat rice~dine' (=Yixing *ʧʰɛ̀ và*~*ʧʰɛ̀ vǎ*) may be treated as non-atomic units. For example, it is possible to interpose additional material between the components of the collocation without losing the idiomatic meaning 'dine'. It should be observed that while all NCCs show a degree of semantic atomicity, non-compositional semantics is not *restricted* to the class of compounds we call NCCs, which, as illustrated in the following sections, share properties other than semantic non-compositionality. We do observe phrasal idioms in the language as well. In Yixing there is evidence, to be discussed in section 5, that there are cases (of which *ʧʰɛ̀(ʔ)+và* is an example) where a phrasal idiom and an NCC may share a single interpretation. It is reasonable to treat the Mandarin example in the same way.

2.2 Syntactic Diagnostics for NCCs

A null argument (represented here as *pro*) may refer to a noun embedded in a CC, but this is impossible in NCCs.[21]

(18) a.   dzáŋsá   jóu jí bə̀n hâo ʃỳ,   dàzɔ́ Lísì̥ jóu jí bə̀n ʧʰú gə̀
           Zhangsan have one CL good book but Lisi have one CL bad LNK

           (*pro*)
           'Zhangsan has a good book but Lisi has a bad one'

     b.   *dzáŋsá jóu jí bə̀n ʃào ʃý,   Lísì̥ jóu jí bə̀n lèsî̥   gə̀
           Zhangsan have one CL small book Lisi have one CL history LNK

           (*pro*)
           (Intended: 'Zhangsan has a comic and Lisi has a history book')

(19) a.   ŋó fɔ́ ʥè   ʃý dzɔ́ xwéʃì má
           1SG NEG borrow book only like   buy (*pro*)

           'I don't borrow books, I only like to buy them'

---

[21] A reviewer suggests that what is at issue in (18) is the difference between a 'phrase' and a 'compound', along the lines identified by Paul (2005). Our NCCs do indeed bear a good deal in common with Paul's compounds – so much so that it seems reasonable to suggest that they represent the same phenomenon. We cannot adopt Paul's analysis of this phenomenon, however: Paul suggests that compounds (our NCCs) simply constitute a single word, composed in the lexicon, accounting for the fact that their components are syntactically inaccessible. On the other hand, she supposes that phrasal A N (or N N) sequences are composed in the syntax, allowing their components to be accessed. This is compatible with most of our diagnostics here, but (as will be discussed later on) would not allow us to provide a fully general description of the distribution of PS tone sandhi. It is also worth noting that many constructions (some of which will be discussed in section 3.1) that would generally be analysed as compounds in other languages *are not* analysable as NCCs under this diagnostic.

b. *tʰɔ̀ ʥíŋdzào mɔ́   ɲē   ʃỳ   dàzɔ́ kʰɑ̃e má gɔ̀
    3SG today   NEG.PST read book but go   buy PST (*pro*)
    (Intended: 'He didn't study today, but he went to buy books')

A second diagnostic is coordination: a modifier in CCs may be coordinated with another adjective, but this is not possible in NCCs.

(20) a. gɔ́ bù djèjĭŋ hâo gɔ̀ ɖóŋ wà gɔ̀ ɲǐŋ   àdzáo jòu lǎo
          this CL film good LNK and bad LNK person both have ASP
          'This film has both good people and bad people [in it]'
      b. *gádou ʃâo gɔ̀ ɖóŋ lèsî̀ gɔ̀ ʃý àdzáo jòu lǎo
          here small LNK and history LNK book both have ASP
          (Intended: 'There are both comics and history books here')

One final syntactic diagnostic concerns the scope of negation (and its associated focus operator). Negation (and focus) can only scope over the entire NCC – if any of the individual components of the NCC are negated/focalised the non-compositional meaning is lost.

(21) a. ŋó fɔ́   xwēʃi ɲè-ʃỳ
          1SG NEG like   read-book
          'I don't like to study'
      b. ŋó fɔ́   xwēʃi ɲè ʃỳ
          1SG NEG like   read book
          'I don't like to *read* books' (*I don't like to *study* [but I like to *buy* books])
      c. ŋó fɔ́   xwēʃi ɲè ʃý
          1SG NEG like   read book
          'I don't like to read *books*' (*I don't like to *study* [but I like to read *magazines*])

A summary of the NCCs and a prototypical CC is given below:

(22) *Syntactic diagnostics for NCCs*

	NCCs	**CCs**
Noncompositional semantics?	*yes*	*no*
Null argument reference?	*no*	*yes*
Modifier coordination?	*no*	*yes*
Negate/focus components?	*no*	*yes*

2.3 Phonological Diagnostics

There is a single important phonological diagnostic for NCCs. NCCs invariably form a single phonological word, but CCs never do. It is not quite correct to say that all

morphologically complex phonological words are NCCs, but the exceptions to this can be unified quite straightforwardly with NCCs, as will be discussed in the next section. In any case, it is clear that if a morphologically complex expression does not form a single phonological word, it cannot be an NCC. Since phonological words are pattern substitution sandhi domains, NCCs can often be detected by the presence of this kind of tone sandhi.

Examples of the contrast are shown below:

(23)   a.   NCC:

wɔ^{11} dəŋ^{25}

learn hall

'school'

(= wɔ(ʔ)^{13} (IVB) 'study' + dəŋ^{15} (IB) 'hall')

b.   CC:

wɔ^{11} wae^{51}

learn association

'learning association'

(= wɔ(ʔ)^{13} (IVB) 'study' + wae^{21} (IIIB) 'association')

In (23a), the tone class of *wɔ(ʔ)* 'learn' is IVB, with the underlying tone pattern **LH L%**. This pattern is seen in the *wɔ^{11} wae^{51}* 'learning association', where only Pattern Extension sandhi applies. In *wɔ^{11} dəŋ^{25}* 'school', on the other hand, we see the substitute specification **L H%** – both Pattern Substitution and Pattern Extension have occurred. We can therefore conclude that whereas *wɔ^{11} dəŋ^{25}* forms a single phonological word, *wɔ^{11} wae^{51}* does not. Given the proposed link between PS sandhi and NCC status, we would conclude that *wɔ^{11} wae^{51}* cannot be an NCC, but that *wɔ^{11} dəŋ^{25}* likely is. This conclusion is supported by the fact that the semantics of *wɔ^{11} wae^{51}* are transparent and compositional – the term refers to a kind of association (*wae^{IIB}*) concerned with learning (*wɔ(ʔ)^{IVB}*). On the other hand, the semantics of *wɔ^{11} dəŋ^{25}* are opaque – a school is not necessarily a kind of hall.[22]

We can observe that *wɔ̀ wâe* satisfies the various syntactic diagnostics for CCs we have established above:

(24)   a.   *Null-Argument Reference, Focus:*

gɔ́ gɔ̀ zɔ̀ wɔ̀ wâe,   fɔ́ zɔ̀ làodóŋ gɔ́
this CLS COP learn association NEG COP labour LNK (pro)

'This is a *learning* association, not a labouring one'

b.   *Coordination:*

wɔ̀   dôŋ làodóŋ wáe
learn and labour association

---

[22] A reviewer suggests that the tonal difference here may be down to the different underlying tone on the second syllable, which can alter the application of PS sandhi. If both forms constituted PS domains, however, we would expect the possibility of substituted tone **L H%** in both cases (albeit optional in 23b and obligatory in 23a). But substitution is ruled out in (23b).

'Learning and labouring association'

We can even see this kind of contrast in strings made up of entirely identical roots:

(25)   a.   NCC:

do^{11} $mən^{25}$

big   gate/door

'front door'

   b.   CC:

do^{11} $mən^{11}$

big   gate/door

'big gate'

The tone class of *do* is IIIB, with underlying tone pattern **L L%**. In (25b), we see PE spreading this pattern over the entire phrase, erasing the IB (**LH H%**) specification of *mən* but showing no PS sandhi. In this case, we have a compositional meaning – the construction refers to a gate (or door) which is physically large. On the other hand, in (25a), PS sandhi is triggered on *do*, changing the specification to **L H%**, which is again spread, yielding a rising tone on the second syllable. In this case, the meaning of the compound is not compositional – the door in question may be physically small.

We can therefore add an additional diagnostic to our table above:

(26)   *Diagnostics for NCCs*

	NCCs	CCs
Noncompositional semantics?	*yes*	*no*
Null argument reference?	*no*	*yes*
Modifier coordination?	*no*	*yes*
Negate/focus components?	*no*	*yes*
Pattern substitution sandhi?	*yes*	*no*

It should be emphasised that our CC diagnostics are for an idealised 'prototypical' CC, and that not every compositional construction has all these properties. For some further discussion of our proposed typology of structures, see section 3.8.

3 Theoretical Considerations

3.1 The Syntactic Nature of NCCs

A proper study of the formation of NCCs should explain the source of the noncompositional semantics borne by them, and on the other hand account for the syntactic and phonological properties presented in the previous section. It might at first sight be tempting to assume that (at least verbal) NCCs are derived from the syntactic combination of a predicate and its argument. After all, if the noncompositional semantics are put aside, we can see that many verbal NCCs superficially seem to be divided into a predicate and an argument. A small selection of NCCs of this type are shown in (27).

