Hakka Noun Phrases—A Bidirectional OT Approach on Hakka Relative Clauses[*]

Yu-Ching Tseng
Tamkang University

This paper discusses the structure of two types of relative clauses, restrictive and non-restrictive, and provides an OT approach grounded in Weak Bidirectional Optimization to account for the syntactic construction of both types of clauses. The paper will show that while the Hakka basic NP structure favors the head to be positioned at the right edge, it is through the OT model of constraint interaction that different ordering patterns can be generated as grammatical outputs for a given input meaning. The first part of the analysis will explain the data by proposing constraints from the production-oriented perspective, as their ranking successfully yields the correct results in a unidirectional OT model. However, in the second part of the analysis, when the data grows more complex and requires syntactic and semantic distinctions between restrictive and non-restrictive relative clauses, the explanatory power of a unidirectional approach turns out to be limited. We find the necessity to adopt a bidirectional model, in which a form-meaning combination can be evaluated as a pair. Moreover, the fact that this innovative OT allows a recursive version of evaluation provides the possibility to generate optimal outputs successively for the two distinctive types of relative clauses under a single constraint ranking.

Keywords: Hakka, noun phrase, relative clause, bi-directional OT

1. Introduction

In this paper I provide a Bidirectional Optimality Theoretic approach (Bi-OT) (Blutner 2000) to account for the structure of Hakka relative clauses. The classic unidirectional OT approach (Prince and Smolensky 1993) assumes a one way optimization from the perspective of either production or interpretation, depending on whether the implementation occurs in the syntactic or semantic domain. The unidirectional approach determines the grammaticality of an expression through the process of competition, in which a grammatical expression must compete with other alternative expressions and prove that it is better than or equally as good as other alternatives.

This paper demonstrates an empirical difficulty of the unidirectional OT when an asymmetric relationship is found between form and meaning, or input and output. The difficult case is observed in the Hakka syntax when we need to pair the syntactic forms of restrictive and non-restrictive relative clauses appropriately with their semantic meanings. In this case we need to build an association of three distinctive

grammatical forms with two semantically similar meanings under one single grammar. This paper demonstrates that an appropriate division for the form-meaning correspondences is impossible with simply a one-way unidirectional analysis. Instead, the paper argues that the difficult case can be solved by proposing a bidirectional approach, which differs from the traditional version in a few different ways. In this approach the candidates to be considered are form-meaning pairs, with the optimal output being the most harmonic pair. The optimization process is cyclic whereby an input may be recoverable from the optimal output if the optimization yields form-meaning asymmetries. As I will show, the Hakka facts support the bidirectional version of OT optimization, where the bidirectional account predicts correct grammatical forms for restrictive and non-restrictive meanings through two rounds of optimization based on one set of constraint ranking. In addition, this paper shows that the merits of Bi-OT allow the pairing of marked forms with marked meanings and unmarked forms with unmarked meanings, arguing for a very strong innovation for the OT architecture in its potential to solve the difficult cases under the classic OT.

The organization of the remaining sections of this paper is as follows: section 2 gives a brief sketch of Hakka nominal constructions, in which the basic construction of noun phrases and other prenominal modifiers are described as right-headed. Section 3 discusses the structure of relative clauses in Hakka. This section proposes that restrictive relative clauses in Hakka are formed by left-adjoining relative modifiers to their NP's. As to their non-restrictive counterparts, relative modifiers either right-adjoin to their NP's, or left-adjoin to the lower N-bars. In this section a Bi-OT approach will be developed to capture the grammar of these two types of relative constructions in Hakka. Section 4 summarizes the approach and provides theoretical remarks on the specific Hakka syntactic structure at issue. Finally, section 5 concludes the paper.

2. Hakka nominal constructions

2.1 Classifier phrases

A Hakka noun phrase consists of at least a bare noun, which is an independent syntactic unit immediately dominated by a non-phrasal node in the syntactic tree.[1] Examples are shown below in (1), where each bracket represents a bare noun:[2]

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[1] For Chinese languages, including Hakka, it is not easy to draw a boundary between morphs and words. In Zhang's (1988) comprehensive research on Hakka morphology, the first three volumes of Tang's (1988, 1989, 1992) series in discussing the morphological and syntactic structures of Mandarin Chinese, and Duanmu's (1998) review of different findings for testing wordhood in Chinese, the authors contribute very detailed analyses to issues related to the concept of Chinese words. However, this complex issue concerning the distinction of morphs and words is beyond the scope of this paper.

[2] This paper uses the following glosses: CL "classifier", DEM "demonstrative", EXC "exclamatory",

(1) a. [gieu-e]   ngau   [sei-ngin-e]
    dog-PART   bite   little-human being-PART
    'Dogs bite kids.'

  b. [diau-e]   hei [gieu-e]   ge   [ho-pen-yiu]
    bird-PART   is   dog-PART   GE   good-friend-friend
    'Birds are dogs' good friends.'

A noun may be preceded by a sequence of "demonstrative-quantifier-classifier." An example is provided in (2a). It is not true that the three elements of this sequence always occur together, but in general situations, a head noun requires the presence of a classifier if a demonstrative or a quantifier is present. See the following examples (2b) and (2c):

(2) a. [lia   liong bun]   **su**
    DEM   two   CL   book
    'these two books'

  b. [ge   gien]   **diam**
    DEM   CL   store
    'that store'

  c. [yit ge]   **gua-fu**
    one CL   widow
    'a widow'

In this paper the "demonstrative-quantifier-classifier" sequence is described as constituting a syntactic unit. As revealed in (3), demonstratives and quantifiers are bound with their classifiers.

(3) a. gi siit-tet   [NP [ge   *(liap)] ling-go]
    he eat-off   DEM   CL   apple
    'He ate that apple.'

  b. gi siit-tet   [NP [liong   *(liap)] ling-go]
    he eat-off   two   CL   apple
    'He ate two apples.'

As shown in (3), when a noun is modified by a quantifier or a demonstrative, the presence of a classifier is almost always required; but the reverse is not true, i.e. a classifier may be overt without the presence of a quantifier (3a) or a demonstrative

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MOD "modifier", NEG "negative", PART "particle".

(3b). In view of their close syntactic relation and the obligatory presence of a classifier, this paper suggests that the three elements actually form a syntactic unit, a classifier phrase (CLP), headed by the functional classifier.

Another argument in favor of their syntactic boundedness is through a series of constituency tests. Knowing that a constituent is a group of words which function as a unit sharing some kind of syntactic function, given a sentence (4), first, the example in (5) shows that the "demonstrative-quantifier-classifier" sequence can function as a unit to be pseudo-clefted to receive some focus interpretation. Second, the example presented in (6) shows that we are allowed to conjoin two strings of "demonstrative-quantifier-classifier" to modify the same head noun. Third, as shown in (7), when (4) is turned into a wh-interrogative sentence with the object NP being questioned, the entire sequence can serve as a sentence fragment in response to this wh-question; however, if the demonstrative is left out of the constituent, the incomplete pattern results in unacceptability.

(4) gi oi   siit [NP [CLP lia   liong liap] ling-go]
    he want-to eat   DEM two   CL   apple
    'He wants to eat these two apples.'

(5) [CLP lia liong liap] he gi oi   siit ge   ling-go
          DEM two   CL   be he want-to eat   GE   apple
    'These two (items) are the apples that he wants to eat.'

(6) gi oi   siit [CLP lia liong liap] tung [CLP ge   sam   liap] ling-go
    he want-to eat   DEM two   CL   and   DEM three CL   apple
    'He wants to eat these two and those three apples.'

(7) Q: gi   oi   siit ma-gai?
       he   want-to eat   what
       'What does he want to eat?'
    A: [CLP lia   liong   liap]
            DEM   two   CL
       'These two.'
       (*liong   liap)

Like all the other Chinese languages, in Hakka the selection of an appropriate classifier for a noun is determined generally by the idiosyncratic property of the noun. For examples, a computer, a television, an air conditioner, or a vehicle may be

classified by the same classifier *toi* for their machine quality; while a rope, a tube, a bridge, or pants and skirts may be used with the classifier *tiau* due to their long narrow shape. Accordingly, concerning the position of classifier phrases within their NP projections, the following (8) suggests that classifier phrases occupy the SpecNP position, so they can agree with their nouns in a specifier-head agreement configuration; that is, the semantic agreement between classifiers and their nouns can be checked in a specifier-to-head relation.
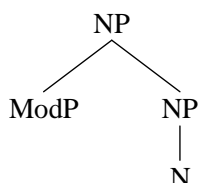
(8)

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            NP
          /    \
        CLP     N'
       /___\     |
                 N
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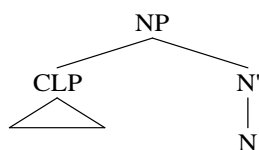
2.2 Prenominal modifiers

In this section, I will argue that the internal structure of Hakka noun phrases is head final, and the NP's have their head nouns after modifiers. The structure is presented in (9). As shown by the tree, the head noun of an NP branches to the right, and the modifier projection left-adjoins to this NP:

(9)

```
            NP
          /    \
       ModP     NP
                 |
                 N
```

A noun can be modified by almost every phrasal category, including the prepositional phrase (PP), the verbal phrase (VP), the adjectival phrase (AP), another noun phrase (NP) or the sentential complement (S). Each sentence in (10) below represents an NP with the head noun modified by each of the above types, in the order of a PP, VP, an AP, NP, and S.

(10) a. [di dang-go ge]   **sei-moi**   PP+N
        at   upstairs   MOD   girl
        'the girl on the upper floor'

b. [hi hok-gau ge] **hok-sang-e** VP+N
   go school MOD student
   'students who go to school'

c. [dong ze ge] **sei-ngin-e** AP+N
   really ugly MOD kid
   'very ugly kid'

d. [hok-gau ge] **ki-mat-kau** NP+N
   school MOD final exam
   'school's final exam'

e. [gi kia kuai-e ge] **su** S+N
   he hold chopstick MOD hand
   'the hand he uses to hold chopsticks'

All these phrases are found with a functional morpheme *ge*,[3] which obligatorily follows each modificational element. Accordingly, the tree diagram proposed in (9) can be elaborated as follows:

(11)


```
                    NP
                  /    \
            ModP        NP
           /    \        |
        XP       Mod     N
        PP       ge
        VP
        AP
        NP
         S
```
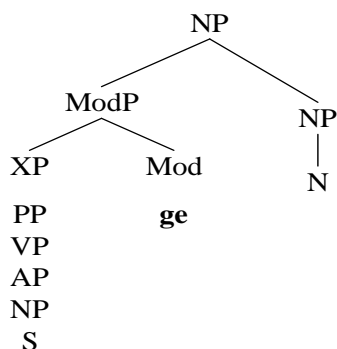
In (11), the functional *ge* projects a modifier phrase and takes a phrasal constituent XP as its complement, the XP could be clausal, prepositional, adjectival, or nominal. The projected ModP is an adjunct to the head noun which adjoins to the left side of an NP.

Note that when multiple modifiers co-occur, the order of these prenominal modifiers is syntactically free, as demonstrated in the following (12):

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[3] The function of Hakka *ge* here parallels that of the Mandarin *de*. According to Simpson (2001) and Simpson and Wu (2002), *de* in Mandarin Chinese has developed over time from a demonstrative and has undergone the loss of its deictic and definite specification during the process of grammaticalization. It should be analyzed as an enclitic determiner requiring phonological supports from its preceding phrase, which may range from a variety of possible structures including relative, possessive, adjectival and prepositional phrases, to produce a modificational functional phrase adjoining to the NP.

(12) a. [di hok-gau ge]   [dong ze   ge]   hok-sang-e   PP+AP+N

      at school   MOD   really ugly MOD student

      'ugly students at school'

  b. [dong ze   ge]   [di hok-gau ge] hok-sang-e   AP+PP+N

      really ugly MOD   at   school   MOD student

      'ugly students at school'

The two NPs in (12) both contain multiple modifier phrases with ordering possibilities. In (12a) the prepositional phrase precedes the adjectival phrase, while the order in (12b) is reversed, but the different surface orders do not differentiate their corresponding meanings.