(27) *Examples of 'V+O' NCCs*

NCC	Gloss	Components
tʰjǎo wû	'dance (v.)'	tʰjǎo 'jump' + wú 'dance (n.)'
gò̥ gó	'link'	gö̥ 'hand (v.)' + gó 'hook'
mà d̥òŋsǐ	'shop (v.)'	má 'buy' + d̥óŋsí 'thing'
kʰǔn gâo	'sleep'	kʰǔn 'sleep (v.)' + gão 'sleep (n.)'
d̥ò̥ sáŋwó	'work'	d̥ö̥ 'do' + sáŋwó 'life'
zàŋ mǎŋ	'surf the web'	záŋ 'ascend' + máŋ 'net'
dìŋ sî̃ŋ	'focus'	dìŋ 'fix' + sî̃ŋ 'temper'

If indeed such a predicative relationship is encoded in these NCCs, there are two possible derivational routes. The first possibility is to assume that NCCs are not truly compounds, but idioms, and that their noncompositional content is imposed after the derivation of a phrase (ie. [$_{VP}$ V DP] or [$_{DP}$ AP DP]). This is generally assumed for English idioms such as *throw up one's hands* or *pull the strings* – Nunberg et al. (1994) provide sufficient evidence to state that these idiom chunks are phrasal in nature, and that their noncompositional meaning is imposed after the phrase is constructed. This analysis is problematic for Yixing NCCs, however: the phonological facts in particular – i.e. that NCCs undergo PS tone sandhi but other constituents do not – seem to point to a structural difference between NCCs and most phrasal constituents.

Another way to maintain a bipartite analysis of NCCs would be to assume that NCCs are formed in the same way as synthetic compounds. For Harley (2009), the 'object' of a synthetic compound is a fully categorised nP – that is to say, a typical noun (if not a typical nominal phrase). English examples of such compounds are shown below:

(28)　a.　truck driving

　　　b.　meat eating

A synthetic compound is composed only of a predicate and an argument – additional fuctional categories such as determiners and prepositions, which would otherwise appear in the argument structure of a nominalised verb (as shown below), are not required.

(29)　a.　*the* driving *of a* car

　　　b.　*the* eating *of* meat

A link between NCCs and synthetic compounds would seem to be promising, as the two constructions share two important properties: (a) Neither construct involves functional categories such as D and P; (b) Both constructs are syntactically composed of two overt parts, apparently involving a predicate and its argument (so, for instance, the NCC ɲèʃy̌ might be analysed as consisting of a predicate ɲè 'read' and an argument ʃy̌). The vast literature on the formation of synthetic compounds (e.g. Roeper and Siegel 1978; Selkirk 1982; di Sciullo and Williams 1987; Roeper 1999; Ackema and Neeleman 2004; Spencer 2005; Borer 2012, 2013b) could provide us with an account of a mechanism which combines these two parts.

However, there is clear evidence that NCCs cannot be analysed as synthetic compounds. Firstly, synthetic compounds tend to have transparent, compositional semantics, in sharp contrast to NCCs. Secondly, we see a phonological distinction between NCCs and synthetic compounds, with the NCCs forming a phonological word, in contrast to the synthetic compounds. This is clear when we consider the following contrast:

(30) a. má tsʰàe   lào
          buy vegetable NMZ
          'vegetable buyer'

      b. mà-dòŋsì láo
          buy-thing NMZ
          '[personal] shopper'

Both examples in (30) begin with the root *má* 'buy' and end in a nominaliser. But (30a) is a synthetic compound while (30b) is an agentivised NCC. Only the latter displays PS tone sandhi on its first component (though both examples show PE sandhi).

Thirdly, in both English and Chinese, synthetic compounds (where they are distinguishable from ordinary V-O constructions) are only permitted to appear as nominals, while NCCs are often verbal in nature. This is shown below:

(31) a. *John *truck drives* every day
      b. *John máitʰíe   kʰàtsʰɔ́ ʤósí
          John every.day *truck   drive*
          (Intended: 'John drives trucks every day')

Fourthly, as can be seen from (31), the combination of argument and predicate is ordered differently in synthetic compounds and NCCs – in NCCs, the argument tends to follow the predicate, while in certain synthetic compounds (those with polysyllabic objects), it precedes.[23]

Finally, the components of synthetic compounds may be focussed, unlike those of NCCs:

(32) a. kʰátsʰɔ́ ʤósí ɥé
          'truck driver' (no focus)
      b. kʰátsʰɔ́ ʤŏsì ɥè
          'truck *driver*'

It seems certain, then, that NCCs are distinct from synthetic compounds.

---

[23] A reviewer suggests that this ordering could also be attributed to the presence of a polysyllabic verb – this is difficult to test, as polysyllabic objects in synthetic compounds seem to consistently co-occur with a polysyllabic verb. It is certainly the case, however, that polysyllabic objects cannot readily follow a verb in an agentive nominal. We can contrast the grammatical agentivised verb phrase with monosyllabic object *má tsʰàe lào* 'vegetable buyer' and NCC *mà-dòŋsì láo* 'shopper' with the ungrammatical *mà djènào lào/ɥè* 'computer seller', where the object is polysyllabic. It will also be observed that NCCs select the agentive nominaliser *-lao*, ungrammatical with heavy objects.

3.2 Deriving NCCs via Root Merge

We require an account that retains NCCs as a distinct class. Suppose that the lexicon of Yixing Chinese (and probably that of Chinese more generally, perhaps of all languages – this is the 'Marantz-Borer conception') contains various acategorial roots, each with an individual phonological index. Each root introduced into the derivation undergoes a process of categorisation. For instance, in Distributed Morphology accounts (Marantz 2007; Embick and Noyer 2007), the root can be selected by a categorial functional head (*n, v, a*, etc.), with which it forms a *phase*, which acts as as an atomic item with a syntactic category. Alternatively, we might adopt the approach of Borer (2013a) which supposes that these roots are automatically categorised in the relevant syntactic environment. The former makes certain phonological generalisations discussed below easier to formulate, but otherwise the difference between the approaches is not of great relevance here.

We can now give a straightforward account of the formation of NCCs. First, we assume that the components of NCCs are bare roots, not fully categorised items. This is perhaps independently desirable, given that there is evidence that roots in Chinese have a phonological form independent of syntactic category: often, a single phonological form in Chinese can have different categories when inserted in different environments, as shown by the Yixing examples below. Whether we follow conventional DM models or the XS (eXo-Skeletal) model (Borer 2005 *et seq.*), the phonological form is borne by a root. In DM terms, this root would be categorised by merging with a null categoriser, while the XS model would have the root categorised according to its syntactic environment. In either case, the phonological form is taken to be (at least partly) independent of categorisation:

(33) a.   tʰɔ́ máitʰíe   ḏâŋ gôu
            3SG every.day hit d̥og

           'He hits the dog every day'

      b.   kɔ́ bù dèjíŋ fɔ́   zɔ̀ má ḏāŋ gɔ̀
           this CL film NEG be very hit LNK

           'This film isn't very action-packed'

      c.   *gɔ́ gɔ̀ nĭŋ   zɔ́ má kʰāe gɔ̀
           this CL person is very go   LNK

           (Intended: 'This person really goes')

(34) a.   gɔ́ gɔ̀ wódòu má pʰjāoljàŋ
           this CL girl   very beautiful

           'This girl is very beautiful'

      b.   pʰjáoljáŋ dàe ɲè ʃy̌   m̀mɔ̂   jòŋ
           beautiful to   read book NEG.have use

           'Beauty is of no use in study'

(35) a.   fɔ́ jào nɔ́ tʰɔ́ ḏáŋ bɔ̀tsĭ
           NEG want take 3SG as   idiot

'Don't take him for an idiot.'

b. gɔ́ gɔ̀ ɲǐŋ   jí djē à   fɔ́ bɔ̄tsì gɔ̀
    t̥his CL person one bit even NEG idiot LNK

'This person isn't idiotic at all'

In (33a), the word *dâŋ* functions as a verb, while it functions as an adjective in (33b). In example (33c) we show that the environment in (33b) is truly an adjectival one, by showing its incompatability with a verb which may *not* act as an adjective. In (34a) we see the word *pʰjâoljàŋ* being used as an adjective (diagnosable by the presence of the intensifier *mâ*), but as a noun in (34b). Finally the word *bɔ̀tsǐ* 'idiot' is used as a noun in (35a) but an adjective in (35b). The fact that the compounds *bɔ̄tsì* 'idiot' and *pʰjāoljàŋ* 'beautiful' are NCCs (by the diagnostics given above) suggests that we are indeed correct to assume that these constructions do not contain any inherent categorial marker – categorisation follows the formation of the compound.[24]

We propose that roots in NCCs are categorised after they are Merged to one another, and function, following categorisation, as an atomic unit (following, among others, Marantz (2007), Embick and Noyer (2007), Borer (2013b)). This directly explains the syntactic properties discussed in section 2.2. Because the two components are treated simply as parts of an unanalysable lexical item, it is not possible to coordinate them with any other element. A similar argument can be made with regard to referentiality – since a 'noun' root in NCCs is treated simply as a part of a single lexical item, it cannot serve as any kind of referential antecedent (explaining, for instance, their inability to bind null pronominals, or to participate in coordination - see (18), (19), (20)).[25]

Since we treat NCCs as unanalysed atoms, we predict that they can be further incorporated into another construct without any kind of linker. This prediction does indeed hold; consider the examples in (36).[26]

(36) a. ʃý djē
          book shop
          'bookshop'

---

[24] A reviewer raises a question concerning the history of Chinese – lexical items in Archaic Chinese show a great deal *more* flexibility in terms of their syntactic role than comparable elements in Modern Chinese. This raises the question of how the model offered here might treat this difference. We can perhaps relate this to another change that took place between the Archaic Chinese period and the Modern Period, namely the emergence of a much greater preponderence of polysyllabic words over monosyllabic words. We could propose that while in Archaic Chinese, null categorisers could freely attach to roots, such null categorisation in Modern Chinese varieties is permitted to apply only in certain phonological contexts (in polysyllabic words) and with a restricted set of roots. This would account both for the increased number of polysyllabic words and the relative lack of categorial flexibility in roots.

[25] A reviewer points out that if Harley (2009) is correct in assuming synthetic compounds to involve categorised items, there is not a straightforward link between referentiality and acategoriality. We should underline that the link to referentiality is *one-way*. Roots may not refer, but not everything which fails to refer is a root. Constructions where components do not individually refer, but do show evidence of categorisation, are common in Yixing, and will be discussed, for instance, in Section 5.

[26] The brackets here represent the domain of the NCC. Note that the resulting formation is a compositional noun-noun compound, not an NCC itself.

b.   [ʃào níŋ]   ʃý
     small person book
     'children's book'

c.   [ʃào ʃý]   djé
     small book shop
     'comic book shop'

d.   *[bèjî lào ʃỳ] djè
     cheap ATTR book shop
     (Intended: 'shop for cheap books')

Examples (36a, b) show that the atomic item *ʃý*, as well as the compounds *ʃào ɲíŋ* and *ʃào ʃý* may combine with another noun to form yet another compound, but a fully compositional nominal phrase (*bèjî lào ʃỳ*) may not.[27]

Verbal NCCs also act as single heads. Consider the examples in (37), repeated from section 3.1. In Yixing agentive nominals with a heavy (i.e. polysyllabic) object, the nominaliser must directly follow the verb – if an object is included, then it is placed to the left of the verb, with the nominaliser immediately following the verb (shown in (37b)). It is noteworthy, then, that when a verbal NCC is nominalised in this way, the nominaliser follows the entire compound, with the 'nominal' component of the NCC remaining in place following the 'verbal' component (37c, d). This is best explained by assuming that these verbal NCCs do indeed act as single atomic units for most morphosyntactic purposes.

(37) a.   English: *truck driver* (**drive truck-er*)

      b.   kʰátsʰɔ́ ʥósí ɥé
           truck   drive NMZ
           'truck driver' (**ʥŏsì kʰàtsʰɔ̀ ɥè*)

      c.   mà-dòŋsì láo
           buy-thing NMZ
           'shopper'

      d.   *dóŋsī mà lào
           thing   buy NMZ
           (Intended: 'shopper')

While a full account of these agentive nominals is beyond the scope of this paper (for a detailed crosslinguistic analysis of these, see e.g. Borer 2013a, pp. 606–615), these facts demonstrate clearly that, unlike standard V-O constructions, verbal NCCs are treated as atomic items, which conforms to our hypothesis.

---

[27] This distinguishes 'A-N' NCCs (containing a root which is typically adjectival) from nominal phrases containing modifiers, though it does not single them out uniquely – we find that NCCs of this type pattern with compositional noun-noun compounds, even rather complex ones, so that it is possible (albeit rather unnatural) to say *ǎdzɔ́ dóŋ gáɲtʰjē tsʰàŋ ʧỳ* 'shoe and steel factory district' (i.e. a district which contains shoe factories and steel factories). The point being illustrated here, however, is that 'A-N' NCCs can be readily differentiated from A-N compositional phrases, and that the former pattern with atomic lexical items.

3.3 Functional Heads and the Phonological Word

We noted above that NCCs always form a single phonological word, but it may not be clear how this relates to our hypothesised syntactic structure. To relate these two things, we first note that almost all functional elements appear to form a separate phonological word, failing to trigger PS tone sandhi in any preceding material, even if they lie in the same phonological phrase. A plausible hypothesis, then, is that phonological words are delimited by syntactic functional heads.

As a reviewer observes, this is not a cross-linguistically valid generalisation. In many languages, phonological words may contain multiple heads, not only lexical, but also functional. For instance, the Ojibwe word *ni-giː-ini-aːgam-oseː* [1-PST-there-snowshoe-walk]'I walked there in snowshoes' (Newell and Piggott 2014) contains multiple functional heads *and* multiple lexical heads. There are a few plausible explanations for this – firstly, in many languages head movement processes create complex heads which may be parsed as single phonological words without violating the generalisation just stated. In modern Chinese it has been argued that head movement is distinctly restricted (see e.g. Huang 2015), which might explain the relatively limited range of possible phonological words. Another possible point of cross-linguistic variation which is relevant here concerns the treatment of recursive prosodic structures. Yixing shows no evidence of recursive prosodic words, unlike Ojibwe (as Newell and Piggott analyse it). One possible prosodification algorithm we could adopt here (following Perry 2016) would suppose that initially *all* projections of functional heads are parsed as prosodic words, but that the dense, recursive structure produced in this way is later 'pruned' due to constraints on well-formedness. If recursions of prosodic words are removed as part of this procedure, this would recover the distribution of phonological words posited here. We do not commit to this procedure here, however, and other possible algorithms can readily be imagined.

In any case,we can say that because NCCs are simply composed of two lexical roots and do not contain any functional heads, they act as a single phonological word which is delimited by the (often null) functional head which acts as a categoriser.

(38)   *Structure of NCC, Correspondence to Phonological Word*

($_\omega$ʃào   ʃý   [n]) 'comic'
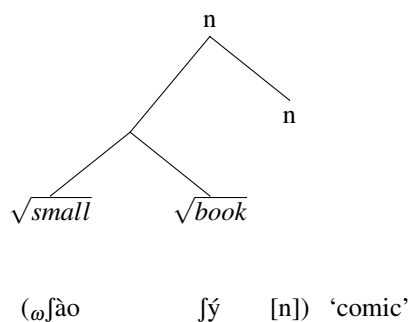
The supposition that a categorial functional head delimits a phonological word in this way is supported by the behaviour of *overt* categorisers. These include the attributive marker *-lao* (as shown in (4)), exemplified in some detail above, which

seems to be best analysed as an adjectivalising head, and the nominalisers *-lao*[28] and *-tsə*, which also form a phonological word with the root which they categorise. Examples of these overt categorisers are shown below:
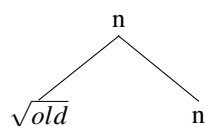
(39)   *Overt Categorisers and the Phonological Word*

a.   *Overt adjectivaliser*

$$
\begin{array}{c}
\text{a} \\
\sqrt{old} \qquad \text{a}
\end{array}
$$
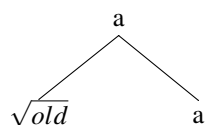
($_\omega$lào   lǎo)   'old'

b.   *Overt nominaliser*

$$
\begin{array}{c}
\text{n} \\
\sqrt{old} \qquad \text{n}
\end{array}
$$

($_\omega$lào   tsǐ)   'father'

It seems that the analysis which proposes that a phonological word is delimited by a categoriser is indeed correct. The phonological and syntactic analyses of NCCs are therefore in agreement – they both point to a representation in which an NCC is composed of two uncategorised roots which undergo categorisation later in the syntactic derivation. This is discussed further in section 3.8.

3.4 Derivation of Surface Tones

It may be helpful to briefly illustrate in more detail how surface tones are derived given a particular syntactic structure. In particular, we will consider the contrasting tones in the verb phrase of (21).

If the verb phrase *ɲe*^{IIIB} 'read' $+$ *ʃy*^{IA} possesses the obligatory non-compositional reading 'study' (as opposed to simply 'read books'), as in (21a), it is an NCC, with the structure in (40).

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[28] It is tempting to analyse the nominalising and adjectivalising *lao* heads as being identical, and perhaps to link these to an identical head which marks aspect in verb-final position. This may well be a fruitful avenue of investigation, but it lies beyond the scope of this paper.

(40)
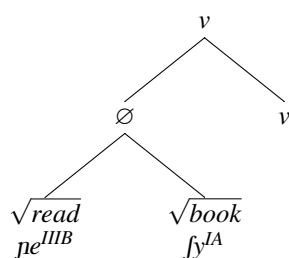
The categoriser, as a functional head, delimits a phonological word, as discussed in section 3.2 – there is a single functional head here, delimiting a single functional word which includes both ɲe^{IIIB} and ʃy^{IA}. The presumed underlying specifications of tones IIIB and IA are **L L%** and **H L%**, respectively. Generally speaking a verb also forms a separate phonological phrase from preceding material – a fact we shall simply take as given for the purposes of this paper. The initial phonological representation is therefore as shown in (41):

(41) $(_\phi \ (_\omega \ \text{ɲe}^{L\,L\%} \ \text{ʃy}^{H\,L\%}))$

The phonological word is a domain for PS sandhi, which applies turning the **L L%** specification of the ɲe^{IIIB} 'read' to **L H%**:

(42) $(_\phi \ (_\omega \ \text{ɲe}^{L\,\mathbf{H\%}} \ \text{ʃy}^{H\,L\%}))$

Next, Pattern Extension applies, deleting the tonal specification of $\text{ʃy}^{H\,L\%}$ 'book' and attaching the lexical boundary tone of $\text{ɲe}^{L\,H\%}$ to the right edge of the phrase.

(43) $(_\phi \ (_\omega \ \text{ɲe}^{L} \ \text{ʃy}))\text{H\%}$

The boundary H% tone is then realised phonetically as a final rise, giving the observed pitch pattern ɲè ʃy̆.

We can contrast this with combinations of the same roots where the compositional meaning 'read book' is available. This, we assume, has something like the structure in (44):

(44)
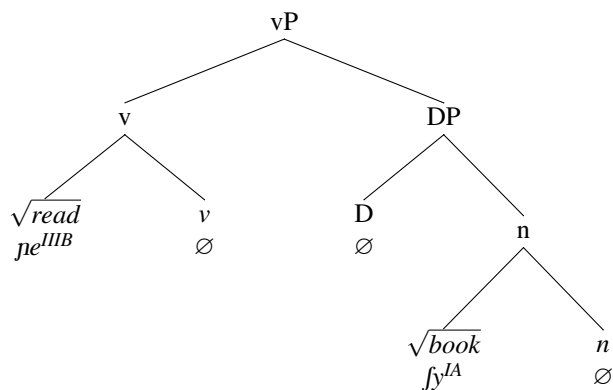
Here we have multiple functional heads, and consequently multiple phonological words – the *n* head delimits one ω containing the root $\int y^{IA}$, and the *v* head delimits another containing ηe^{IIIB}. For illustrative purposes, we will assume that the verb phrase here forms a single phonological phrase, though in fact this depends on information-structural properties of the elements in question.[29] The initial phonological representation, then, is as follows:

(45)　$(_\phi (_\omega \eta e^{L\ L\%})(_\omega \int y^{H\ L\%}))$

Because the elements are each final in their phonological word, PS sandhi does not apply. Because they share a phonological phrase, however, PE sandhi does apply, deleting the tone specification of $\int y^{H\ L\%}$ and attaching the low boundary tone of $\eta e^{L\ L\%}$ to the right edge of the phonological phrase.