2.3 Head noun and prenominal modifiers

This section shows that if a CLP co-occurs with another phrasal modifier, the CLP may either precede or follow the modifier so long as they are both prenominal, see examples (13a) and (13b), the order is syntactically free:

(13) a. [CLP yit tiau] [MODP dong vu   ge] hien-gon   CLP+AP+N

        one CL   really black MOD earthworm

     'a very black worm'

  b. [MODP dong vu   ge]   [CLP yit   tiau] hien-gon   AP+CLP+N

        really black MOD   one   CL   earthworm

     'a very black worm'

A noun may also be modified by a bare adjective without the appearance of *ge*,[4]

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[4] Two types of adjectival modification are generally recognized in studies of Chinese linguistic structures. Adjectives occurring in the first type are followed by a modificational functional morpheme (i.e. *de* in Mandarin and *ge* in Hakka), as shown in (i). While in the second type, adjectives simply juxtapose with their head nouns, as in (ii).

(i) dong   lo-siit   ge   ngin
   really   simple-minded   GE   person
   'a truly simple-minded person'

(ii) lo-siit   ngin
   Simple-minded   person
   'a simple-minded person'

Different arguments have been proposed concerning the syntactic and semantic properties of the two types of modification. Sproat and Shih (1988, 1991), Duanmu (1998), and Simpson (2001) suggested that the first type of modification should be analyzed as a relative clause, while the second type should be analyzed as a lexical compound. Feng (2001) observed the second type of modification and suggested that adjectives in the second type should be considered as "syntactic compounds," which

as in (14a). When any other modificational element such as a CLP or a MODP co-occurs with the bare adjective within the same NP, the bare adjective must be closer to the head noun. If it appears that another phrasal modifier is intervening between the adjective and the noun, the structure becomes ill-formed, shown in (14b) and (14c).

(14) a. tai   muk-zu   ADJ+N
        big   eyes
        'big eyes'
     b. [liong liap] tai   muk-zu   CLP+ADJ+N
        two   CL   big   eyes   *ADJ+CLP+N
        'two big eyes'
        (*tai [liong liap] muk-zu)
     c. [ngai ngin-vi ge] tai   muk-zu   MODP+ADJ+N
        I   consider MOD big   eyes   *ADJ+MODP+N
        'the kind that I consider as big eyes'
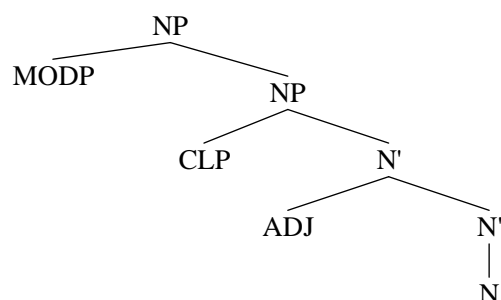   **(*tai [ngai ngin-vi ge] muk-zu)**

   Accordingly, the phrase structure of an NP can be unified as follows. The head noun occupies the rightmost position, which is optionally preceded by other prenominal modifiers. If a bare adjective also appears to the left of this head noun, it must be more proximate to the head than the other phrasal modifiers:

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differ from lexical compounds in that they are formed in the syntax by head-to-head adjunctions.
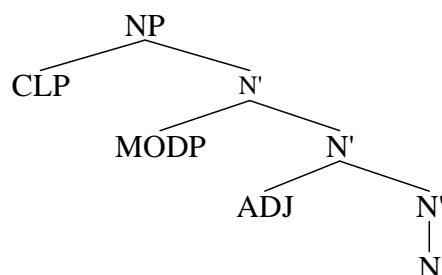
   On the other hand, Paul (2005) argued against their approaches, and according to his suggestion, both types of adjectival modification should be assigned phrasal status. The modificational morpheme (*de*/*ge*) serves to affect the interpretation of an NP: if an adjective appears to the immediate left of the modificational morpheme, the modifier is interpreted as an accessory property; on the other hand, if an adjective immediately precedes the noun, the modifier is interpreted as a defining permanent property. The latter modification holds a more natural, plausible classification on the noun. Besides, the two types also differ structurally: nouns can only be modified by heads in the second type; the first type of construction must be adopted when nouns are modified by maximal projections. Therefore, whenever a modificational adjective is further modified by an adverb, the functional *de*/*ge* must occur as in (i).

(15)

  a.

```
                    NP
         MODP              NP
                      CLP       N'
                            ADJ     N'
                                     |
                                     N
```

  b.

```
              NP
         CLP        N'
                MODP      N'
                      ADJ     N'
                               |
                               N
```

The tree in (15a) represents the constituent structure for the word order in which modifier phrases precede classifier phrases. As it shows, modifier phrases adjoin to their noun phrases on the top of the tree, while classifier phrases bear a specifier-head relation with their licensing nouns to check some sort of semantic agreement, and bare adjectives adjoin to the N' at the lower level. On the other hand, the structure presented in (15b) describes the order in which classifier phrases precede modifier phrases. In such cases, the relation of specifier-head agreement is checked on the top of the tree between classifier phrases and their head nouns, while both modifier phrases and bare adjectives adjoin to the lower N'.

Semantically, the different order between modifier phrases and classifier phrases actually corresponds to two different kinds of meanings, which we will later argue to be associated with the distinction of restrictive versus non-restrictive relative clauses. All these will be further discussed in section 3.

3. Hakka relative clauses

3.1 Relative constructions

According to Li and Thompson (1981), a Chinese relative clause is constructed

simply by placing a nominalized clause in front of a noun to modify it. As discussed in the previous section, nominal modifiers (MODP) consist of a phrasal element followed by the modificational *ge*. When the phrase in front of *ge* is clausal such as an S or a VP, or possibly an AP that is attributive,[5] the structure is analyzed as a relative construction in which a relative MODP is embedded into a noun phrase functioning as a modifier. A few examples are given in (16):

(16) a. [_{NP} [<u>**REL**</u> [_S **gi   cong   go-e]   ge]**   sang]   dong   ho-tang
                        he   sing   song   MOD   voice   really   harmonious
     'The voice with which he sings is very good to listen to.'

   b. [_{NP} [<u>**REL**</u> [_{VP} **siit   fan]   ge]**   cien]   ma-ngin   oi   cut
                        eat   meal   MOD   money   who   will   pay
     'Who will pay the money which is for the meal?'

   c. ngai   tok   bun   gi   [_{NP} [<u>**REL**</u> [_{AP} **ka   ho]   ge]**   ng-e]
     I   select   to   him   more   good   MOD   fish
     'I picked fishes that are in better quality for him.'