(46)　$(_\phi (_\omega \eta e^{L})(_\omega \int y))L\%$

This is expected to result in a domain with a (roughly) level low pitch, giving us the observed *ɲè ʃỳ*. As we can see, the difference in structure necessary to account for the syntactic and semantic behaviour of NCCs also yields the correct phonological behaviour.

3.5 Asymmetry and Root Merge

The Merger of two roots raises some interesting questions with respect to the hierarchical relationship between them. Generally speaking, a Merge operation involves some hierarchical asymmetry, perhaps imposed by a labelling algorithm of some sort (Collins and Stabler 2016, Chomsky 2013 *inter alia*). This asymmetry is taken to be required to enforce selectional restrictions and to ensure interpretability at the interfaces (see e.g. Citko 2011, Chomsky 2013), and is often supposed to be necessary to retrieve the correct linear order (if approaches such as that of Kayne (1994) are followed). But if roots lack categories, or indeed any syntactic features whatsoever, it is impossible to create this kind of asymmetry in the syntax. We hope to show that this lack of asymmetry is not problematic for our syntactic framework, and in fact is desirable for empirical reasons.

Labelling, in particular, is not especially problematic. If we follow an approach such as that of Chomsky (2013), labelling is required for interpretation. One of the Merged items, or a prominent feature thereof, is taken to be selected as the label of the complex object created by Merge. Chomsky is concerned here with the problem that there is not always an unambiguous choice of label (when, for instance, two complex syntactic objects are Merged). In fact, no such problems are encountered here. Since roots are taken to be devoid of syntactic features, including categorial features, they are not distinguishable in the syntax, and may be represented as an empty set $\varnothing$. If two such roots are Merged, they are treated as identical, and the choice of label is unambiguous – it must be $\varnothing$. There is a remaining issue: one of

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[29] In particular, if the object is focused, it will not be the case that the verb and object share a phonological phrase.

the assumptions of Chomsky (2015) is that roots (along with T) are 'too weak' to label a category, a proposal that he uses to derive certain facts concerning movement in English. In Chomsky's framework, as just mentioned, the purpose of a label is to render an item interpretable at the interface with the Conceptual-Intentional (C-I) system. We follow Chomsky insofar as we agree that $\varnothing$-labelling is insufficient for a category to be interpreted. To provide semantic content to $\varnothing$-labelled structure when it is subsequently categorised, we propose that the interpretive system must refer to the *Encyclopedia*.[30] We provide more detailed analysis of the mechanisms at play in section 4.1; the point to note at this stage is that there is no issue of ambiguous labelling here, and in that sense the structures we propose are well formed.

If we adopted the rather different approaches to labelling of Adger (2003), Collins (2002), Collins and Stabler (2016), we would likewise predict that root Mergers should result in symmetric structures. The core intuition shared by these approaches is that asymmetries in the behaviour of complex elements created under Merge are crucially determined by feature-valuation, specifically valuation of *selectional* features. Again, however, since roots are without syntactic features,[31] we simply do not expect that their Merger should lead to asymmetric behaviour. This seems to be correct empirically – there is no evidence that either root in an NCC behaves as if it were a head (see section 3.5 for more details).

Perhaps a more important issue is that of *linear* asymmetry. It is certainly true that root Merge does not seem to result in linearly symmetric representations. That is, in a given NCC, one of the roots invariably precedes the other. We do not see free ordering between the two elements. If the preceding observations are correct, we must suppose that the source of the linear ordering does not lie in the structure derived by syntax, since there is no asymmetry between the two roots. As one might expect, the ultimate source of the ordering we find in roots can be located in diachrony. Most NCCs in Yixing are reanalysed from compositional phrases, typically VP and NP phrases, following the path illustrated in (47).

(47) a. $[_n[_a \text{ a } \sqrt{root_1}] [_n \text{ n } \sqrt{root_2}]] \rightarrow [_n \text{ n } [_\varnothing \sqrt{root_1} \sqrt{root_2}]]$

     b. $[_v[_v \text{ v } \sqrt{root_1}] [_n \text{ n } \sqrt{root_2}]] \rightarrow [_v \text{ v } [_\varnothing \sqrt{root_1} \sqrt{root_2}]]$

Initially, both roots are fully categorised, and as such behave asymmetrically in the syntax – in (47a), for instance, the noun projects over the adjective. This means that we can straightforwardly derive a linear order from the properties of the phrase

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[30] A reviewer notes that if we take categorising heads (*n, v, a, . . .*) to be phase heads (following e.g. Marantz 2007), our account would require that phase heads and their complements are interpreted together, agreeing with e.g. Newell 2008, Embick 2010, but contrasting with the initial view (Chomsky 2000) that complements of phase heads constitute an independent spellout domain. We take no position on the phasal status of the categorisation operation, but it is certainly the case that we take roots to be interpreted only upon categorisation.

[31] A reviewer observes that not all authors take roots to be syntactically vacuous. In particular, Harley (2014) observes that roots are not uniform in their syntactic behaviour, being distinct from one another, in terms of argument selection. It seems to us that the facts that Harley describes need not imply that roots have e.g. c-selectional features in the Narrow Syntax, but could plausibly be accounted for post-syntactically, on the LF branch. As Harley states "Roots, *or more precisely, the intepretations introduced by roots, must have an argument structure*" (emphasis ours). See Borer (2013b), Merchant (2016) for examples of systems in which roots are taken not to select.

or compound. At some point, however, no doubt due in part to the fact that the categorial heads are non-overt, the expression is reanalysed as containing only a single functional head, and the roots reanalysed as immediate sisters. The original order of the roots, however, is retained.

It is worth noting that this path of diachronic change is exactly along the lines we expect from the "markedness conditions" of Roberts and Roussou (2003), Roberts (2007).

(48)   *Feature Economy* (FE)
        Given two structural representations R and R′ for a substring of input text S,
        R is less marked than R′ iff R contains fewer formal features than R′.

It is supposed that a language acquirer will prefer the less marked structure for reasons of computational efficiency. In diachronic change, this means that, other conditions being equal, a construction with underlying structure A will be reanalysed as having underlying structure B, providing B is less marked. In (47), it is clear that the compositional phrases preceding the arrow contain more formal features (at least one additional categorial feature), and consequently are more marked than the items following the arrow which contain only a single categorial feature, by (48). The diachronic reanalysis of (more marked) CCs as (less marked) NCCs is consequently predicted.

What remains to be explained is the synchronic implementation of this ordering relation – how the ordering of the roots, due to the diachronic development of the expression, is stored. In synchronic terms, as we have argued, roots are treated symmetrically in the syntax. Any determination of the linear order must consequently resort to post-syntactic mechanisms. Our proposal is that these orderings are stored in the *Encyclopedia* – as mentioned, reference to the Encyclopedia is required for roots to be interpreted, and we assume (with e.g. Harley and Noyer 2002) that the Encyclopedia has some limited access to phonological information, including linearisation. An Encyclopedia entry for an NCC may include not only the identity of the roots in question, but also a specific linear order, stored in the Encyclopedia due to the diachronic development outlined above – in order for an NCC to be matched to a content unit stored in the Encyclopedia, it must also conform to the linear order specified in the entry.[32]

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[32] A reviewer points out an alternative in models of stem storage (Bermudez-Otero 2013, 2016) or Nanosyntactic models (Starke 2009, Caha 2009). What these models have in common is that they both permit insertion of phonological material in non-terminal nodes. Bermudez-Otero's lexeme entries in particular match complex syntactic structures (in this case, the relevant structure would be the syntactic object composed of two roots) to particular phonological forms and (atomic) semantic structures. This would permit us to achieve the required matching between the proposed syntactic structure, the fixed linear phonological ordering and the atomic meaning we observe. What this loses us, however, is a synchronic explanation of the separate identity of roots in these constructions – the combinations of roots would constitute a single lexeme, and the roots would not be inserted as individual items with, for instance, their own tonal properties. As we argue below, though, there is reason to believe that roots are (usually) individuated in Yixing, and may be combined productively.

3.6 Exocentricity in NCCs

We have analysed NCCs as involving noncompositional semantics, but it is not entirely clear that they are headless, as our analysis in terms of a symmetric Merge operation would suggest. For instance, Hagit Borer (p.c.) observes that while ʃáo-ʃý 'small-book = comic' does not refer to a book that is small, it still does arguably refer to a kind of book. Likewise, while ʃáo-ɲíŋ 'small-person = kid' does not refer to small people in general, it still does refer to a category of person. We suppose that this apparent headedness can be ascribed to the diachronic reanalysis of NCCs from CCs. Our account might be more convincing, however, if we can find examples without such residual effects. In fact, such examples can be found:

(49) a.   mjè 'surface' + kʰɔŋ 'hole' → mjè-kʰɔ̌ŋ 'face' (PS, PE)
            *mjè-kʰɔŋ (PE only)

      b.   zǎ 'greedy' + tʰû 'to spit' → zà-tʰû 'saliva' (PS, PE)
            *zǎ-tʰú (PE only)

Both of the compounds in (49) are NCCs – they both present PS tone sandhi, and they both have non-compositional meaning. Let us consider (49a) first. *mjè* in Yixing means 'surface', while *kʰɔŋ* means 'hole'. The meaning 'face' is clearly not derived compositionally from these roots. Now, the second component of an NCC is in general the putative head, so we would expect *kʰɔŋ* to be the head of the compound meaning 'face'. It is difficult to see, however, how a face could be considered a category of hole. This is likewise the case in (49b), where the literal meanings of the roots *zǎ* and *tʰû* are 'greedy' and 'to spit', respectively. Although there is a semantic relation, 'saliva' cannot be readily defined as a subcategory of the action of spitting.

An interesting piece of evidence for our analysis is the behaviour of the Mandarin term for saliva, *kǒushuǐ* (= mouth-water). This compound is quite transparent, and might therefore be plausibly analysed a compositional construction, with a head on the right. In general, when NCCs are borrowed from Mandarin into Yixing (a very common phenomenon, as one might expect), PS tone sandhi applies, as discussed in the next section. For the (compositional) term *kǒushuǐ* (*kʰôuʃỳ* in Yixing), however, only PE applies, as illustrated in (50).

(50)   kʰôu 'mouth' + ʃỳ 'water' → kʰôu-ʃỳ 'saliva' (PE only)

This lends support to the idea that Pattern Substitution is a good diagnostic of non-compositionality, and that NCCs are distinguished from CCs (at least in part) by a symmetric, headless relation between the roots that form them.

It may be worth considering how the non-compositional reading in these examples is derived. Take *mjèkʰɔ̌ŋ* as an example. The original meaning of the initial root (Yixing *mjè*, Mandarin *miàn*) is in fact 'face' – this is the meaning observed in oldest available texts, such as the Classic of Poetry (composed before 7th century BCE):

(51)   *Wéi guǐ wéi yù, zé bù kě dé.*
       *Yǒu tǐn **miàn** mù, shì rén wǎng jí.*
       Zuò cǐ hǎo gē, yǐ jí fǎn cè.

> If you were an imp or a water-bow,
> You could not be got at.
> But when one with **face** and eyes stands opposite to another,
> The man can be seen through and through.
> I have made this good song,
> To probe to the utmost your veerings and turnings.
> (Classic of Poetry, Ode 199, verse 8, translated by Legge 1871)

The second root (Yixing $k^h\hat{o}\eta$, Mandarin $k\check{o}ng$) may refer to orifices, and formed a dvandva compound with *miàn*, yielding *miàn-kǒng* 'face-and-orifices', which is used to refer to someones general appearance. At some point, we can assume, this latter non-compositional meaning is stored, and later narrowed to refer specifically to the face. The meaning 'surface' arose through metaphorical extension (cf. a parallel process in English, whereby we speak of the 'faces' of a polyhedron), and the original meaning was later lost (though it survives in some Southern varieties of Chinese). The compound predates the narrowing of the meaning of *miàn/mjè* in isolation to 'surface'. The earliest citation of the compound in the *Hanyu Da Cidian* is from the Tang dynasty:

(52) *Wénshù **miànkǒng** bù shì húsūn, húsūn **miànkǒng** qiáng sì Wénshù.*
       'Wenshu doesnt look like the monkey (lit. his face is not like the monkey's), the monkey looks better than Wenshu.'

We can suppose that the availability of a non-compositional encyclopedia entry allowed this compound to be reanalyzed (through the process discussed above, and in some detail in 5) as an NCC. This, in combination with the change in meaning of *mjè*, resulted in the present state of affairs. The development of *zàt^hû* 'saliva' follows a slightly different path. This can be identified with the rare Written Chinese compound *chántuò*, where Mandarin *tuò* is a noun meaning 'saliva' (now lost in Yixing), and Mandarin *chán* (Yixing *zǎ*) is the adjective 'greedy, gluttonous', so the compound *chántuò* can be analysed compositionally meaning 'greedy saliva' (i.e. the saliva that arises from gluttony) – this and parallel constructions are attested in the *Hanyu Da Cidian*, including *chánshuǐ* 'greedy-water'. This compound was then bleached to acquire an atomic meaning, referring neutrally to saliva in general. At some point, presumably after *tuò* was lost as an independent noun, we can assume that the vowel of the second root was altered, perhaps by analogy, leading to the identification of the second root with that of the verb *tǔ* 'to spit' (the expected Yixing cognate of Mandarin *tuò* is *t^hŏ*, as opposed to the verbal root which we see here: Mandarin *tǔ*, Yixing *t^hû*).

In both these cases, diachronic changes have caused the meanings of these compounds to become opaque and left them without an obvious head.

3.7 Why Roots?

We have shown that NCCs are semantically atomic, syntactically opaque and phonologically fused, and so we might well ask why we require these constructions to be

composed of separate roots at all. We could instead simply analyse NCCs as indivisible lexical (or vocabulary) entries, with no internal structure whatsoever. The answer lies in creative linguistic processes which result in the introduction of new NCCs into the language.

At this stage it may be worth noting some conditions which permit the existence of an NCC – there are, broadly speaking, two issues at play: a) Narrow-syntactic derivability and b) Syntax external considerations, including the availability of a corresponding Encyclopedia entry (as discussed in section 3.4). Given our framework, the first issue here is quite straightforward: all roots may be freely selected to form unbounded NCCs – there is no narrow-syntactic constraint on their length. Syntax-external considerations include the diachronic derivability of an NCC from an earlier phrase, but also the availability of a permissible atomic interpretation of an NCC – a condition which depends on real world knowledge. We would ideally want to find a situation, besides the diachronic development discussed above, which permits free Merger of roots in Yixing to form an NCC, corresponding to a newly created Encyclopedia entry. We expect PS tone sandhi to always apply in these cases, and since the NCC in question will not be diachronically derived from an endocentric construction, the linear order of these NCCs is expected to be arbitrary. This ideal condition is in fact found, in the coining of personal names.

Chinese given names are typically disyllabic, one syllable of which is often shared between members of the same generation, while the other is chosen relatively freely. Generally speaking, both these syllables would, under our account, already exist as roots in the language, and are chosen for their meaning. When these syllables are combined, they act as an NCC, with noncompositional semantics (referring, of course, to the bearer of the name), opaque syntax, and pattern substitution tone sandhi. As an example, consider a name in Yixing which is composed of two syllables, namely *ʃɔ́(ʔ)*, which in isolation refers to the rising sun, and *xwáe*, which means 'brightness'. In combination, they are pronounced *ʃɔxwáe*, with PS tone sandhi.[33] The ordering of roots in names is arbitrary – the name *dʑèlɔ́n* (composed of roots *dʑɛ́(ʔ)* 'hero' and *lɔ̌n* 'order') would be an equally permissible name if the order were reversed (*lɔ̀dʑɛ̌*). Since a combination in a given name may not have existed prior to the birth of the bearer of the name, speakers must have some way to form it and arrive at the correct tone sandhi patterns – the root Merge process discussed above is the obvious candidate.

The second process which points to the reality of roots is the treatment of borrowed words from other varieties of Chinese, primarily Mandarin Chinese. Mandarin terms are not borrowed as opaque items into Yixing, but rather calqued using lexical material from Yixing. As an example, consider the Mandarin place name *jiànqiáo* [tɕjêntɕʰjǎo] 'Cambridge'. With the exception of the nasal final in the first syllable, this is a phonotactically well-formed word in Yixing. It is, of course, an NCC – the meaning derived from the pairing of these two roots is purely conventional, not dependent on their semantic content. The form that surfaces, however, is not a simply

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[33] Note that the vowel of *ʃɔ́ʔ* is not realised in as [o] in NCCs such as the name *ʃɔxwáe*, as might be expected from the alternations illustrated in (12). This is because the vowel here is underlyingly /ɔ/, not /o/. These two vowels are neutralised to [ɔ] in checked syllables, but surface in their underlying form when the glottal stop is deleted internal to an NCC.

minimally modified transfer of the Mandarin form, but is borrowed according to the following process:

(53)

   i)   Identify the roots forming the Mandarin word with their Yixing equivalents.
        M. *jiàn* → Y. ʨɛ̥̃, M. *qiáo* → Y. ʨ̊ǎo

   ii) Recombine the two roots as an NCC.

   iii) Form prosodic constituents, apply phonological processes, including Pattern Substitution sandhi:
        ʨɛ̥̃+ʨ̊ǎo → (_ω_ʨɛ̥̃ʨ̊áo)

It is also relatively straightforward to find coinages and borrowings which are not proper names – recent examples include words for electronic devices. For instance, the roots *djè* 'electric[ity]' and *nǎo* 'brain' can be composed as an NCC *djè-nǎo* 'computer'.[34] Besides calquing and name coinage, there are other productive processes which produce combinations of roots which undergo PS sandhi – one process closely related to name coinage is the formation of hypocoristics. It is possible to form a hypocoristic from a given name by taking the second syllable (which is also a root) of the name and applying the prefix ə- to that syllable. A name ending in the root *ɲǒu* 'cow', for example, may have the hypocoristic form *ə́ɲóu* (Never *ə́ɲòu*, without PS sandhi).[35] Surnames may be prefixed by the elements *lǎo* 'old' and *ʃâo* 'small', which again undergo PS sandhi. The common Chinese surname Hú (Yixing *wǔ*) may be prefixed with *lǎo* to yield *làowǔ* or with *ʃâo* to yield *ʃàowú*, both displaying PS tone sandhi. We do not find the forms **lǎowû* or **ʃâowù*, without PS sandhi.

A final productive domain of PS tone sandhi may be found in abbreviations. For example, abbreviations of university names are typically created by combining the first syllable of the University name with the root *dò* 'big' (a clipping of *dòjɔ̌ʔ* 'university (=big + study)').[36]. PS sandhi applies to the result. For example, Peking University (*b̥ɔ́ʨíŋ dòjɔ̌ʔ*) is abbreviated *b̥ɔ̂dǒ*, with PS sandhi, never **b̥ɔ́dò*, without PS sandhi.