In the above three examples, each relative clause modifies the noun following it, and the noun along with its relative modifier acts just like any other ordinary NP. In (16a) the syntactic function of the NP is a subject; in (16b) a topicalized object; and in (16c) it functions as a direct object. The branching direction for all the NP's and their relative MODP's are head-final, in which the functional *ge* is placed after the modifying phrase at the end of the relative clause, and the relative clause is placed before the head noun.

Now we put the construction into the Optimality Theoretic analysis. The word order within NP's can be illustrated by the following Tableau 1. The analysis is based on the Generalized Alignment constraints proposed in (17) below. When the proposed constraint ALIGN-R (X, XP), which enforces the head of a phrasal constituent to be positioned at the right edge, outranks the constraint ALIGN-R (YP, XP), which enforces both specifier and modifier phrases to be positioned at the right edge of their mother phrasal node, the ranking ensures the branching direction of both noun phrases and modifier phrases to be right-headed and left-branching.

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[5] The widespread analysis that treats attributive adjectives in Chinese as relative clauses can be found in Sproat and Shih (1988, 1991) and Duanmu (1998).

(17) **ALIGN-R (X, XP):** Align X with the right edge of the XP that immediately contains it.

    ALIGN-R (YP, XP): Align YP with the right edge of the XP that immediately contains it.

Tableau 1

[[XP GE]_{MODP} N]_{NP}	ALIGN-R (X, XP)	ALIGN-R (YP, XP)
☞ [[XP GE] N]		**
[[GE XP] N]	*!	*
[N [XP GE]]	*!	*
[N [GE XP]]	*!*	

As illustrated in the tableau, in order to avoid violating the highest ranking constraint ALIGN-R (X, XP), the word order of NP's must be as follows: Modifying Phrase-Modificational GE-Head Noun. Following this order, the head of MODP's and NP's occurs at the right edge.

As stated previously, readers may note that a bare adjective, functioning as a nominal modifier, may intervene between the head noun and other phrasal modifiers if they co-occur in the same NP. To account for this possible word order, another Generalized Alignment constraint (18) is proposed:

(18) **ALIGN-R (Z, XP):** Align Z with the right edge of the XP that immediately contains it.

The relevant constraint ranking can be seen in the following Tableau 2:

Tableau 2

[XP ADJ N]_{NP}	ALIGN-R (X, XP)	ALIGN-R (Z, XP)	ALIGN-R (YP, XP)
☞ [XP ADJ N]		*	**
[ADJ XP N]		*!*	*
[N XP ADJ]	*!*		
[XP N ADJ]	*!		

In this paper, the evaluation of Generalized Alignment constraints takes into account degree of violation; namely, constraints are taken as gradient constraints measuring the distance between two designated edges for the referring categories, and
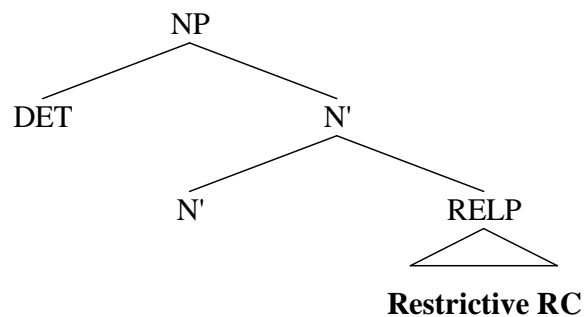
constraint violations are calculated in a cumulative manner. From the above tableau, we can see that assigning the highest ranking to the constraint ALIGN-R (X, XP) ensures the rightmost position of head nouns within their NP's. On the other hand, the candidate that positions bare adjectives phrase-initially in front of both phrasal modifiers and head nouns must be ruled out due to a collection of double violations on the constraint ALIGN-R (Z, XP). Thus, the first candidate, incurring two violations on the lowest ranking ALIGN-R (YP, XP), is selected as the only optimal surface order.

3.2 Restrictive vs. non-restrictive relative clauses

Relative clauses generally can be classified into two types: restrictive and non-restrictive relative clauses. Restrictive relative clauses restrict the referent of their head nouns to a subset of a large domain; while a non-restrictive clause simply adds parenthetic information to the head noun.

In discussing the syntactic construction of English relative clauses, McCawley (1998) argued that the two types of relative clauses have different constituent structures, as shown in (19). Restrictive relative clauses occur as adjuncts to an N', while their non-restrictive counterparts adjoin to an NP or any other phrasal category:[6]

(19)

```
                        NP
                       /  \
                    DET    N'
                          /  \
                        N'    RELP
                              /\
                       Restrictive RC
```

Corresponding   the bicycle which has yellow handlebars
English example:
                       (single out the bicycle with yellow
                       handlebars from all the other bicycles)

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[6] Non-restrictive relative clauses may adjoin to phrases other than NP; for example in (i) below it adjoins to an S, and in (ii) it is an adjunct to a VP:

(i) Jay claimed that his new album would be great, which I believe.

(ii) Susan flew back to Germany, which Joe did, too.
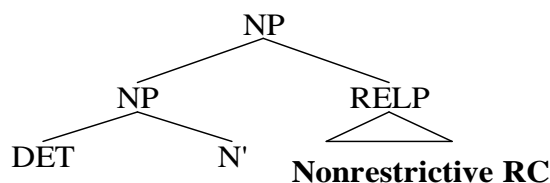
	the bicycle, which has yellow handlebars
Corresponding English example:	(a bicycle with yellow handlebars)

The top diagram in (19) presents the structure for restrictive relative clauses. The RELP in this case adjoins to the lower N' and functions to narrow down the referent of the bicycle to a specific one that has yellow handlebars. The structure for non-restrictive relative clauses is represented by the bottom diagram in (19). The RELP now adjoins to the higher phrasal NP projection, and it provides additional information "with yellow handlebars" to modify the already designated bicycle. More details concerning the structural differences between the two types of relative clauses in English can be found in McCawley's original works (1998:427-454).