If we do not assume the reality of roots and the merger process discussed above, it is not possible to account for coinages and borrowings such as these. Since root merger is independently required, then, it seems to be an additional stipulation to restrict it only to the contexts mentioned in this section. As such we will continue to assume that it applies to all NCCs (defined as elements which satisfy the diagnostics above). This may not be altogether correct – a reviewer points out that there are various cases in which individual monosyllabic roots in a polysyllabic word cannot be identified. Since such polysyllabic words are possible, it is not clear that all

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[34] An alternative composition of these is available, namely *djè-nào*. This is a *compositional* compound where PE sandhi, but not PS, applies. It has a more general meaning of 'electronic brain', which can also be used narrowly refer to computers.

[35] This happens to be the Yixing rendition of the stage name of Malaysian-Chinese singer Tan Kheng Seong.

[36] In more 'Mandarinised' speech and expressions, this root may be pronounced *dà*.

forms which are diachronically composed of two elements are synchronically analysed as such. Criteria for distinguishing these from ordinary NCCs are not readily found, though one such criterion might be irregularity in tone patterning, meaning that the tone pattern of the whole word is not decomposable into the underlying tone categories of two roots. We see this, for example, in the undisputably monosyllabic word (borrowed from Tibetan via Mandarin) *làmǎ* 'lama', which is borrowed with its tone pattern preserved from Mandarin – we do not generally see the pattern **lǎmà*, which is what we would expect if the individual Mandarin syllables were calqued and underwent ordinary tone sandhi processes. This sort of phenomenon could act as a one-way diagnostic for atomic word status.

Another possible diagnostic may be found by considering certain reduplication processes in the language. For example, *delimitative* aspect in verbs is expressed through reduplication in Yixing (as it is in Mandarin). We see *kʰʒ* 'look' but *kʰʒ-kʰʒ* 'take a look'. If a form is polysyllabic, either the whole form may be reduplicated, or a single syllable may be reduplicated. In the latter case, NCCs appear to behave differently to unanalyseable atomic polysyllables. For instance, the delimitative form of the NCC *kʰŭn-gâo* 'sleep' (= *kʰŭn* 'sleep (v.)' + *gão* 'sleep (n.)') is *kʰŭn-kʰûn-gào* 'sleep a little', with reduplication of the first syllable. This seems to be the general pattern for NCCs. Unanalysable polysyllables, however, seem to reduplicate their second syllable. Hence *bə̀ʃăŋ* 'play', which cannot be broken down into roots, has a delimitative form *bə̀ʃàŋ-ʃăŋ* 'have a play'.

Similar distinctions can be seen in child-directed diminutives in nouns. Here NCCs reduplicate their second syllable, whereas atomic polysyllables may not reduplicate at all. Hence we see forms derived from NCCs like *ʃàoɲíŋ-ɲíŋ* 'child (dim.)', or *ʃɔxwáe-xwáe* (diminutive of the personal name discussed above). But reduplicated diminutives of atomic polysyllables like *bùdǎo* 'grape' or *ódjào* 'bird' are impossible.

The extent to which these phenomena are reliable diagnostics of atomic word (as opposed to NCC) status remains unclear, however, and more research is required.

3.8 Brief Typology of Constructions

While we analyse NCCs as an essentially unitary class, with a shared structure, our label CC represents a rather disparate class of structures, defined primarily by failing to meet the criteria of an NCC. It may therefore be useful (following the suggestion of an anonymous reviewer) to briefly outline a typology of constructions discussed in this paper, and to illustrate the structures we assume for them.

First, we assume three sorts of structures which constitute a single phonological word, namely NCCs, Root + categoriser combinations, and (overtly) monomorphemic words.

We suppose (non-functional) monomorphemic words and Root/categoriser combinations to share a structure – the only difference is that the categorising morpheme in monomorphemic words is not realised phonologically. The structures of the root/categoriser combination *ʤɔ-dzɔ́* 'aubergine' and the monomorphemic form *bùdǎo* 'grape' are shown below.

(54)   a.

$$n$$
$\sqrt{aubergine}$ n
$\textit{tʂɔ}^{IB}$ $\textit{dzə}^{IIA}$

b.
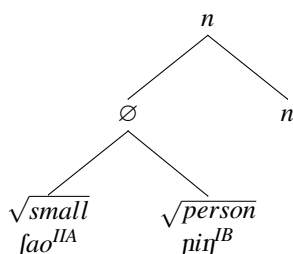
$$n$$
$\sqrt{grape}$ n
$\textit{bùdǎo}$ $\varnothing$
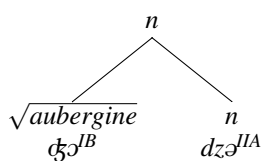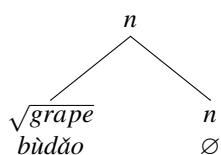
NCCs differ from these constructions only insofar as they contain multiple roots
– this is illustrated below with the form *ʃào-ɲíŋ* 'child', formed from the roots *ʃâo*
'small' and *ɲǔŋ* 'person'.

(55)

$$n$$
$\varnothing$ n
$\sqrt{small}$ $\sqrt{person}$
$\textit{ʃao}^{IIA}$ $\textit{ɲiŋ}^{IB}$

In principle, an NCC could have a more complex structure. Consider the verbal NCC *mà-dòŋ-sǐ* 'go shopping'. This seems to be made up of two components – *ma*^{IIB} 'buy' and *dóŋ-sí* 'thing'. The word *dóŋ-sí* 'thing' in turn is made up of two components, namely *doŋ*^{IA} 'east' and *si*^{IA} 'west'. We might, then, posit the following structure:

(56)

$$v$$
$\varnothing$ v
$\sqrt{buy}$ $\varnothing$
$\textit{ma}^{IIB}$
$\sqrt{east}$ $\sqrt{west}$
$\textit{doŋ}^{IA}$ $\textit{si}^{IA}$
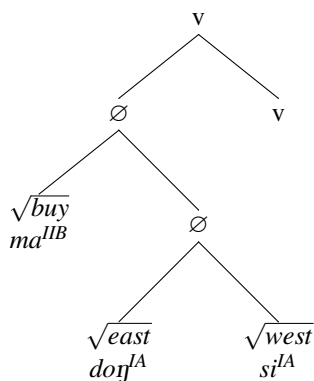
Unfortunately it is difficult to be sure of the precise structure, because tone sandhi in Yixing, unlike some other Wu dialects such as Danyang (Chan 1991), does not

show any sensitivity to branching direction in the syntax. Hence while it is plausible that *mà-dòŋ-sǐ* 'go shopping' has the structure in (56), this is not readily tested.

NCCs can be identified as any structure which satisfy all the diagnostics in (26). We use the term CC as a catch-all label for those constructions which do not satisfy all the relevant diagnostics. They may, however, satisfy *some* of these diagnostics – for example, idioms may display non-compositional semantics, but be otherwise compositional – some examples of CCs which show idiomatic semantics are discussed in Section 5. What CCs have in common, under our analysis, is that their structures contain multiple functional heads.

For example, the CC *wɔ̀ wâe* 'learning association' is an V-N compound. This can presumably be represented as the result of merging a categorised verb with a categorised noun, with the noun as head.
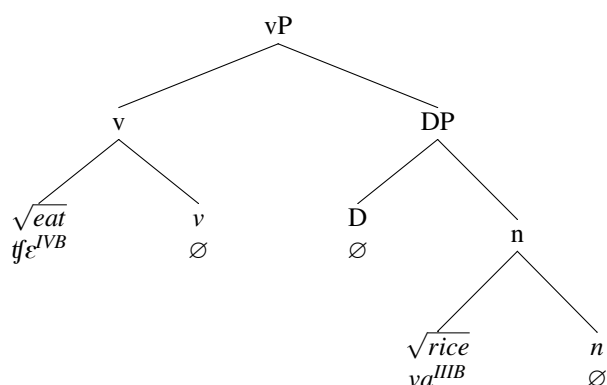
(57)
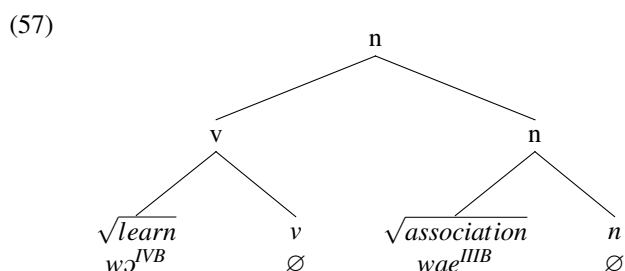
Here, we see that the structure contains multiple functional heads – specifically, the two categorising heads *v* and *n*.

Evidence for the presence of categorial heads here comes from the fact that the initial component of V-N compounds like these cannot be readily coordinated or contrasted with the initial component of N-N compounds. While one can coin forms like *wɔ̀ dôŋ làodóŋ wáe* 'learning and labouring association', where both initial components are verbs, it is not possible to say something like **wɔ̀ dôŋ sáŋ wáe* (Intended: 'learning and business association'), because *sáŋ* 'business' is a noun.

The components of N-N compounds are also readily coordinated with one another – consider the phrase *ò dǒŋ xâe ʃỳ* 'river and sea water'. Note that in this case neither *o*[IB] 'river' nor *xae*[IIA] 'sea' may undergo PS sandhi, in spite of the fact that in isolation 'seawater' may be rendered either as *xâe ʃỳ*, without PS sandhi, or as *xǎe ʃỳ*, with PS sandhi. We can ascribe the impossibility of PS in coordinated forms like this to to the presence of multiple functional heads, which are necessary to permit coordination, and which also block PS sandhi. Examples like this last case, where a particular construction may either be treated as an NCC or not, are not infrequent in Yixing, particularly where the meaning of the compound is close to the compositional meaning. This will be dealt with in some more detail in section 5.
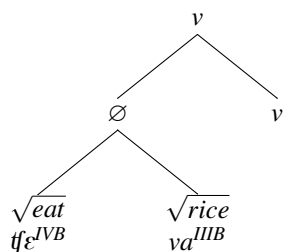
Another type of CC we have discussed is the verb phrase – take, for example, the phrase *ʧɛ̀ vâ* 'eat rice'. This can be taken to have something like the structure shown below:

(58)

$$
\begin{array}{c}
\text{vP} \\
\diagup\;\diagdown \\
\text{v}\qquad\qquad\text{DP} \\
\diagup\diagdown\qquad\qquad\diagup\diagdown \\
\sqrt{eat}\quad v\qquad\quad\text{D}\qquad\text{n} \\
\textit{tʃɛ}^{IVB}\;\;\varnothing\qquad\varnothing\;\;\diagup\diagdown \\
\sqrt{rice}\quad n \\
\textit{va}^{IIIB}\;\;\varnothing
\end{array}
$$

Here we have not only multiple categorisers, but also a D head, and presumably (though not shown here) other functional heads in the nominal extended projection. The corresponding NCC *tʃɛ vǎ* 'dine', on the other hand, is simply made up of two roots, subsequently merged to a single verbal categoriser.

(59)

$$
\begin{array}{c}
v \\
\diagup\;\diagdown \\
\varnothing\qquad\quad v \\
\diagup\diagdown \\
\sqrt{eat}\quad\sqrt{rice} \\
\textit{tʃɛ}^{IVB}\;\;\textit{va}^{IIIB}
\end{array}
$$

In principle, our CC category could subsume any kind of phrasal material – those which interest us here, however, are those which are superficially most similar to NCCs, and we limit our discussion to those.

4 Assignment of Non-Compositional Content

Root merger provides a good explanation for the syntactic properties of NCCs, but we have not addressed the issue of semantic non-compositionality in detail. We propose that this can, at least in part, be accounted for using results from Borer (2013a,b) based on her XS (eXo-Skeletal) model.

One important cross-linguistic question concerns the size of the domain to which non-compositional content may be assigned. One proposal (Arad 2003; Embick and Marantz 2008; Embick 2010) is that it may only be assigned to material within the domain of the first categorisation:

(60)   "The combination of [a] Root-attached [categorial head] and the Root might yield a special interpretation. When attached in the outer domain, the [functional heads] yield predictable interpretations" (Embick and Marantz 2008, 11)

However, Borer (2013a,b) shows quite convincingly that atomic content may be borne by a larger domain – as a simple example, consider the English word *natur-al-ise*, which contains two categorisers: an adjectivaliser *-al* and a verbaliser *-ise*. Following Embick and Marantz's formulation, while a non-compositional meaning might be borne by *natural*, *-ise* should combine compositionally with a previously categorised item. This is not what we see, however – *naturalise* has a non-compositional sense, meaning 'to make *x* a citizen', even though the adjective *natural* does not, in current English, refer to the state of possessing citizenship.[37] In fact, the behaviour of Yixing NCCs is equivocal between these two positions, but given the crosslinguistic evidence that atomic content can be assigned to a domain larger than that of first categorisation (though see e.g. Marantz (2013) for some suggested ways to account for this), we tend towards taking Borer's position. However, as we will show, the domain of first categorisation does still play a role in the assignment of non-compositional semantics.

We briefly outline the essential points of Borer's analysis here: Borer proposes (with Marantz 1997) that there is a reservoir of atomic content units, termed the Encyclopedia – discussed briefly in section 3.5. The language faculty provides a mechanism for "recognizing strings of a particular size and matching them with individual Content units" (Borer 2013a: 418). That is, the linguistic system can launch a single *encyclopedic search* (en-search), which can match an atomic content unit to some qualifying domain. All non-compositional semantic content is an atomic content unit of this type. Borer proposes that the domain is restricted by functional structure. Specifically, she suggests that the boundary of the qualifying domain for non-compositionality of this sort is a functional node in the extended projection (i.e. projections of T, Asp, D).

At this point it is worth discussing how this approach may interact with the proposals of Chomsky (2013, 2015) concerning labelling. When combined with Borer's proposals concerning *en-search*, they provide further support for our analysis. Chomsky's central point here is that labelling facilitates interpretation. As we mentioned in section 3.5, Chomsky (2015) suggests that roots are too weak to serve as labels – we take this to mean that they are not individually interpretable at the C-I interface, and consequently cannot initiate *en-search* and do not have access to atomic content units stored in the Encyclopedia. Now, our analysis implies that an NCC initially involves the Merger of two roots – but the result of this is still ∅-labelled.[38] In order to have access to information for the purpose of C-I interpretation, a categoriser (or at least, some functional head) is Merged with this ∅-labelled structure and provides a label. It is only at this stage that the syntactic object (the result of two instances of Merge, one between roots and one with a categoriser) is able to access the atomic content stored

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[37] A reviewer observes that *natural* does have a meaning related to citizenship, as in the phrase *natural citizen*. This is, however, a different meaning to the one expressed in *naturalise* – naturalisation *does not* render one a natural citizen: indeed, a natural citizen is by definition one who has not undergone the process of naturalisation. It is infelicitous to say #She was made natural through naturalisation – the term *natural* in the verb *naturalise* has semantics which are not borne by the adjective in isolation.

[38] It is worth observing here that we suppose a difference between a structure which is unlabelled because labelling is ambiguous and an unambiguously ∅-labelled structure. The former, we suppose, are illicit and cause the derivation to crash, whereas the latter, while lacking an individual interpretation, are nonetheless licit syntactic objects.

in the Encyclopedia. The result of a root Merge alone, without a categoriser, can never have compositional meaning, because it lacks an interpretable label. One thing that follows straightfowardly from this is that the domain of first categorisation is the lowest domain to be qualified for the assignment of atomic content. This account also captures some observations made by Arad (2003) concerning the semantics of domains where a functional head is Merged to a bare root, in contrast to those where the lexical item is already categorised. The former show a good deal more semantic variation than the latter, since their semantics are imposed non-compositionally at categorisation, in agreement with the model outlined here.

Above we contrasted the predictions of Borer's XS model to the model of interpretation and its relation to the syntactic cycle proposed by Embick and Marantz (2008). The latter takes the domain of first categorisation to be the *only* domain to the assignment of non-compositional semantic content, readily refuted by examples like *naturalise*, as shown above. We might naively expect that a compound consisting of two roots, such as the NCCs we discuss here, could bear compositional semantics – but, as the discussion above shows, there are principled reasons to reject such an analysis. This seems to be confirmed by the Yixing data. In other varieties, such as Mandarin, it would be difficult to determine whether a compound consists of two fully categorised items or two uncategorised roots, since for the most part there are no overt categorisers. Thanks to the tone sandhi patterning of Yixing, however, we can detect categorisation, as that forms the domain of PS tone sandhi. We find that if a string is to indicate compositional meaning, it will never display PS tone sandhi, as in (4b). Conversely, if a string displays PS sandhi,[39] it will never have compositional meaning, as in (4a).

(61)   dò (gò)gǒ (with PS)
         big brother
         'eldest brother'

(62)   dò gógō   (no PS)
         big brother
         '[elder] brother who is big'

We can thus hypothesise that a categorial head does indeed have a role to play here – in addition to its syntactic role in categorisation, it also plays an important semantic role, delimiting the domain within which content cannot be compositionally derived. In languages such as Yixing where phonology is sensitive to these domains, it is clear that processes such as tone sandhi are not only of interest for what they tell us about the phonology-syntax interface, but that they can also indirectly provide information concerning the interaction between syntax and semantics. It is worth noting that Borer (2013a) also stipulates that a single root may not be associated with atomic content, and it naturally follows that the combination of two roots cannot

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[39] Note that there is a possibility here that has not yet been discussed in detail, but is permitted given our formulation – namely, that a phrase exhibits non-compositional semantics, but does not undergo PS tone sandhi – in which case the non-compositional content is assigned to a domain larger than that of first categorisation, in agreement with Borer's analysis. Examples like this include *ʧʰɛ̀ ʤâ* 'eat+alcohol = attend a wedding'.

result in a compositional interpretation, since there is nothing to compose. But Borer's account on its own requires further explanation: why does a root lack atomic content? Our analysis, which combines Borer's notion of *en-search* and the labelling algorithm of Chomsky (2013, 2015), fills this gap – because a root does not have an interpretable label, it cannot be interpreted by the C-I interface so as to trigger *en-search*.

5 Residual Issues

As discussed at the end of section 2.1, if NCCs are the result of root merger and are consequently treated as atomic items in general, we do not expect the sub-components within an NCC to be separable. Although this prediction does hold in many, if not most cases, there do seem to be exceptions, which might seem to present a problem for our analysis. We will account for this possibility later in this section, but first illustrate the existence of *inseparable* NCCs.

The data in (63), (64)[40] and (66) show that when the sub-components of a typical NCC are separated, either the non-compositional meaning will be replaced by a compositional one, or the whole construction becomes uninterpretable. Let's first consider nominal NCCs of the 'A+N'[41] type . When the 'adjectival' and 'nominal' roots are separated with a linking morpheme like the adjectivaliser *lao* or the more general attributive particle *gə*, the construction is interpreted as nominal phrase with compositional meaning.

(63)

    a)   ʃào   ɲíŋ
           small person
           'child' (*small person)

    b)   ʃào   láo   ɲíŋ
           small ADJ person
           'small person'

(64)

    a)   ɔ̀ŋ xwǒ
           red flower
           'safflower' (*red flower)

    b)   ɔ̀ŋ lâo xwɔ̀
           red ADJ flower
           'red flower'

For V+N type NCCs, we can test separability with the insertion of the aspectual particles *lə*, *dzə* and *go*, which typically follow the verb immediately.