Similar to the English case, Hakka also makes a distinction between restrictive and non-restrictive relative clauses. This paper claims that there are two ways to distinguish between the two types of relative clauses. The first distinction is similar to what Tiee (1986) suggested about the Mandarin Chinese case, in which the two types of relative clauses are distinguishable based on their relative position with respect to the classifier phrase that modifies the same head noun. Compare the two Hakka sentences given in (20) below:

(20) a. gi mai-tet [MODP **zong-fong ho   ge]** [CLP **ge   gien]** vuk
　　　　he sell-off　　　　renovate　done　MOD　　　DEM CL　　　house
　　　　'He sold that newly renovated house.'
　　b. gi mai-tet [CLP **ge   gien]** [MODP **zong-fong   ho   ge]** vuk
　　　　he sell-off　　DEM CL　　　　renovate　　done　MOD　house
　　　　'He sold that newly renovated house.'

The above two sentences differ in their word order between the CLP and the MODP. In example (20a) the MODP precedes the CLP, while in (20b) the word order is reversed. According to Tiee (1986), the first example (20a) corresponds to the

restrictive type of relative clauses, while the second (20b) corresponds to the non-restrictive type of clauses.

Another possible way to mark the non-restrictive interpretation is by positioning the entire classifier phrase along with the head noun to the left edge of their NP:

(21) gi   mai-tet   **[ge   gien   vuk]**,   zong-fong   ho   ge
    he   sell-off   DEM   CL   house   renovate   done   MOD
    'He sold that house, the renovated one.'

As I will argue, some slight semantic differences actually exist to distinguish between the two types of relative clauses. The reading of (20a) implies that "he owns more than one house, and among them he sold a specific one that had been renovated, which distinguishes this house from all the other ones he has." But such an implication is much weaker in (20b) and (21). The contrast in semantic meaning mentioned above can be obtained by providing the following question-answer test (22):

(22) Q: ge   sam   gien   vuk   gi   mai-tet   nai   gien?
      that   three   CL   house   he   sell-off   which   CL
      'Which one among those three houses is the one he sold?'
     Ans 1: (✓ **better**)   gi mai-tet zong-fong ho ge ge gien vuk………(20a)
     Ans 2: (# **worse**)   gi mai-tet ge gien zong-fong ho ge vuk………(20b)
     Ans 3: (# **worse**)   gi mai-tet ge gien vuk, zong-fong ho ge……...(21)

An appropriate answer to (22) ought to precisely single out one from the three houses that both speakers have common knowledge about. The first answer successfully attains this goal by emphasizing the condition of a specific house. But the reading of the second answer simply describes his selling that big house as an event. Therefore, the first answer is considered more adequate as an appropriate response to the proposed question. As shown in (23), if a given question requires some sort of general description about what he has done, in this situation the question can be answered by describing an event as explanation, the answers 2 and 3 in (22) that correspond respectively to (20b) and (21) then become good answers.

(23) Q: gi   ngiong-voi   con   an-do   cien   no
       he   how come   make   so much   money   PART
       'How could he make so much money?'

Ans: (✓ **good**) yin-vi gi mai-tet ge   gien zong-fong ho   ge] vuk
                because he sell-off DEM CL   renovate   done MOD house
                'It is because he sold that renovated house.'

(✓ **good**) yin-vi   gi mai-tet ge   gien vuk, zong-fong ho   ge
                because he sell-off DEM CL   house renovate   done MOD
                'It is because he sold that house, the renovated one.'

The same semantic contrast can be even more clearly observed if we compare the three sentences in (24):

(24) a. ngai **[di mi-guet tuk-su ge]**   **[ge zhak]** ng-pen-yiu da tien-fa   zon-loi
         I   in America study MOD DEM CL   girlfriend call telephone back
         'My girlfriend who is now studying in the US calls back.'

   b. ngai **[ge zhak][di mi-guet tuk-su ge]**   ng-pen-yiu da tien-fa   zon-loi
         I   DEM CL in America study MOD girlfriend call telephone back
         'My girlfriend, who is now studying in the US, calls back.'

   c. ngai**[ge zhak ng-pen-yiu]**, di mi-guet tuk-su ge   da tien-fa   zon-loi
         I   DEM CL girlfriend   in America study MOD call telephone back
         'My girlfriend, who is now studying in the US, calls back.'

According to the judgment of my native Hakka consultant, in contrast to (24b) and (24c), the sentence in (24a) contains a stronger "two-timer" implication in its literal meaning, which implies that the speaker *ngai* has more than one girlfriend. We can therefore argue that the delimiting function of restrictive relative clauses is much more obvious in (24a) than that which is in (24b) and (24c). The same proposition also explains why the first two sentences in (25) are bizarre. By attempting to single out one father from a large set of the speaker's father candidates, the sentence contradicts our common sense that everyone should have only one father. The other two sentences, according to the native speaker, may sound a little impolite or teasing, but they are still acceptable.

(25) a. *ngai **[song pien-so   m   guan mun ge]** **[ge   zhak]** a-ba
         I   go to bathroom NEG close door MOD DEM CL   Father
         'My father who never closes the bathroom door…'

   b. ngai **[ge   zhak][song pien-so   m   guan mun ge]**   a-ba
         I   DEM CL   go to bathroom NEG close door MOD Father
         'My father, who never closes the bathroom door…'

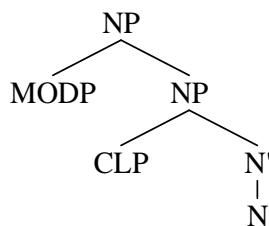c. ngai **[ge   zhak   a-ba   o]**,   song   pien-so   m   guan   mun   ge

   I   DEM CL   Father EXC   go to   bathroom   NEG   close   door   MOD

   'My father (sigh..), who never closes the bathroom door…'

The semantic contrast described above determines whether a relative clause is restrictive or non-restrictive. When the modifier phrase precedes the classifier phrase, the relative clause is interpreted as a restrictive type of clause with the function to limit the scope of possible meanings of the referred head noun. On the other hand, when the order between the modifier phrase and the classifier phrase is reversed, the interpretation suggests a non-restrictive meaning in which the modifier phrase simply offers some information about the referring noun. Besides, in non-restrictive relative constructions the head noun may either precede or follow the modifier phrase.
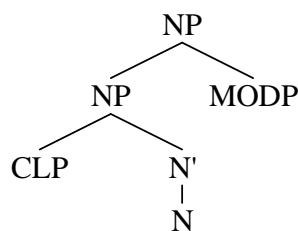
The structure adopted in (26) below represents the two types of relative clauses:

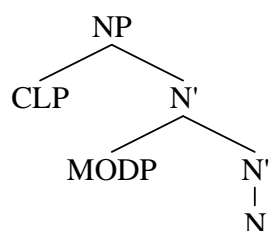(26) The structure of restrictive vs. non-restrictive relative clauses in Hakka

    a.   Restrictive RC

```
              NP
            /    \
        MODP      NP
                /    \
             CLP      N'
                      |
                      N
```

    b.   Non-restrictive RC

```
              NP
            /    \
          NP      MODP
        /    \
     CLP      N'
              |
              N
```

    c.   Non-restrictive RC

```
          NP
        /    \
     CLP      N'
            /    \
        MODP      N'
                  |
                  N
```

Modifier phrases left-adjoin to their NP's in restrictive relative constructions (26a); while in non-restrictive constructions, modifier phrases either right-adjoin to the NP (26b) or left-adjoin to the N' (26c).

While the OT account of the NP word order established earlier in section 3.1 captures the grammatical structures in (26a) and (26b), the problem is that the analysis fails to derive the well-formed structure in (26c), as illustrated in Tableau 3:

Tableau 3

[CLP MODP N]$_{NP}$	ALIGN-R (X, XP)	ALIGN-R (Z, XP)	ALIGN-R (YP, XP)
☞ [CLP MODP N]			***
☞ [MODP CLP N]			***
☹ [CLP N MODP]	*!		**
[MODP N CLP]	*!		**
[N MODP CLP]	*!*		*
[N CLP MODP]	*!*		*

According to (26), the first three candidates are all grammatical patterns in Hakka; however, the evaluation shown in Tableau 3 allows only the two topmost right-headed NP candidates to be optimal outputs. All the other candidates fatally violate ALIGN-R (X, XP). The evaluation wrongly eliminates the well-formed pattern "CLP N MODP" from the grammatical list, which is represented by the symbol ☹ in the above tableau.

An even more difficult case is to relate each of the grammatical forms exclusively with its restrictive or non-restrictive meaning, which apparently is beyond the explanatory capacity of the solution we have developed up to this point. As I will show in the next section, adopting a bidirectional OT model can not only derive the correct results through recursive tableau evaluations but encode on them the appropriate semantic distinction between restrictive and non-restrictive meanings.

3.3 A bidirectional OT solution

A classic unidirectional OT approach assumes a one way derivation from either "meaning to form" or "form to meaning", depending on the relevance of OT in the syntactic or semantic domain. The OT syntax takes the meaning representation of a type of syntactic construction as the input, and the generated competing candidates are a set of semantically equivalent forms (Grimshaw 1997). On the other hand, the OT semantics is processed in the reverse direction. According to Hendriks and de Hoop (2001), it takes a grammatical form as the input to evaluation, with alternative

interpretations competing with each other to derive the optimal meaning. While in the case of Hakka restrictive versus non-restrictive relative clauses, at least three distinctive grammatical forms co-exist corresponding to two semantically similar meanings. This poses a difficulty for the classic OT to connect the multiple grammatical patterns successfully with their restrictive or non-restrictive interpretations with simply a unidirectional analysis; instead, to determine an appropriate division for the meaning-form pairs, a bidirectional optimization, which considers meaning and form as a pair in the tableau evaluation, is therefore required (Blutner 2000).

To develop a bidirectional analysis on the restrictive and non-restriction relative clauses, we need to first make explicit the relation between markedness and the two types of relative clauses. Restrictive relative clauses are generally considered as the prototypical unmarked forms in relation to non-restrictive relative clauses, which are prototypically marked. The argument can be well-defended with the following two senses: (1) Based on the definition of Forner et al. (1992), given two minimally different linguistic structures A (non-restrictive) and B (restrictive), A (non-restrictive) is marked and B (restrictive) is unmarked if languages that have A (non-restrictive) also have B (restrictive), but not all languages that have B (restrictive) also have A (non-restrictive). (2) Based on Lehmann's (1989) definition, given two linguistic forms A (non-restrictive) and B (restrictive), A (non-restrictive) is marked and B (restrictive) is unmarked if the number of subtypes of A (non-restrictive) is less than that of B (restrictive).

Next, we need to propose three additional constraints which follow the universal structural requirement of X' theory. The two generative positional constraints *[…X…]XP and *[…YP (ADJCT)…]XP enforce heads and phrasal adjuncts occurring at either edge of their phrases; while the alignment constraint ALIGN-L (YPSPEC, XP) more specifically requires classifier phrases to occur at the left edge of their noun phrases, concerning that Hakka noun phrases are head-final in general, and classifier phrases, while taking the [Spec, NP] position, occurs at the opposite edge to the head noun. The structure of NP can be found in the tree diagram proposed earlier in (15).

All the relevant constraints as well as their ranking are stated in (27):

(27)
Generative positional constraints:
 *[…X…]XP: Heads occur at the boundary of their phrases.
 *[…YP (ADJCT)…]XP: Modifier phrases occur at the boundary of their phrases.

Alignment constraints:

ALIGN-R (X, XP): Align X with the right edge of the XP that immediately contains it.

ALIGN-R (YP, XP): Align YP with the right edge of the XP that immediately contains it.

ALIGN-R (Z, XP): Align Z with the right edge of the XP that immediately contains it.

ALIGN-L (YPSPEC, XP): Align the specifier YP with the left edge of the XP that immediately contains it.

Constraint ranking:

ALIGN-R (X, XP), *[…YP (ADJCT)…]XP >> ALIGN-R (Z, XP) >> ALIGN-R (YP, XP), *[…X…]XP >> ALIGN-L (YPSPEC, XP)

The following tableaux illustrate the constraint ranking proposed in (27). We will start with the traditional unidirectional OT on two simpler cases to show that the ranking in (27) yields the correct grammatical results.

In Tableau 4, when the input NP expression contains a specified head noun modified by a bare adjective, the high ranking ALIGN-R (X, XP) eliminates all NP candidates that are not head-final. The dominance of ALIGN-R (Z, XP) over ALIGN-R (YP, XP) ensures the position of the bare adjective to the right of the classifier phrase. Thus, the only possible word order is "CLP ADJ N."