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[40] As Paul (2005) observes, the inseparability of the components in this example also holds in Mandarin – evidence that the notion of NCC we adopt here is not restricted to Yixing.

[41] This label is purely a convenience and does not have any theoretical import here. Where we refer to 'A', 'N' and 'V' roots, we simply mean roots which, when used outside NCCs, typically fall into the relevant category without requiring overt affixation.

(65)   ŋŏ zŏɲɛ́   ʧʰɛ̀ lɔ̂ sá   bāe dzɔ̀
       1SG yesterday eat ASP three CL   tea
       'I drank three cups of tea yesterday'

In the above example, the particle *lə* can follow the verb, separating it from the object. But the intervention of aspectual particles between the putative 'verb' and 'object' is impossible for the 'V+N' NCCs. These particles can only *follow* the whole NCC.

(66)

a)   tʰɔ gáe-dɔ̊́   láo
     3SG own-money ASP

     'He is rich'

b)   tʰɔ gáe-dɔ̊́   gó má
     3SG own-money ASP Q

     'Has he ever been rich?'

c)   *tʰɔ gáe gó dɔ̊́   má
     3SG own ASP money Q

     Intended: Has he ever been rich?

The form *gáe dɔ̊́* 'be rich' is an NCC with non-compositional meaning and PS tone sandhi. In 66, it is shown that the root *gáe*, which otherwise generally functions a verb, cannot be followed by the particle *g̊o*, as is shown in (66c), and which can only follow the whole NCC, shown in (66b). The behaviour of the aspectual marker *go*, then, further supports the assertion that NCCs like *gáe dɔ̊́* act as atomic lexical items instead of phrases.

Finally, let us consider 'N+V' type NCCs. At first sight, such NCCs appear to be predicate phrases, with the first component acting as the subject and the second component as the predicate .

(67)

a)   ɲō   mǒ
     flesh tingle
     'disgusting'

b)   dòu tʰôŋ
     head hurt
     'upset'

All the above examples exhibit PS tone sandhi, and their meanings are non-compositional. While there seems at first sight to be a predicative relationship between the two sub-components in the above NCCs, the meaning of the whole construction is *not* the result of composition of a subject and a predicate. For example

(67a), should, if interpreted compositionally, mean something like 'for flesh to tingle', but in fact the meaning here is simply 'disgusting', which serves as a single predicate which may take an external subject. To test the separability of such NCCs, the best way is to see whether the second component can be preceded by a negator. If a predicative relationship really is involved, then we would expect the predicate to be negateable. This however, is not permitted. In order to obtain a negative sense, we must place a negator before the whole compound. This is illustrated in (68) .

(68)

    a) gɔ́ dāo ts^{h}àe fɔ́ ɲō-mò
        th̥is CL dish NEG flesh-numb

        'This dish is not disgusting'

    b) *gɔ́ dāo ts^{h}àe ɲɔ̀   fɔ́   mò
        th̥is CL dish flesh NEG numb

        Intended: 'This dish is not disgusting'

While the above data supports our assertion that NCCs are inseparable and treated as atomic items, there is evidence that some NCCs do allow for separation of their subcomponents, while still maintaining non-compositional meaning. This seems to be particularly frequent in the case of verbal 'V+N' type NCCs. For instance, the 'N' component can be independently fronted, and the 'V' and 'N' can be separated by aspectual markers. Consider, for example, the NCC ʧɛ̀ vǎ 'dine (=eat+rice)':

(69)

    a) ɲǐ   và ʧ^{h}ɛ̀ má
        2SG rice eat Q

        'Have you eaten rice?' OR 'Have you dined?'

    b) ŋó ʧ^{h}ɛ̀ dzâ và lè
        1SG eat ASP$_1$ rice ASP$_2$

        'I've already eaten rice' OR 'I've already dined'

We can see the same behaviour with the NCC ɲè ʃỹ 'study (=read+book)'.

(70)

    a) ɲǐ ʃý ɲè gò má
        2SG book read ASP Q

        'Did you ever study' OR 'Have you read the book?'

    b) ŋó mɔ́ ɲē gò ʃý
        1SG NEG read ASP book

        'I have never studied' OR 'I have never read the book'

The way we account for the separability of certain NCCs, such as those just discussed, relies on our diachronic analysis in section 3.4. In particular, we propose that most NCCs develop from phrases with compositional meaning. Here, we further hypothesize that an NCC may develop from a phrase in three stages.

(71)
           1. Phrase with compositional meaning
                       ↓
        2. Phrase with (optional) idiomatic meaning
                       ↓
          3. NCC with non-compositional meaning

When a chunk moves into the second stage of this process, it receives an idiomatic meaning, stored in Encyclopedia. Syntactically, however, this subcomponents of this chunk remain accessible, and may still contain functional heads such as categorisers. This is in line with the analysis by Nunberg et al. (1994), whereby idioms are syntactically transparent. The presence of functional categories, however, means that a chunk in stage 2 may not have PS tone sandhi – the root merger structure is not present at this point. The creation of an idiomatic encyclopedia entry, however, prepares the ground for the transition to stage 3: the presence of a non-compositionally derived meaning means that the categorial heads are no longer necessary for semantic interpretation, and the Feature Economy Principle in (48) may lead to the reanalysis of the chunk as involving a simple merger of roots – that is to say, an NCC.

Given the hypothesis above, it is reasonable to suppose that in the transition from Stage Two to Stage Three, a chunk involving the same combination of roots might permit two structures to map to a single idiomatic meaning in the Encyclopedia. It is only later that certain idiomatic readings are *restricted* to NCCs. A combination of roots such as ʧɛ̌+và, then, may have multiple structures – one phrasal, in the sense that it involves functional categories, not simple root merger, and one acting as an atomic lexical item (i.e. an NCC). This multiplicity of structures is indicated by the fact that an idiomatic reading may be obtained even in the absence of PS tone sandhi: ʧɛ̀ vâ, with PE sandhi alone, may mean 'dine' as well as 'eat rice'. The phrasal structure has syntactically accessible components, which may be separated from one another, as above. The difference between a phrase and an NCC here is that a phrase is always *ambiguous* – it may have an idiomatic reading, or it may not. Given our analysis in the preceding section, however, NCCs *may not* have compositionally derived meaning. This gives us a prediction, then – where an NCC is apparently separable, what are actually being separated are the components of an idiomatic phrase. In this case, we should always have an ambiguity between compositional and idiomatic interpretations. As far as we can tell, this is indeed always the case, as in the examples above.

6 Conclusion

Based on the Yixing data, we make two theoretical proposals: first, that two roots can undergo symmetric Merge,[42] which, as we demonstrate, should be allowed by current assumptions in Minimalist syntax – although this kind of symmetric Merge

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[42] This representation, as a reviewer observes, is also adopted by Newell and Piggott (2014) for certain compounds in Ojibwe. This structure is also adopted by Lowenstamm (2014) for the combination of lexical roots and 'Level 1' suffixes (both of which are treated as roots by Lowenstamm).

has been taken to be impossible in some previous studies (e.g. De Belder 2011, De Belder and van Craenenbroeck 2015), it poses no difficulty for notions such as labelling. This symmetric Merge operation leads to an underdetermined linear order: we explain the observed linear order in terms of diachrony, resulting from the reanalysis of originally compositional phrases. Semantically speaking, root Merge of this type results in a compound without compositionally derived meaning – a conclusion which is compatible with, and lends support to proposal of Borer (2013a) that the domain preceding the Merger of a functional category in an extended projection may be assigned atomic content.

We take the possibility of symmetric Merge between roots to be universal, i.e. permitted by UG. Special properties, however, are required in order for the operation to apply in a given language. In Chinese languages, each root has an independent phonological form, which may generally be used in isolation (given the right circumstances). But this is not true, for example, in most Indo-European or Semitic languages, where roots may only be realised in concert with inflectional morphology. This accounts, we argue, for the absence of an analogue of the NCC in languages such as French – this is not to say that a language like French does not assign non-compositional content to expressions in the language, but this content is ascribed in the manner of idioms, such that the non-compositional expression always stands in an ambiguous relationship with a corresponding compositional expression. As an illustration, consider the expression *chemin de fer*. This has both a non-compositional meaning (meaning 'railway') and a literal, compositionally derived meaning ('road of iron'). Our approach predicts that in languages where non-compositional expressions contain functional material (e.g. case markers, tense markers, prepositions such as *de* in the example above, and many other items), they will always stand in an ambigious relationship with a corresponding compositional construction. We can consequently suppose that NCCs of the type discussed here will be restricted to relatively isolating (and perhaps agglutinating) languages.[43]

A general take-home message can be drawn from the fact that neither the syntactic facts of Yixing nor the phonological facts would be individually comprehensible without considering the other. The intricate relationship between syntax, phonology and semantics in the language requires us to take all these linguistic systems into account simultaneously – a situation which is by no means limited to Yixing, and which provides a reminder of the virtue of venturing out of one's subdisciplinary comfort zone. We can also note that the conclusions we reach here could not have been obtained on the basis of Standard Mandarin, but that we can readily apply our results to it. This speaks against a 'standard-centric' approach to linguistics – non-standard varieties have much to tell us about standard languages and about language more generally.

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[43] Examples of agglutinating languages which display similar phenomena include Central Tibetan languages – Perry (2016). Another example of a non-isolating language which has compounds which pattern similarly NCCs is Dutch, as discussed by De Belder (2017), who proposes a similar structure to our NCCs, albeit as part of a rather different analysis – note that, importantly, the compounds in question are forbidden to contain functional elements.

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