Tableau 4

[CLP ADJ N]NP	ALIGN-R (X, XP)	*[…YP …]XP (ADJCT)	ALIGN-R (Z, XP)	ALIGN-R (YP, XP)	*[…X…]XP	ALIGN-L (YPSPEC, XP)
☞ [CLP ADJ N]			*	**		
[ADJ CLP N]			**!	*		*
[CLP N ADJ]	*!			**	*	
[ADJ N CLP]	*!		**		*	**
[N ADJ CLP]	*!*		*			**
[N CLP ADJ]	*!*			*		*

In Tableau 5, the input expression contains a noun modified by a modifier phrase and a bare adjective at the same time. The two top ranking constraints ALIGN-R (X, XP) and *[…YP (ADJCT)…]XP are decisive in this case. The former requires head nouns in phrase-final positions and the latter places modifier phrases at the opposite

edge to their head nouns, leaving bare adjectives in the middle. Thus, the candidate "MODP ADJ N" is the only optimal output.

Tableau 5

[MODP ADJ N]_{NP}	ALIGN-R (X, XP)	*[…YP …]_{XP} (ADJCT)	ALIGN-R (Z, XP)	ALIGN-R (YP, XP)	*[…X…]_{XP}	ALIGN-L (YP_{SPEC}, XP)
☞ [MODP ADJ N]			*	**		
[ADJ MODP N]		*!	**	*		
[MODP N ADJ]	*!			**	*	
[ADJ N MODP]	*!		**		*	
[N ADJ MODP]	*!*		*			
[N MODP ADJ]	*!*	*		*		

Now we are about to build up our analysis to cover the more complex cases. The problem for the ranking in (27) can be observed when we need to generate grammatical forms for expressing the distinctive meanings of restrictive and non-restrictive relative clauses. When one compares Tableau 6 and Tableau 7, with the same constituents encompassed in their input: a noun, a specifier CLP and a modifier MODP, we expect to obtain an ordering pattern from Tableau 6 which expresses the meaning of a restrictive relative clause and another pattern from Tableau 7 which expresses the meaning of a non-restrictive relative clause. As it turns out, with the same set of constraints and ranking, the two tableaux derive exactly the same output form "MODP CLP N" as the optimal expression for the two distinctive meanings.

Tableau 6

m= restrictive [MODP CLP N]_{NP}	ALIGN-R (X, XP)	*[…YP …]_{XP} (ADJCT)	ALIGN-R (Z, XP)	ALIGN-R (YP, XP)	*[…X…]_{XP}	ALIGN-L (YP_{SPEC}, XP)
☞ [MODP CLP N]				***		*
[CLP MODP N]		*!		***		
[MODP N CLP]	*!			**	*	**
[CLP N MODP]	*!			**	*	
[N CLP MODP]	*!*			*		*
[N MODP CLP]	*!*	*		*		**

The optimization process of Tableau 6 is similar to that of Tableau 5. The two highest ranking constraints enforce the head noun to the right edge and the modifier

phrase to the left edge of their NP, rendering the classifier phrase in-between.

Tableau 7

m= non-restrictive [MODP CLP N]$_{NP}$	ALIGN-R (X, XP)	*[…YP …]$_{XP}$ (ADJCT)	ALIGN-R (Z, XP)	ALIGN-R (YP, XP)	*[…X…]$_{XP}$	ALIGN-L (YP$_{SPEC}$, XP)
☹☞ [MODP CLP N]				***		*
[CLP MODP N]		*!		***		
[MODP N CLP]	*!			**	*	**
[CLP N MODP]	*!			**	*	
[N CLP MODP]	*!*			*		*
[N MODP CLP]	*!*	*		*		**

Tableau 7 problematically selects the same form "MODP CLP N" as the optimal output for non-restrictive relative clauses, indicated by the symbol ☹ in Tableau 7, since it is the only candidate satisfying both highest constraints. We know this result is not correct because according to (26), the non-restrictive meaning is actually expressed by the other two candidates "CLP MODP N" and "CLP N MODP."

A solution to this is to claim it is not possible to use the form "MODP CLP N" to express the non-restrictive meaning because it is identical to the form selected to express the restrictive meaning, and in this language, we do need two distinctive grammatical forms to express these two types of relative clauses as they are semantically different. The optimal form "MODP CLP N" constitutes a better form-meaning pair with the restrictive meaning in the sense that it is considered the unmarked construction selected by both tableaux to express the meaning of relative clauses. As argued earlier in this section, the restrictive version of relative clauses is considered the unmarked prototype in the category of relative clauses. It is natural and commonsensical to associate the least-marked linguistic form with the least-marked prototypical meaning of a certain linguistic structure, as it conveys the essence of the generalization claimed by Horn (1984:26) that "unmarked forms tend to be used for unmarked situations and marked forms for marked situations."

As the unmarked construction "MODP CLP N" pairs with the unmarked restrictive meaning, it forms a super-optimal pair which blocks the pairing of "MODP CLP N" with the marked non-restrictive meaning in Tableau 7. This can be formally expressed by Tableau 8, in which the optimal pairing of "MODP CLP N" with the unmarked restrictive interpretation blocks the pairing of this form with the marked non-restrictive interpretation. This sub-optimal pairing is therefore removed from the competition, leaving the two candidates "CLP MODP N" and "CLP N MODP" to be

selected as the new optimal outputs pairing with the marked non-restrictive meaning.

Tableau 8

m= non-restrictive [MODP CLP N]$_{NP}$	ALIGN-R (X, XP)	*[...YP ...]$_{XP}$ (ADJCT)	ALIGN-R (Z, XP)	ALIGN-R (YP, XP)	*[...X...]$_{XP}$	ALIGN-L (YP$_{SPEC}$, XP)
✂ [MODP CLP N]				***		*
✌ [CLP MODP N]		*		***		
[MODP N CLP]	*			**	*	*!*
✌ [CLP N MODP]	*			**	*	
[N CLP MODP]	**!			*		*
[N MODP CLP]	**!	*		*		**

Having identified the pair of "MODP CLP N" and "restrictive meaning" as the optimal one, it blocks the pairing of this candidate with the "non-restrictive meaning." In Tableau 8, the blockage is shown by the symbol ✂, which means to eliminate the selected candidate from the competition. With the candidate being removed, the optimization process recurs to the second round searching for the new optimal pairs. The newly resulted grammatical outputs are indicated by the symbol of V gesture ✌.

4. Summary

The Hakka facts presented in this paper provided an empirical demonstration for the Weak version of Optimization (Blutner 2000). In this paper, I propose a Bidirectional OT analysis on relative clauses in Hakka, which requires an evaluation from the perspectives of both production and interpretation. Blutner (2000) has proposed two versions of the bidirectional approach, the Strong Bidirectional Optimization and the Weak Bidirectional Optimization, which according to Beaver and Lee (2003), can account for different types of blocking. The idea of Strong Bidirectional Optimization is that a form-meaning pair $<f, m>$ is grammatical iff there is no other pair which is more harmonic than $<f, m>$. Apparently this version of Bi-OT is too strong for the Hakka case as we need to grant both pairs $<f, m>$ and $<f', m'>$ as grammatical. On the other hand, the Weak Bidirectional Optimization allows the association of marked forms with marked meanings and unmarked forms with unmarked meanings. In this version of Bi-OT a less harmonic form-meaning pair $<f', m'>$ may be selected as the optimal output when the most harmonic pair $<f, m>$ blocks the sub-optimal pairs $<f, m'>$ and $<f', m>$ and eliminates them from further evaluation. In the Hakka case, when the most harmonic pair $<MODP\ CLP\ N,$

Restrictive meaning> is selected as the optimal pair, the sub-optimal pair *<MODP CLP N, Non-Restrictive meaning>* which shares with the optimal pair an equivalent grammatical form is eliminated from further competition. The idea is that the same grammatical form *<MODP CLP N>* cannot be selected to represent both restrictive and non-restrictive meaning at the same time since we need to adopt two distinct grammatical forms for the representations of two different semantic meanings. With the form *MODP CLP N* removed from the candidate set in the second round of optimization, the pairs *<CLP MODP N, Non-Restrictive meaning>* and *<CLP N MODP, Non-Restrictive meaning>* become the new Weak optimal winners.

The optimization process can be more clearly illustrated with Tableaux 6 and 8 put side by side, shown in the following Tableau 9. For ease of reading, the grammatical forms are expressed by a simple {*f1*, *f2*, *f3*}, and the constraints are generalized into three {C1, C2, C3}, with each one representing one level of hierarchy. The notation of each node is illustrated below the tableau.

Tableau 9

m1= restrictive	C1	C2	C3	*m2=non- restrictive*	C1	C2	C3
☞ f1		***	*	✄ f1		***	*
f2	*!	***		✌ f2	*	***	
f3	*!	***		✌ f3	*	***	

C1= ALIGN-R (X, XP), *[…YP (ADJCT) …]XP

C2= ALIGN-R (YP, XP), *[…X…]XP

C3= ALIGN-L (YPSPEC, XP)

f1= MODP CLP N

f2= CLP MODP N

f3= CLP N MODP

By pairing the three forms {*f1*, *f2*, *f3*} with two meanings {*m1*, *m2*}, six form-meaning pairs result, which are represented by the six rows in Tableau 9. The first round of optimization selects the optimal pair *<f1, m1>*. Note that the function of EVAL selects *f1* as the unmarked form since it is the most harmonic candidate among the three. The most harmonic *f1* pairs with the most harmonic meaning *m1*. The pairing process is illustrated in Tableau 10 below, in which the most harmonic pair *<f1, m1>* is determined in an Interpretational OT evaluation. The constraints coming into play include *Unrestrictive and *Restrictive. The former penalizes any expression to be interpreted as a non-restrictive relative clause; while the latter penalizes any expression to be interpreted as a restrictive relative clause. The relevant

ranking follows the argument that restrictive relative clauses are considered the prototypes of relative clauses, thus *Unrestrictive must outrank *Restrictive to ensure a preference of restrictive relative clauses over non-restrictive relative clauses, see (28).

(28)

Interpretational constraints:

*Unrestrictive: Relative Clauses do not receive unrestrictive interpretations.

*Restrictive: Relative Clauses do not receive restrictive interpretations.

Constraints ranking: *Unrestrictive >> *Restrictive

Tableau 10

f1	***Unrestrictive**	***Restrictive**
☞ *m1=R*		*
m2=U	*!	

The optimal *<f1, m1>* blocks and eliminates the sub-optimal pairs {*<f1, m2>*, *<f2, m1>*, *<f3, m1>*} of Tableau 9 in the second round of evaluation, resulting in *<f2, m2>* and *<f3, m2>* as the Weak optimal outputs. The bi-OT account therefore correctly selects three optimal pairs: {*<f1, m1>*, *<f2, m2>*, *<f3, m2>*} whereby the unmarked form is paired with the unmarked meaning, and the marked forms with marked meanings.

5. Conclusion

In this paper I have demonstrated that a successive-cyclic optimization model of bidirectional OT is necessary in the context of Hakka relative clauses, in which a number of constructions consisting of the same constituents but with different permutations are matched on two possible interpretations, restrictive and non-restrictive. In addition, this paper shows the merits of the bidirectional OT in its capacity to pair marked forms with marked meanings and unmarked forms with unmarked meanings, which according to the generalizations underlying most linguistic theories, is quite a natural and positive assumption. Suspicions may arise concerning whether the requirement of this bidirectional approach is maintained when the examination of Hakka syntax extends to other parts of constructions. This potentiality will require further investigation.

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Department of English
Tamkang University
Taipei, TAIWAN
Yu-Ching Tseng: ychtseng@mail.tku.edu.tw

客語名詞片語－從雙向優選理論探討關係子句結構

曾郁景

淡江大學

這篇論文主要探討限定和非限定關係子句的結構，並以雙向優選理論作為理論架構，區別兩種關係子句的語意以及句型結構。本篇論文以傳統單向優選理論分析解釋客語名詞片語的基本結構，並進而主張傳統單向優選理論無法成功解釋限定和非限定關係子句的結構區別，而必須使用雙向優選理論方能將兩種關係子句與其限定和非限定語意做適當的連結。此外，本篇論文亦顯示由於雙向優選理論允許循環式的表格分析，兩種關係子句得以在同樣的限制條件下，將標記的句型連結標記的意義，未標記的句型連結未標記的意義。

關鍵詞：客語、名詞片語、關係子句、雙向優選理論

客語名詞片語－從雙向優選理論探討關係子句結構